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ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Physicochemical Content, Metabolizable Energy and *In-vitro* Protein Digestibility of Wheat Screening Diet on Growth Rate of Broiler

A.A. Saki[1]* and A. Alipana
Department of Animal Science, Bu-Ali Sina University, Hamadan, Iran
E-mail: dralisaki@yahoo.com

Abstract: In competitions by monogastric animal particular in poultry by consumption human food sources, high attempt should be made to find out new sources of feed that is not consumed by human. Wheat screening is one of the these sources of feed which need to be considered. Determination of physicochemical content, metabolizable energy (ME) and protein digestibility may lead to elucidate the quality of this feed as well as arrangement in feed formulation of broiler ration. Physical content of two types of wheat screening (W. S.) were tested by seed sorting system (grad 1 and 2), lots of straw, sand, dust, soil and none cereal seed were observed in wheat screening grads 2 compared with wheat screening grade 1. In addition 80% of wheat screening includes wheat screening grads 1 which content less Straw, soil, sand and none cereal seed. Otherwise metabolizable energy which was estimated by Sibbaled method was significantly higher ($P<0.05$), In W. S. grad 1 (2992.51 kcal/kg) than grad 2 (2212.72 kcal/kg). Based on these finding wheat screening grads 1 was selected for broiler feeding. Crude protein and crude fibre (11.4 and 4.14%) respectively in chemical composition of wheat screening grad 1 were determined by AOAC method. In-vitro protein digestibility 81.7% and digestible energy 2352.73 kcal/kg in wheat screening grad 1 were quiet desirable which evaluated by Fuller method. The effect of wheat screening grad 1 on growth rate of broiler, was examined by carried out an experiment which includes 320 day old unsexed Ross broiler chicken with (0, 10, 20 and 30% W. S.). No significantly differences were found in daily feed intake (DFI), daily growth rate (DGR), uniformity (UF) and production index (PI) in concern to different levels of wheat screening. The result of this study have shown that, it is possible to use wheat screening grad 1 in broiler ration, but the exact amount of this unconvencial feed source need to be clarify by further investigation.

Key words: Wheat screening, Metabolism energy, In-vitro protein digestibility

Introduction

Finding new source of feed for animal especially in poultry as a monogastric animal not only could help to growing animal and increasing meat and egg production but it could leads to more healthy in our human society, by increasing meat and egg quality. Recognition of these new sources of feed such as wheat feeding screening as by-product, it is not sufficient to use that, This is only the first step, consideration of this type of feed should going through in details for determination physical status, useful nutrient, energy content, antinutritives and their digestibility. These will clear the ability and amount of this feed on animal and particular poultry performance. Otherwise the availability of wheat screening is more priority for poultry industry. Related to this, availability, annual wheat production in Iran is 4-8 million tons which 7% of this produce in kordestan (location of this study). Wheat screening as a by-product is obtained after grinding, sorting, cleaning wheat and estimated in 6-10% of annual wheat production, but during the harvesting, and processing in flour factory, macaroni factory and Plant breeding centre it could be obtained in 8-12% of annual wheat production in Iran (Rajabzadeh, 2001; Golian and Parsaie, 1996). The physical status of wheat screening diet is dependent to the quality of harvesting machine and sorting seed system (Rajabzadeh, 2001; Golian and Parsaie, 1996). These researchers also have reported that 80% of this wheat screening consist of wheat screening grad 1 which includes less, soil, sand, none cereal seed, straw thin and broken wheat seed than wheat screening grad 2 which is suggested to use for ruminant nutrition. Stapleton *et al*., 1980 have shown in 1970-1976 in 21 samples of wheat screening the percentage of wheat seed and tiny wheat, broken wheat, black wild wheat, wild oats, soil and straw (77, 17.3, 1.29, 1.13 and 1.6%) were respectively. They also have indicated that 62% of wheat screening at 6 weeks chicken had no any adversely significant ($P> 0.05$) effect on daily growth rate (DGR), feed conversation ratio (FCR) and body weight (BW). Biely and Pomeranz, 1975, demonstrated that crude protein (CP), Ash, crude fibre (CF), ether extract (EE) and moisture of 12 sample of wheat screening were (13.7, 2, 2.5. 3.14 and 12%) respectively. In addition they noted that gross energy (GE) of wheat screening diet was 4665 kcal/kg and the amount of digestibility energy in this case was 50% of GE. Where that Bragg and Biely, 1977 have stated that there was no found any depressing effect of wheat screening on growth rate of broiler chicken. Fehramand,

