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A Study On Wheat Middling's Usage On Broilers Performances

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Abstract:: Two trials were conducted to determination of chemical composition and nutritive value of grade 1 wheat middlings wastes and its suiTable levels in broiler chicks diets were investigated. Experiment 1 evaluated the chemical composition, and energy and protein content . The experiment 2 was conducted by 200 day old unsexed Cobb 500 chicken were housed in straw litter pens. Five rations were used as a five treatments includes (0, 10, 20, 30 and 40%) of wheat middlings in broiler diets. Four replicates with 10 birds were arranged in each. All of diets were Isoenergetic and isonetrogenous. The 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 3220 kcal/ kg and 14. 2% 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 by different levels of wheat middlings($p>0.05$). There were significant variables in final weight . The treatments fed with 40% 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: Broiler chicken, wheat midddlings

INTRODUCTION

Wheat midddlings (WM) are a by-product of the wheat milling industry and do not compete with humans as 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 millfeed (MF), wheat mill run (WMR), or WM with little regard for the various mill streams and 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 portions of the wheat kernel (bran, germ, shorts, and red dog mill streams) that are richest in proteins, vitamins, lipids and minerals. Forexample, 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 (K. Satate University, 1998) . 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(K. Satate University, 1998). Many factors are important on protein digestibility and on content of metabolisable energy of Wm such as amount of non starsh polysaccharides(NSP) and environmental factors . High water soluble NSP for example pentosans in diet can cause increase of viscosity of digestives and decrease digestibility of nutrients of feed and increase of water consumption and loss of performance and do management problems(Classen, H.L., 1996). Stapelton and et al after determination of Wm

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composition reported that Wm includes: broken and shrunken grains 77%, wild buckwheat 17. 3%, wild oat 1. 29%, rape-seed 1. 13%, cow cockle 0. 76% , lady's thumb 0. 92% and dust is 1. 6% (Stapelton, P., 1980). In k. state report amount of of broken grains and weed seeds is reported about 2%-3% (K. Satate University, 1998). 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(Stapelton, P., 1980). Stapleton et al. studied five different commercial samples of Wms containing from 67 to 84% wheat, 12. 2 to 14. 6% protein, 4 to 12% wild buckwheat and 5 to 11% rapeseed, in feeding studies with broiler chickens to 4 wk of age. No significant effect of Wm was seen on body weight and feed efficiency(Stapelton, P., 1980). Gheisari and et al studied grade 1 and grad 2 Wm and macaroni wastes as energy resources on broiler diets(Gheisari, A., 2003). 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(Gheisari, A., 2003).

Saki and Alipana studied on metabolizable energy and protein digestibility of Wm diet on growth rate of broiler. 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(Saki, A.A. and A.A. Ali Pana, 2005). The above data indicate a high degree of potential for the use of Wm in poultry diets. Therefore, the following study was designed to study the nutritive value and use of Wm in broiler chicken diets.

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 [Association of Official Analytical Chemists (AOAC) 1990], protein (AOAC 1995) ether ex (AOAC 1990), (Table 4). The samples were used in a sibbald method for determination of metabolizable energy(Sibbald, L.R., 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 contents of the tract. Then they divide to two groups of control and trial group by 3 replication with 4 rooster 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).

Experiment 2:

A total of 200 unsexed broiler chickens(Cobb 500) were housed in straw litter pens. Each dietary treatment had 4 replications (10 birds each) for a total of 40 birds per treatment. The same Wm samples used in exp. 1 replaced, 0%, 10%, 20%, 30% and 40% of the diet for the experimental period of 36 d. Diets were formulated to be isoenergetic and isonitrogenous (Table 1, 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(SAS Institue, Inc., 1999).
Statistical design mathematical model above is as follows.

$$X_{ij} = \mu + a_i + \varepsilon_{ij}$$

In the above model:
X_{ij}: numeric value of each view
μ : population mean
a_i: effect of each treatment
ε_{ij}: is the effect of experimental error.

Daily body weight gain, final weight, daily feed consumption were measured in periods of 14-35 days and 35-49 days and14-49 days . Final weight, production index, feed conversion ratio and cost of 1 kilo meat per feed consumped were measured in day of 49. Carcass characteristics of broilers include % of breast, thighs,

