INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
Volume-4, Issue-2, April-June-2014
ISSN 2231-4490
Coden : IJPAES www.ijpaes.com

Received: 25th Feb-2014 *Revised: 26th March-2014* *Accepted: 28th March-2014*
Research article

DETERMINATION OF CHEMICAL COMPOSITION AND SUITABLE LEVEL OF WHEAT MIDDLINGS IN BROILER DIETS

Kaveh Ahmadi[1] and Amini .B[2]

[1]Department of Animal Science, University Of Applied Science and technology Of Jahad-Keshavarzi of zanjan.9th Km, Sohrain Road (Industrial City), Zanjan, IR-Iran. P. O. BOX: 45195-471.
Email kmkmkm3000@gmail.com.Telefax 00982417282158
[2]Tabriz Payamnoor University

ABSTRACT: Two trials were conducted to determination of chemical composition and nutritive valueof grade 1 wheat middlings wastes and its suitable levels in broiler chick's diets were investigated. Experiment 1 evaluated the chemical composition, and energy and protein content. The experiment2 was conducted by 400 day old unsexed Ross 308 chicken were housed in straw litter pens. Fiverations were used as a five treatments includes (0, 7.5, 15, 30 and 45%) of wheat middlings in broilerdiets. Four replicates with 20 birds were arranged in each. All of diets were Isoenergetic and isonetrogenous. The main experiment was started from 14 days of age to the slaughter weight. Experiment statistical was in complete random design (CRD), data analysed by SAS program and means were examined by Duncan multiple test. The metabolizable energy and protein content were 3225 kcal/ kg and 14% respectively. No significant differences were found in body weight (BW), feed intake (FI)and feed conversion ratio (FCR) and production index (PI) in the broiler's feeding trial and in bydifferent levels of wheat middlings($p>0.05$). There were significant variables in final weight. Thetreatments fed with 45% wheat middlingss have had less weight than others ($p<0.05$). There were no significant variables in breast and thigh and abdominal fat and viscera percent of slaughtered broilers too ($p>0.05$). However, in this study, these variations did not significantly affect the performance of broiler chickens. It would suggested that 30% of wheat middlings in broiler ration could leads to decrease the ration price and approach more benefits for poultry industry.
Key words: Chemical composition, Broiler chicken, wheat midddlings

INTRODUCTION

Wheat midddlings (WM) are a by-product of the wheat milling industry and do not compete with humansas a source of food. As such these by-products have the potential to reduce Poultry and livestock feeding costs.
During the wheat milling process, about 70 to 75% of the grain becomes flour, and the remaining 25 to 30%is available as wheat by-products largely destined for livestock consumption. These by-products commonly are referred to as mill feed (MF), wheat mill run (WMR), or Wheat midddlings (WM) with little regard for the various mill streamsand proportions that are combined and ultimately constitute the byproduct's final composition. From a human nutrition standpoint, it is a paradox that wheat milling methods to produce white flour eliminate those portionsof the wheat kernel (bran, germ, shorts, and red dog mill streams) that are richest in proteins, vitamins, lipidsand minerals. For example, highly refined (patent) flour may contain only 10 to 12% of the total thiamine and niacin, 20% of the phosphorus, and 50% of the calcium of the parent grain [14]. Wheat middlings are available in two types as grade 1 and grad2.Grade 1 includes 80% of Wm. Hole and broken grains are the magor parts of grade 1 Wm and in grade 2 in addition flour and other cereal grains and straw and dust are available[4,5]. Many factors are important on protein digestibilityand on content of metabolisable energy of Wm such as amount of non starch polysaccharides (NSP) and environmental factors .High water soluble NSP for example pentosans in diet can cause increase of viscosityof digestives and decrease digestibility of nutrients of feed and increase of water consumption and loss ofperformance and do management problems[12]. In a research after determination of Wm composition reported that Wm includes: broken and shrunken grains 77%, wild buckwheat 17. 3%, wild oat1. 29%, rape-seed1.13%, cow cockle 0.76%, lady's thumb 0. 92% and dust is 1.6% .In k. state report amount of broken grains and weed seeds is reported about 2%-3% [14] Previous research has suggested that Wm can be used successfully in poultry feeding. Amino acid content of Wm is higher than wheat grains and its use in broiler diets have not undesirable effects on broiler Performance [13] ,[23].