Table 1: Ingredient in four experimental diets (Kg)

Ingredient	control	10% W.S.[1]	20% W.S.	30% W.S.
Corn	620	525.2	428.7	332.7
Soy bean meal	271.2	262.5	255	247
Concentre[2]	75	75	75	75
Wheat screening	-	100	200	300
Oyster shell	12.7	12.7	12.30	12
Corn oil	17	21	25	29
DL-methionine	1.5	1.5	1.7	2
L-Lysine	0.3	0.2	0.2	0.2
Antioxidant	0.15	0.15	0.15	0.15
Vitamins	1.45	1.20	1.40	1.40
Salt	0.7	0.55	0.55	0.551

W.S, Wheat screening; 2, Concentre Includes: Corn gluten, 0.49; Soya, 43.14; Fish meal, 4.9; mothionine, 4.51; Lysine, 1.57; grindazim GP15000, 0.26., Colin Chloride, 0.52., Betaien, 0.66, DCP 35.30, Salt, 5.49, Vit. Premix, 1.18; Mine. Premix, 0.59; Antioxidant, 1.39%; ME, 2000 kcal/kg and Crude protein, 35%

Table 2: Nutrient in four experimental diets (%)

Nutrient	control	10% W.S.[1]	20% W,S.	30% W.S.
Crude protein	19	19	19	19
Calcium	0.85	0.85	0.85	0.85
Available phosphorous	0.42	0.42	0.42	0.42
sodium	0.16	0.16	0.16	0.16
cholera	0.216	0.211	0.207	0.205
Methionine	0.46	0.46	0.46	0.46
Lysine	1.0	1.0	1.0	1.0
Crude fibre	4.55	4.55	4.68	4.61
ME (kcal/kg)	2999.88	3000.41	2999.55	2999.46

1, W. S, Wheat screening; 2, ME, Metabolizable energy.

1988 indicated that consumption of wheat screening with high level of weed seed could cause more mortality in broiler feeding. In contrast, Golian and Parsaie (1996) have found it is a good new source for broiler feeding and this was supported by (Audren *et al*., 2002; Biely and Pomeranz, 1975; Proud Foot and Hulan, 1987). On the other hand apparent metabolizable energy (AME) in wheat screening grad 1 and grad 2 were measured in 3217 and 3114 kcal/kg respectively and their corrected by nitrogen also were tested in (2950 and 2210kcal/kg) respectively by Golian and Parsaie, 1996. Metabolizable energy corrected by nitrogen in two samples of wheat screening was (3107 and 3023 kcal/kg). Moisture, CP. EE were (12.04, 15.77 and 2.36%) respectively in first sample and were (12.02, 15.19 and 2.63%) in second sample respectively. Crude protein (CP) digestibility in both samples were (83.3 and 80.4%) respectively. However, it was confirmed that 75% of wheat screening in finisher broiler ration had no any deleterious reflection on growth rate and FCR (Audren *et al*., 2002). In our condition limited work was carried out to show the nutrient ontent and ability of wheat feeding screening in poultry nutrition as well as production. Since this study was modulated to going through of that and find out of wheat screening nutrient content, ME, protein digestibility, growth rate and its ability as an alternative for cereal feeding in poultry industry.

Materials and Methods

In determination of the wheat feeding screening component in first step, physical status of this feed has been tested by sorting seed system and the differences between of wheat screening (W. S.) grad 1 and grad 2 recognized by this way, Metabolizable energy in wheat screening grad 1 and 2 were measured by sibbaled methods, 12 maturation roosters were used as a three treatments diets (W.S. Grad 1, W. S. Grad 2 and control) with four roosters in each. Chemical composition of W. S. was determined by AOAC method 1990; *in vitro* dry matter digestibility, energy digestibility and protein digestibility were tested by Fuller method (1993). Daily feed intake, daily growth rate, uniformity, production index and financial out put were considered by using Barary, 1996 method and setting up an experiment with 320 day old unsexed Ross chickens. They arranged in four treatment diets after 21 days old to 46 days of age (0, 10, 20 and 30%) of W. S. All rearing condition were similar for treatments. Data was analyzed by SAS programme. Means were tested by employed Duncan multiple test. The experiment was proved in animal care committee of Bu-Ali Sina University in Iran.