Table 1: Composition of diets for broiler chickens

Ingredients %	Grower					Finisher				
	0%	10%	20%	30%	40%	0%	10%	20%	30%	40%
Corn	62	55	45	35.36	30.305	64.50	55	47	37.20	29.65
SBM	27	26	25	24	22.50	25	26	25.05	23	22
Fish Meal	2	3	2.255	2	1.90	2.765	2	1.50	2.20	1.60
Broiler concentrate *	3.96	2	2	2	1.90	3	2	2	1.80	2
Wheat Middlings	0	10	20	30	40	0	10	20	30	40
Bran (wheat)	1	0.50	0	0	0	0	0	0.70	0	0
NaCl	0.12	0.12	0.13	0.12	0.12	0.10	0.10	0.10	0.10	0.10
Oyster shell	0.90	0.93	085	0.88	0.90	0.60	0.60	0.72	1.20	0.85
Vit premix **	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Min premix **	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Oil	1.315	1.17	1.90	1.80	1.55	2.80	3	2.894	3.50	2.973
Enzymite ***	1.205	0.78	2.385	2.485	3.425	0.735	0.80	0.50	0.60	0.327
Calculated values	----	----	----	----	----	----	----	----	----	----
TME kcal\kg	3050	3050	3050	3050	3050	3100	3100	3100	3100	3100
CP%	20.3	20.10	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 %	0.40	0.40	0.40	0.40	0.40	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

1. Protein 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. 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%

3. Poultry Premix provided per kilogram of diet Mn, 88 mg; Cu, 6. 6 mg;Fe, 8. 5 mg; Zn, 88 mg; Se, 0. 30 mg; vitamin A, 8, 800 IU; cholecalciferol, 3, 300 IU; vitamin E, 6. 6 IU; vitamin K, 5. 0 mg; riboflavin, 4. 4 mg;pantothenic acid, 5. 5 mg; niacin, 25 mg, choline, 150 mg; vitamin B12, 8. 8 mg; ethoxyquin, 1. 1 mg/kg.

abdominal fat content, viscera truct and liver were measured after slaughter. In economic discussions, the production index is calculate from division of(average final weight × percentage of viability) to (feed conversion ratio × days × 10). Whatever the number is larger is better achieved (Saki, A.A. and A.A. Ali Pana, 2005).

Results:

Experiment 1:

Wm botanical composition shows in Table2.

Table 2: Botanical composition of Wm samples

Whole wheat grain %	34. 2
Broken wheat grain %	61. 8
Weed seed %	3. 4

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

Table 3: Chemical composition and nutritive value of Wm

TME(kcal\kg)	3220
Moisture 5	10. 4
Crude protein %	14. 2
Ether extrate %	3. 7
Crude fiber %	4. 5
Calcium %	0. 134
Available phosphorus %	1. 05
Sodium %	0. 36

Experiment 2:

-Daily Weight Gain and Final Weight:

Wm levels did not affect broiler average daily body weight gain for the periods of 14 to 35 or 35 to 49 d, or 14-49 d ($p>0.05$). However the best results belong to treatments of 0%, 10%, 20%, 30% and the daily weight gain of treatment of 40% is less(Table4). There were significant variables in final weight. The treatments fed with 40% Wms have had less weight than others ($p<0.05$), (Table 4).

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

	Treatment						
	0%	10%	20%	30%	40%	SEM	Probability
Avg wg 14-35 d	63. 81	62. 62	62	61. 81	61. 48	0. 15	NS
Avg wg 35-49 d	72. 78	76. 21	73. 78	71. 44	69. 57	0. 291	NS
Avg wg 14-49 d	67. 39	68. 06	66. 71	65. 67	64. 71	0. 111	NS
Final w	2690 a	2698 a	2679 a	2634 ab	2580 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. 40	275. 60	4. 722	NS
Cost	8942	8480	8362	8353	8369	52. 233	NS

z1, control, no wheat middlingss; 2, 25% wheat middlings 1; 3, 50% wheat middlingss 1; 4, Total wheat replacement by wheat middlingss 1; 5, 25% wheat middlingss 2; 6, 50% wheat middlingss 2.
yAvg gain – average gain. xAvg FI – average feed intake

- Daily and Total Food Consumption and Feed Conversion Ratio:

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) (Table4).

- Index of Production and Cost of Meat:

No significant differences were found in index of production and cost of1 kg of meat(p> 0. 05), (Table 4).

- Carcass Traits:

On carcass traits, including carcass parts (percent of the breast, thighs percent, the percentage of abdominal fat, percentage of viscera). No significant differences between different treatments were found(p>0. 05), (Table 5).

Table 5: Effect of wheat middlingss on carcass traits

	Treatment						
% of carcass	0%	10%	20%	30%	40%	SEM	Probability
Breast	28. 61	28. 67	28. 72	28. 78	28. 81	0. 014	NS
Thigh	29. 63	29. 96	29. 95	29. 68	29. 75	0. 020	NS
Abdominal Fat	2. 96	3. 03	3. 22	3. 12	3. 23	0. 010	NS
Viscera	10. 89	10. 78	10. 85	10. 75	10. 71	0. 007	NS
Liver	2. 52	2. 66	2. 58	2. 61	2. 68	0. 004	NS

z1, control, no wheat middlingss; 2, 25% wheat middlings 1; 3, 50% wheat middlingss 1; 4, Total wheat replacement by wheat middlingss 1; 5, 25% wheat middlingss 2; 6, 50% wheat middlingss 2.
yAvg 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 (K. Satate University, 1998).