In a research studied five different commercial samples of Was containing from 67 to 84% wheat, 12.2 to 14.6% protein, 4 to 12% wild buckwheat and 5 to 11% rapeseed, in feedingstudies with broiler chickens to 4 wk of age. No significant effect of Wm was seen on body weight and feed efficiency [23]. In other report studied grade 1 and grad 2 Wm and macaroni wastes as energy resources on broiler diets. They reported it is possible to use macaroni wastes and grade 1 wheat feed middlings at 45% and 30% levels in the diet of broiler chicks, respectively, without any undesirable effects on their performance[13].In a report studied on metabolizable energy and protein digestibility of Wm diet on growth rate of broilers. They show that metabolizable energy of grade 1 of Wm is significantly higher than grade 2 Wm ($p<0.05$). No significantly differences were found in daily feed intake, daily growth rate, uniformity, and production index in concern to different levels of Wm in broiler diet. The above data indicate a high degree of potential for the use of Wm in poultry diets. Therefore, the following study wasdesigned to study the nutritive value and use of Wm in broiler chicken diets.
Ahmadi studied grade 1 wm as energy resources on broiler and layer and turkey diets [2]. They show that no significantly differences between treatments in weight, feed intake and egg production and other traits.in high levels of wm weight decreased but they show that use of wm enable to get more benefits.

MATERIAL AND METHODS

Experiment-1*:* Botanical and chemical composition and nutritive value of grade 1 Wm was determinated. Three Wm samples were measured. Samples obtained with the only stipulation being that the samples were grade 1 Wm appropriate for monogastric species. Amount of contents of grade 1 Wm was measured by grain screening machine (Table 2). The samples were chemically analyzed for key nutritional characteristics, moisture (AOAC, 1990), protein (AOAC, 1995) ether ex (AOAC, 1990),(Table 3). The samples were used in a sibbald method for determination of metabolizable energy (Sibbald, 1986). A total of 24 adult male leghorn roosters were placed in battery cages and used to determine the true metabolizable energy (TME) of the Wm. First 24 hours were all hungry roosters to be emptying the contentsof the tract. Then they divide to two groups of control and trial group by 3 replication with 4 roosters in each replicant. In control group no feed were had for 24 hours. In trial group 30 gr of grade 1 Wm was force feeded to rooster by use of a special funnel. After 24 hours excreta of each group were collected and TME calculated (Table 3).

Table-1: Composition of diets for broiler chickens

Treatments	0	7.5	G 1 15	30	45		0	7.5	F 2 15	30	45
Ingredients %											
Corn	62	55	45	35.4	30.3		64.5	55	47	36.40	29
SBM	27	26	25	24	22.5		25	25.5	25.	23	22
Fish Meal	2	3	2.2	2	1.90		2.76	2	1.50	2.20	1.60
concentrate	4.46	2.5	2.5	2.5	2.40		2.5	2.5	2.5	2.30	2.5
Wheat Middlings	0	7.5	15	30	45		0	7.5	15	30	45
Bran (wheat)	1	0.5	1.2	1.2	1.42		1	0.5	0.7	0.8	0.65
NaCl	0.12	0.12	0.13	0.12	0.12		0.7.5	0.7.5	0.7.5	0.7.5	0.7.5
Oyster shell	0.90	0.93	085	0.88	0.90		0.60	0.60	0.72	1.20	0.85
Oil	1.31	1.17	1.90	1.80	1.55		2.80	3	2.894	3.50	2.97
Enzymite	1.20	0.8	1.2	1.28	2		0.73	0.80	0.50	0.60	0.33
Calculated values	----	----	----	----	----		----	----	----	----	----
TME kcal\kg	3050	3050	3050	3050	3050		3150	3150	3150	3150	3150
CP%	20.3	20.1	20	20	20		19.60	19.50	19.50	19.50	19.50
Ca %	0.85	0.85	0.85	0.85	0.85		0.80	0.80	0.80	0.80	0.80
P a %	0.45	0.45	0.45	0.45	0.45		0.38	0.38	0.38	0.38	0.38
Met+Cys %	0.66	0.65	0.66	0.66	0.65		0.64	0.63	0.63	0.63	0.62

G= Grower, F= Finisher

Concentrate provided per kilogram of diet ME 1960 kcal/kg, Crude Protein 25, Calcium 16. 5%, Available Phosphorus 7. 2%, Na 3 5, Cl 3. 3%, Lysine 4%, Methionine 3.3 %, Met+Cystine 3.5%2 and total vitamins and minerals.