Results

Based on result of seed sorting system wheat screening grad 1 with low, broken and thin wheat seed, none cereal seed, Sand, soil, straw and dust and by high potential compared with wheat screening grad 2 with low quality and huge unknown seeds, soil, sand, and other foreign materials was selected to use as ingredient in broiler feeding.

In addition as a present in Table 3 huge increase significant differences ($P<0.05$) were recognized between Apparent metabolism energy (AME) , apparent metabolism energy corrected by N (AMEn), True metabolism energy (TME) and true metabolism energy corrected by N (TMEn) as well as GE in W. S. grad 1 compared to grad 2. Indicated physical status in Table 4, demonstrated of high potential of W. S. grad 1 since most of two part of this feed includes wheat seed and broken wheat seed (45.79 and 46.98%) respectively therefore sum of them is equal 92.77% of wheat screening grad 1 it is so close to wheat in content. In chemical composition of W. S. crude protein and crude fibre and other nutrient quiet desirable and most of them are in the similar range of cereal. High in-vitro protein digestibility and gross energy (GE), as well as digestible energy are illustrated in Table 5. No significantly Reaction in daily feed intake (DFI), daily growth rate (DGR), uniformity (UF) and production index (PI) were observed in concern to different levels of wheat screening Tables 6 and 7. Although no significantly

Table 3: In comparison Gross and metabolizable energy in two types of wheat Screening (Kcal/kg)

Treatments	GE	AME	AMEn	TME	TMEn
W.S. 1	4457.61[a]	2992.51[a]	2931.28[a]	3491.97[a]	3243.27[a]
W. S. 2	4264.18[b]	2212.72[b]	2128.04[b]	2797.86[b]	2486.80

[b]W.S, wheat screening; 1, Grad 1; 2, Grad 2; GE, Gross Energy; AME, Apparent metabolism energy; AMEn, Apparent metabolism energy corrected by N; TME, True metabolism energy; TMEn, True metabolism energy corrected by N; Means in the same column with no common superscript are different significantly (P<0.05)

Table 4: Physiochemical of wheat screening grad 1 (%)

Physical	Wheat		Broken W.		Straw & Sand		Weed seed	
	45.79		46.98		3.25		3.98	
Chemical	DM	CP	NFE	EE	CF	ASH	Ca	P
	88.76	11.21	69.06	2.90	4.14	1.45	0.09	0.30

W, Wheat Seed; DM, Dry matter; CP, Crude protein; NFE, None nitrogen free extract; EE, Ether extract; CF, Crude fibre; P, Total phosphorous

Table 5: *In vitro* dry matter and protein digestibility of wheat screening grad 1 (%)

W. S. 1	DM	CP	GE	DE
Means	52.78	81.77	4457.61*	2352.73*

W. S. 1, Wheat screening grad 1; DM, Dry matter; CP, Crude protein; GE, Gross energy; DE, Digestible energy; * kcal/kg.

different was shown in financial advantage for using wheat screening (Table 8) but predominant low price are found in feed formulation with 20 and 30% of wheat screening compared to control treatment.