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 (K. Satate University, 1998). Gheisari and et al 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 similary with our project (Gheisari, A., 2003).

These performance results are in accordance with the findings. Stapelton and et al after determining the chemical composition of Wm reported that the amount of amino acids is higher than of wheat grain (Stapelton, P., 1980). Similar results reported about better profile of amino acids in Wm compaired with wheat grain, reports of Wold. Tsadick, audren ans et al Bennet 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 (Audren, G.P., 2002; Wold Tsadick, M.S. and D.B.

Bragg, 1980). Amount of whole grains of wheat in grade1 Wm in our results is 34. 2% that are in accordance with Gheisari and et al. They reported that the whole wheat grain is 33. 8% in grade 1 Wm(Gheisari, A., 2003). Stapelton reported the less results of whole wheat grains content in Wm(Stapelton, P., 1980). Differences in reports is because of differences in screening machines performances(Stapelton, P., 1980). Percent of weed seeds and broken grains of Wm are in accordance with reports of Gheisari and et al and with K. State university reports about Wm, composition, feeding value, and storage guidelines(Gheisari, A., 2003; K. Satate University, 1998).

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. Gheisary and et al, 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 trial until 56 days(Gheisari, A., 2003). Proudfoot and Hulan 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% of Wms. Proudfoot and Hulan found no significant differences in broiler chicken performances when Wm represented 45% of the diet. Hulan found no significant effect on growth and feed efficiency of broiler chickens when 64 different Wm samples were collected over a 3-yr period and represented up to 45% of the diet. The samples ranged in protein content from 12. 2 to 14. 8% (Proudfoot, F.G. and H.W. Hulan, 1986; Proudfoot, F.G. and H.W. Hulan, 1988).

Stapelton reported that no significant differences were found on final weight, feed conversion ratio, and daily weight gain of broilers(Stapelton, P., 1980). Wold. Tsadick 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 21-42 days of age(Wold Tsadick, M.S. and D.B. Bragg, 1980). They reported that the amino acid profile of Wm is better than wheat grain (Wold Tsadick, M.S. and D.B. Bragg, 1980). Audren and et al 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% instead of wheat grain were no bad or adverse effects on live weight, daily weight gain, feed convertion ratio (Audren, G.P., 2002). 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(Bennett, C., 2002). On daily feed consumption, there were no significant differences, although control group consumped little more and group of 40% of Wm consumped less than others(Table 5). On the feed conversion ratio results are very close and it show that nutrients content of Wm is very balanced and uniformed (Table 5).

Alipana ans saki reported that no significant differences were found on final weight, feed consumption, and carcass traits of broilers in trial period 21-46 d (Saki, A.A. and A.A. Ali Pana, 2005).

The amount of NSP in the Wm and levels of Wm in these experiments has not been so dramatically adverse effect on feed intake of broiler chickens. Alipana and saki reported that were no significant differences between control and other groups of treatments on production index (PI) on broilers(Saki, A.A. and A.A. Ali Pana, 2005). Although there were no significant differences between differet treatment on price of 1 kilo meat but we found considerable differences in ducnan methods between treatments 20%, 30%, 40%, and control treatment . 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 and the positive economic effects of the use of grade 1 Wm in broiler diets is abvious (Figure 1).

Conclusions and Suggestions:

Considering the results of this repot and other similar reports, it can be concluded that using of grade 1 Wm up to 30% without processing does not any bad or adverse or unfavorable effects on weight gain, feed consumption, 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 and can be used totally as a animal and poultry feedstuffs. In broiler chickens it can use specialy in grower and finisher 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.

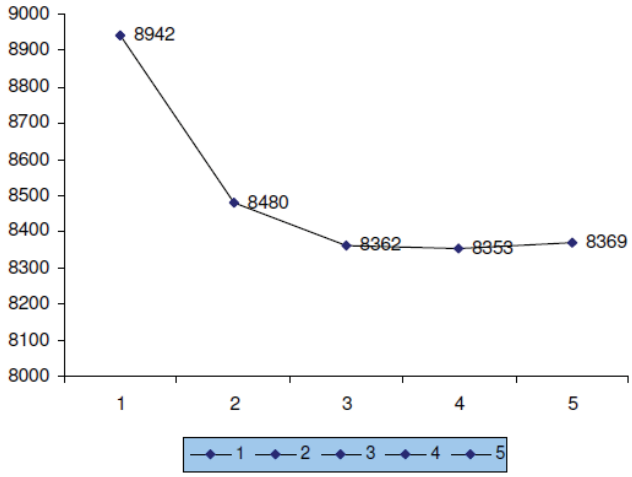

Fig. 1: Effect of wheat middlingss on cost of 1 kg meat production.
Treatments: 1= 0%(8942 rial/kg). 2=10%(8480 rial/kg). 3=20%(8362 rial/kg). 4= 30%(8353 rial/kg). 5=40%(8369 rial/kg).

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