Chemical composition of Enzymite : Sio2 66. 5%, AL2o3 11.81%, Tio2 0.21%, Fe2o3 1.3%, Cao 3.11%, Mgo 0.72%, K2o 3.12%, Nao 2.01%, Mno 0.04%, P2 o5 0. 01%

Experiment 2: A total of 400 unsexed broiler chickens (Ross 308) were housed in straw litter pens. Each dietary treatment had 4 replications (20 birds each) for a total of 80 birds per treatment. The same Wm samples used in exp.1 replaced, 0%, 7.5%, 15%, 30% and 45% of the diet for the experimental period of 36 d. Diets were formulated to be isoenergetic and isonitrogenous (Table 1) and (Table2). Up to 14 days of age, chicks fed with starter diet. Trial period started from 14 to 49 days. Diets formulated using software UFFDA (Table 1).
Experiment statistical was in complete random design (CRD), data analysed by SAS program and means were examined by Duncan multiple test [21].
Statistical design mathematical model above is as follows.

$$Xij = \mu + ai + gij$$

In the above model:
Xij: numeric value of each view, μ: population mean, ai: effect of each treatment, gij: is the effect of experimental error.
Daily body weight gain, final weight, daily feed consumption was measured in periods of 14-35 days and35-49 day's and 14-49 days. Final weight, production index, feed conversion ratio and cost of 1 kilo meat per feed consumed were measured in day of 49. Carcass characteristics of broilers include % of breast, thighs, abdominal fat content, viscera truct and liver were measured after slaughter. In economic discussions, the production index is calculated from division of (average final weight × percentage of viability) to (feed conversion ratio × days × 7.5). Whatever the number is larger is better achieved [20].

RESULTS

Experiment 1: Wm botanical composition shows in Table-2.

Table 2: Botanical composition of Wm samples

Whole wheat grain %	34.5
Broken wheat grain %	61.2
Weed seed %	3.5

In Table 3 chemical composition and nutritive value of Wm is showed.

Table3: Chemical composition and nutritive value of Wm

TME (kcal\kg)	3225
Moisture 5	10.4
Crude protein %	14
Ether extrate %	3.75
Crude fiber %	4.45
Calcium %	0.131
Available phosphorus %	1.02
Sodium %	0.35

Experiment 2

Daily Weight Gain and Final Weight: The author concludes that Wm levels did not affect broiler average daily body weight gain for the periods of 14 to 35 or 35 to 49d, or 14-49d ($p>0.05$).However the best results belong to treatments of 0%, 7.5%, 15%, 30% and the daily weight gain of treatment of 45% is less (Table 4).The author concludes that, there were significant variables in final weight. The treatments fed with 45% Wms have had less weight than others ($p<0.05$), (Table 4).

Daily and Total Food Consumption and Feed Conversion Ratio:

The author concludes that No significant differences were found in feed intake (FI) for the periods of 14 to 35 or 35 to 49 d, or 14-49 d and feed conversion ratio (FCR) by different levels of Wm ($p>0.05$) (Table-4).

Index of Production and Cost of Meat

The author concludes that No significant differences were found in index of production and cost of1 kg of meat ($p> 0.05$), (Table4).

Carcass Traits: On carcass traits, including carcass parts (percent of the breast, thighs percent, and the percentage of abdominal fat, percentage of viscera). The author concludes that No significant differences between different treatments were found ($p>0.05$), (Table 5).

Table 4: Effect of wheat middlingss on growth, feed efficiency, and performance of broilers

			Treatment				
	0%	7.5%	15%	30%	45%	SEM	Probability
Avgwg 14-35 d	63.81	62.62	62	61.81	61.48	0.15	NS
Avgwg 35-49 d	72.78	76.21	73.78	71.44	69.57	0.291	NS
Avgwg 14-49 d	67.39	68.06	66.71	65.67	64.71	0.111	NS
Final w	2694 a	2701 a	2683 a	2644ab	2591 b	23.34	*
Avg fi 14-35 d	104.40	104.30	104.90	104.80	104.10	0.103	NS
Avg fi 35-49 d	154.30	152.90	148.50	148.50	146.30	0.265	NS
Avg fi 14-49 d	124.30	123.70	122.30	122.30	120.90	0.077	NS
Fcr	1.845	1.818	1.834	1.861	1.870	0.001	NS
Pi	293	300.30	293.60	284.45	275.60	4.722	NS
Cost	8942	8480	8362	8353	8369	52.233	NS

Avg gain – average gain. Avg FI – average feed intake

Table 5: Effect of wheat middlingss on carcass traits.