Discussion

Much high attempts have been made to not only find out the new source of feed for animal particularly in monogastric with low capacity to consumption fibre diets, but also these new feed need to be recognition in physiochemical content, digestibility, energy component. Since without these information using this new feed such as wheat screening in poultry feeding and arranging feed formulation impossible. Therefore in physical status of wheat screening grad 1 was more pure in content because in this investigation 45.79 and 46.98% of this feed was includes in wheat and broken wheat seed, this means more than 90% of wheat screening are consist of wheat. Staplaton *et al*., 1980 have supported this point also in personal communication (Tehran university 1994) this finding was approved. On the other hand in chemical composition of wheat screening by this study particularly in protein and fibre as an important nutrient which could play priority role are 11.21 and 4.14 respectively. There are the similar range in this respect by other works (Audren *et al*., 2002; Stapleton *et al*., 1980). The measurement of metabolizable energy in wheat screening in comparison between grad 1 and grad 2 have shown quiet clear result since greater significant increasing (P<0.05) were achieved in grad 1 compared with grad 2. These comparisons were optimized also in GE, AME, AMEn, TME and TMEn in both wheat screening. High significant (P<0.05) potential level in ME were shown in W. S. grad 1 than grad 2. The similar results have noted by Golian and Parsaie, 1996, and personal communication (Tehran university, 1994) the measurement of metabolizable energy has been assessed by sibbaled method (Sibbald, 1975, 1976, 1977, 1982, 1983 and 1989; Yalcins and Onol, 1994). Energy measurement by Farell, 1978; Dale and Fuller, 1980 also confirmed this method which was used in current study. *In vitro* dry matter, crude protein and digestibility energy which tested in this study were (52.78, 81.77 % and 2352.73 Kcal/kg respectively. These ranges have been emphasized by (Audren *et al*., 2002). Daily feed intake and daily growth rate which were similar between different levels of wheat screening and control also were indicated by other researchers (Biely and Pomeranz, 1975; World Tsadick and Bragg, 1980; Proud Foot and Heulan, 1987). Regarding uniformity and production index and also economic advantage of wheat screening limited work are presented particularly in our condition; these are the new approach for wheat screening. As presented in Table 6, 7 and 8 the similar reaction have shown in these parameters regarding different levels of wheat screening. This is quiet known there is no significant differences between different proportion of wheat screening ration price with control, as can be seen in the Table 8, wheat screening was not compared with wheat since main cereal in control group is corn, huge declining are appear in 30 and 20% of wheat screening ration price compared with control group. There is a good view of this fact that wheat screening widely is the best alternative ingredient for cereal in particular for wheat, since in most developing countries especially in Middle East wheat is the most common food for human. An alternative such as wheat screening as a by-product of wheat. Could save more food source for human nutrition and also produce cheaper egg and meat.

Table 6: Broiler performance in response to different levels of wheat screening in 28 and 35 days of age

Treatments	28 days of age				35 days of age			
	DFI	DGR	UF	PI	DFI	DGR	UF	PI
Control	92.56	37.02	72.75	184.64	121.78	59.19	71.25	202.48
10% Wheat Screening	91.62	31.19	71.25	176.47	113.46	56.00	68.75	192.50
20% Wheat Screening	91.31	28.70	70.00	172.25	113.35	59.29	67.50	193.92
30% Wheat Screening	89.50	28.35	70.00	171.01	113.28	55.28	66.25	188.50

DFI, Daily Feed Intake (g); DGR, Daily growth rate (g/day); UF, Uniformity (%); PI, Production Index. No significantly differ (P>0.05) were observed in the means.

Table 7: Broiler performance in response to different levels of wheat screening in 42 and 46 days of age

Treatments	28 days of age				35 days of age			
	DFI	DGR	UF	PI	DFI	DGR	UF	PI
Control	188.67	83.87	61.25	226.56	208.22	64.66	57.50	219.27
10% Wheat Screening	184.60	82.21	61.25	218.10	205.94	75.20	57.50	216.08
20% Wheat Screening	184.07	78.40	60.00	216.04	204.38	68.89	56.25	211.99
30% Wheat Screening	183.85	82.29	58.75	216.32	202.19	67.00	55.00	209.79

DFI, Daily Feed Intake (g); DGR, Daily growth rate (g/day); UF, Uniformity (%); PI, Production Index; No significantly differ (P>0.05) were observed in the means.

Table 8: Financial advantages in response to wheat screening for meat Price (Kg /feed) per $ US

Treatments	28 days	35 Days	42 days	46 Days
Control	0.377	0.399	0.439	0.471
10% Wheat Screening	0.366	0.397	0.433	0.463
20% Wheat Screening	0.363	0.392	0.421	0.458
30% Wheat Screening	0.355	0.356	0.420	0.451

Kg/feed, kg meat production per feed intake; Data are provided base on US $ 1= 860 Tomans in Iran; No significantly differ (P>0.05) were observed in the means.

Conclusion: Wheat feeding screening grad 1 with desirable physiochemical content than grad 2, was selected, in addition high potential in ME status, and similar protein digestibility, daily feed intake, uniformity and financial advantage demonstrated it could be used as a ingredient in broiler ration, but exact amount of this feed in poultry feeding need to further consideration by future works.

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