			Treatment				
% of carcass	0%	7.5%	15%	30%	45%	SEM	Probability
Breast	28.63	28.66	28.74	28.79	28.83	0.014	NS
Thigh	29.65	29.94	29.96	29.67	29.72	0.020	NS
Abdominal Fat	2.94	3.02	3.24	3.15	3.21	0.010	NS
Viscera	10.91	10.82	10.88	10.79	10.75	0.007	NS
Liver	2.50	2.61	2.54	2.62	2.65	0.004	NS

Avg gain – average gain., xAvg FI – average feed intake

DISCUSSION

As is clear the protein amount of grade 1 Wm better than wheat grain. According to some reports, the amount of weed seeds increases protein content of Wm and cause a better profile of amino acids in Wm even compared to hole wheat grain [14]. The metabolizable energy also is high. In the report of K. State University, the amount of starch is about 25. 75 percent and has been reported that could cause the increase of energy [14]. I n a report reported that the amount of metabolizable energy is 3270 kcal/kg. Moisture level was 7. 8%, crude protein 12%, crude fat 2. 2 %, and crude fiber 3. 5% percent has been reported that is similar with our project[13]. These performance results are in accordance with the findings [4,5]. They after determining the chemical composition of Wm reported that the amount of amino acids is higher than of wheat grain. Similar results reported about better profile of amino acids in Wm compared with wheat grain reports of [26] and[8]and[11] and [4]determined the chemical composition and metabolizable energy too. They reported the metabolizable energy and other nutrients in Wm is higher than wheat grain. These performance results are in accordance with the our findings. Amount of whole grains of wheat in grade1 Wm in our results is 34.5% that are in accordancewith [5]. They reported that the whole wheat grain is 34.2% in grade 1 Wm. Stapelton reported the less results of whole wheat grains content in Wm. Differences in reports is because of differences in screening machines performances [23].

Percent of weed seeds and broken grains of Wm are in accordance with reports of [13] and with [14] reports about Wm, composition, feeding value, and storage guidelines. Results in reports of broiler's performances in our experiment (daily wheight gain, final weight, Daily and total food consumption and feed conversion ratio, Index of production and cost of meat, Carcass traits) are similar to results of some reports as below. Ahmadi reported there were no significant differences between treatments of Wm (with 0, 10, 20, 30 percentage levels) on broiler's daily weight gain during the trial until 49 days [1,2]. Gheisary [13] reported there were no significant differences between treatments of Wm (with 0, 15, 30, 45 percentage levels) on broiler's daily weight gain during the trialuntil 56 days[13]. In other research found no significant differences in egg production, egg weight, shell quality, yolk quality, and feed efficiency when adult Leghorn hen diets contained up to 45% and 22.5% of Wm [2]. They found no significant differences in broiler chicken performances when Wm represented 30% of the diet. (Ahmadi et al, 2013) found no significant effect on growth and feed efficiency of broiler chickens when different Wm samples were collected over a 3-yr period and represented up to 30% of thediet. The samples ranged in protein content from 12. 2 to 14. 8%. They reported that no significant differences were found on final weight, feed conversion ratio, and daily weight gain of broilers [1,2,3,4,5].

They after determining the chemical composition of Wm and use it instead of wheat grains reported that there were no bad or adverse effect on live weight , feed conversion ratio, and health of chicks in 21-49 days of age .
They reported that the amino acid profile of Wm is better than wheat grain. In a research determined the chemical and botanical composition and metabolizable energy of the Wm and then reported that nutrients in Wm are normal and its use in broiler's diets up to 75% insteadof wheat grain were no bad or adverse effects on live weight, daily weight gain, feed convertion ratio [8]. Bennet reported that no significant differences were found between different treatments of use of Wm (0%, 25%, 50%) in daily weight gain, and final weight of broilers in 0-36 days of age [11]. The author concludes that, on daily feed consumption, there were no significant differences, although control group consumed little more and group of 45% of Wm consumed less than others (Table 5). On the feed conversion ratio results are veryclose and it show that nutrients content of Wm is very balanced and uniformed (Table 5).
Saki [20] reported that no significant differences were found on final weight, feed consumption, and carcass traits of broilers in trial period 21-46 d. The amount of NSP in the Wm and levels of Wm in these experiments has not been so dramaticallyadverse effect on feed intake of broiler chickens. They reported that were no significant differencesbetween control and other groups of treatments on production index (PI) on broilers. Although there were no significant differences between different treatment on price of 1 kilo meatbut The author concludes that found considerable differences in ducnan methods between treatments 15%, 30%, 45%, and controltreatment .The author concludes that In according to final weight and total feed consumption and number of chickens in farm we found large and considerable economical benefits by use of Wm in broiler diets. Differences show in Figure 1 andthe positive economic effects of the use of grade 1 Wm in broiler diets is obvious (Figure 1).

CONCLUSIONS AND SUGGESTIONS

Considering the results of this repot and other similar reports, it can be concluded that using of grade 1Wm up to 30% without processing does not any bad or adverse or unfavorable effects on weight gain, feedconsumption, final weight, feed conversion ratio, carcass traits, production index. Use of grade1 Wm can reduce considerably costs of production and it is economically and is not compete with human as a food andcan be used totally as a animal and poultry feedstuffs. In broiler chickens it can use specially in grower and finished diets. It is suggested that experiments using different processing methods, for example using enzymes with higher and various levels of grade 1 and 2 Wm will be done.

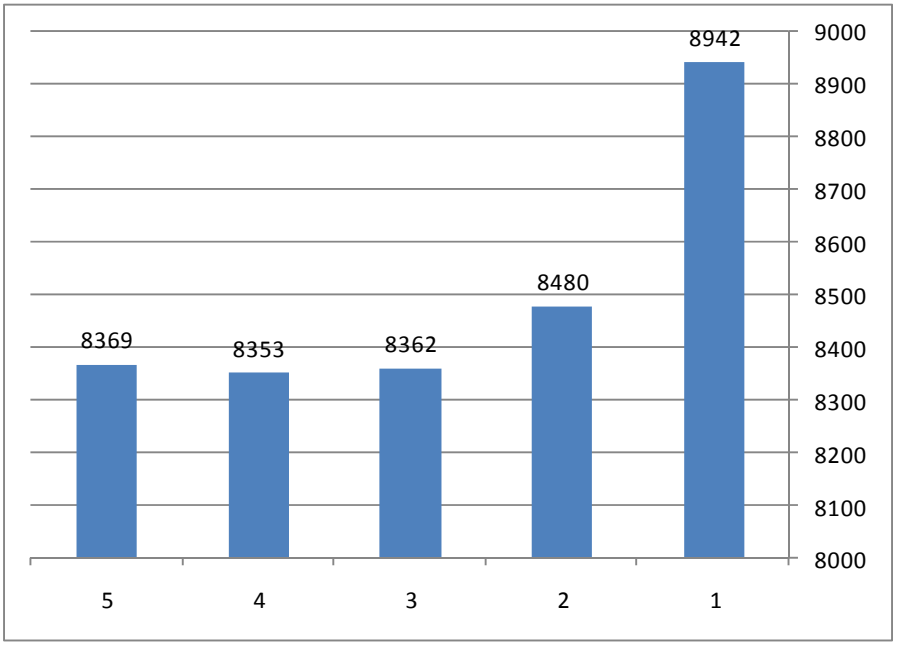

Fig. 1: Effect of wheat middlingss on cost of 1 kg meat production.
Treatments: 1= 0% (8942 rial/kg). 2=7.5% (8480 rial/kg). 3=15% (8362 rial/kg) 4= 30% (8353 rial/kg). 5=45% (8369 rial/kg).

REFERENCES

[1] Ahmadi,K. Karimov,T. 2010.A Study On Wheat Middling's Usage On Broilers Performances. Australian Journal of Basic and Applied Sciences, 4(11): 5642-5648.

[2] Ahmadi,K.Karimov,T. 2010.A Study On Wheat Middling's Usage On layer's Performances. Australian Journal of Basic and Applied Sciences, 4(11): 5636-5641,.

[3] Ahmadi,K.Karimov,T. 2010.A Study On Wheat Middling's Usage On turkey's Performances. Australian Journal of Basic and Applied Sciences, 4(11): 5630-5635.

[4] Ahmadi,K.Shariatmadari, F.Amini ,B.Karimov,T. The use of grade one wheat middlings on Layer's performance.2013.International Journal of Agriculture and Crop Sciences.Available online at www.ijagcs.com.IJACS/2013/57/731-736.

[5] Ahmadi,k.Eila,N.Shariatmadari,F.Amini ,B.A Study on grade one Wheat Middling's Usage on Turkey's Performances..2013. International Journal of Agriculture and Crop Sciences. Available online at www.ijagcs.com . IJACS/2013/5-24/2985-2990

[6] AOAC., 1990. Official Methods of Analysis.15th ed. Assoc. Off.Anal.Chem., Washington, DC.

[7] AOAC., 1995. Official Methods of Analysis.16th ed. Assoc. Off.Anal.Chem., Washington, DC.

[8] Audren, G.P., H.L. Classen and K.V. Scwean, V. Racz, 2002. Nutritional value of wheat screening tobroiler chickens. Journal of Animal science, 54: 761-766.

[9] Bedford, M.R., H.L. Classen and G.L. Campbell, 1991. The effect of pelleting, salt, and pentosanase on the viscosity of intestinal contents and the performance of broilers fed rye. Poult. Sci., 70: 1571-1577.

[10] Bedford, M.R., T.A. Scott, F.G. Silversides, H.L. Classen, M.L. Swift and M. Pack, 1998. The effect ofwheat cultivar, growing environment and enzyme supplementation on digestibility of amino acids by broilers. Can. J. Anim. Sci., 78: 335-342.

[11] Bennett, C., 2002. Manitoba Agriculture, Food and Rural Initiatives.Nutrition Update, 13(1).

[12] Classen, H.L., 1996. Cereal grain starch and exogenous enzymes in poultry diets.World 'sPoult. Sci. J.,62: 21-27.

[13] Gheisari, A., R. Bahadoran and S. Tadayonfar, 2003. Determination of chemical composition and suitablelevels of wheat feed screening and macaroni wastes in broiler chick diets. J. Sci. & Technol. Agric. &Natur.Rsour, 7(2): 161-169.

[14] K.Satate University, 1998. Wheat middlings, composition, feeding value, and storage guidelines.24 pages.

[15] Leeson, S. and L.J. Caston, 1991. Response of two strains of turkey hens to various protein and energy feeding programs. Poultry Sci., 70: 1739-1747.

[16] National Research Council (NRC), 1994. Nutrient requirement of poultry. Revised Edition, Washington, DC, USA.

[17] Pomeranz, Y. and G.S. Robbins, 1972. Amino acid composition of buckwheat. Agric. Food Chem., 20:270-274.

[18] Proudfoot, F.G. and H.W. Hulan, 1986. The nutritive value of wheat screenings as a feed ingredient foradult leghorn hens. Can. J. Anim. Sci., 66: 791-797.

[19] Proud foot, F.G. and H.W. Hulan, 1988. Nutritive value of wheat screenings as a feed ingredient for broiler chickens. Poult. Sci., 67: 615-618.

[20] Saki, A.A. and A.A. Ali Pana, 2005. Effect of dietary wheat screening diet on broiler performance, intestinal viscosity and ileal protein digestibility. MSc thesis.Department of Animal Science Bu-Ali Sina University in Hamedan. Asian network for scientific information, Pakistan. http://www. biomedsearch.com/cite.

[21] SAS Institute, Inc., 1999. SAS user's guide: Statistics. SAS Institute, Inc., Cary, NC.

[22] Sibbald, L.R., 1986. The TME system of feed evaluation: methodology, feed composition data andbibliography, Res. Branch Contribution 86-4E, Anim. Res. Center, Agric. Canada.5647

[23] Stapelton, P., D.B. Bragg and J. Biely, 1980. The botanical and chemical composition and nutritive valueof wheat feed screening. Poult. Sci., 59: 333-345.

[24] Veldkamp, T., 2005. Growth responses to dietary energy and lysine at high and low ambient temperature in male turkeys. Poul. Sci., 84: 273-282.

[25] Waldroup, P.W. and J.A. England, 1998. Dietary arginine and lysine in large white toms. 1. Increasing arginine: lysine ratios does not improve performance when lysine levels are adequate. Poult. Sci., 77: 1364-1370.

[26] WoldTsadick, M.S. and D.B. Bragg, 1980. Utilisation of wheat screening in the broiler diet as a majorsource of energy. Poultry Science, 56: 1674.