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A Comparative Effect of Mash and Pellet Feed on Broiler Performance and Ascites at High Altitude (Field Study)

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Abstract: In this study, a total of 11000 Ross-308 broiler chicks, in 4 groups (2750 chicks) eachwere fed on mash or pellet diet from the 1st to 28thday of age to compare their performance according to different diet. The chicken groups were reared on deep litter in open poultry farm at about 2450 meter altitude above sea. The chicks were fed on Mash from koudijus (Gr. 1), Pellet from koudijus (Gr.2), Pellet from Hendrix N.V. (Gr.3) and Pellet from Hendrix N.V Merksem (Gr.4). The results showed that feeding on Pelleted ration improved the weightgain, feed intake and feed /gain compared to mash diets. The highest body weight throughout all of the4 weeks wasobserved in Pellet fromHendrix fed chickens (1103.73gm), while the lowestbody weight in different weeks were observed inMash from Koudijus. During the whole period it was observed that pelleting increased the feed intake compared to mash feed. The highest (1595g/bird) at 4th week and the lowest (1474g /bird/week) feed consumption were observed in pellet Hendrix (gr 4) and Mash Koudijus (gr1); respectively. The highest (0.786) FCR value was observed in mash group, which indicated lowfeed conversion efficiency.The mashfeed given only for the first four weekssignificantly reduced the subsequent incidence of ascites. The mortality with ascites in birds receiving pelleted feed wasconsistentlythe greatestand was the lowest in birds fed on mash.

Key words: Broiler chicken · Mach ration · Pelleted ration · Body weight · FCR · Mortalities Ascites

INTRODUCTION

The cost of feed is a primary concern to the poultry industry since it is compromises about 60-70 % of the total cost of broiler production *[1]*.Researchers, Nutritionists, feed mill mangers and live production specialists continually look for opportunities to improve feed conversion as well as to improve growth and to reduce broiler production costs. Various feed forms including pellet, mash or crumble are supplied to broiler. Ration forms are the most important factor which directly influences the cost of mixed feed and production performance of broiler. Mash is a form of a complete feed that is finely ground and mixed so that birds cannot easily separate out ingredients; each mouthful provides a well-balanced diet. Mash diet gives greater unification of growth and less death loss and is more economical. However, ground feed is not so palatable and does not retain its nutritive value as well as ungrounded feed [2]. Pellet system of feeding is really a modification of the mash system by mechanically pressing the mash into hard dry pellets or "artificial grains". It is generally accepted that, compared to mash, the feeding of pellets improves feed conversion [3, 4], broiler performance [5] with an increased feed intake [6, 7]. Reasons for the enhanced performance may be due to increased digestibility, decreasedingredient segregation, Decreased feed wastage, reduction of energy during prehension and improved palatability [8] and the so The modern broiler industry has traditionally fed a pelleted diet to birds. The quality of pellets must be taken into account also because feeding pelleted rations is not enough to ensure enhanced performance of poultry [9]. Pelleting of feed also provides the benefits of: increasing the bulkdensity of feed; improving feed flow ability; and providing opportunities to reduce feed formula costs through the use of alternative feed ingredients. The effect of feeding pellets versus mash diets was evaluated and found to ranged from 100% to 20% pellets in comparison to a mash feed, with birds showing a preference for the pellets without fines; respectively [10].

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Ascites, water belly or pulmonary hypertension syndrome is a condition in which the body cavity accumulates serous fluid, leading to carcass condemnation or death especially for rapidly growing broiler strains, resulting in economic loss [11, 12]. It was emerged in the 1970s and recognized in poultry worldwide for many years as a serious problem for broiler-chicken producers [13, 14].

The causes of the syndrome are multifactorial and mainly induced by exogenous and/or endogenous factors (Interaction between physiological, environmental and management factors). An imbalance between oxygen supply and the oxygenrequiredto sustain rapid growth rates and high food efficiencies is believed to be the primary cause of ascites in broiler chickens [15, 16]. The housing environment, including factors such as temperature (cold or fluctuating temperatures) and air quality(dust concentration, carbon dioxide levels and oxygen levels) were known to influence the incidence of ascites in broiler chickens. The incidence of ascites greatly increases at altitudes greater than 1300 meters above sea level, presumably because of the low oxygen partial pressure [12].

Physiologically, low oxygen concentration creates an oxygen deficit (hypoxia) anda demand for more oxygen, the increased demand may exceed the cardiopulmonary capacity to supply sufficient oxygen, resulting in pulmonary hypertension and right ventricular failure [11]. It was recognized that ascites at lower moderate altitude was also occurred and caused by Pulmonary Hypertension resulting in right ventricular hyper-trophy followed by right ventricular failure and ascites.. The peak of ascites incidence occurs in weeks 5-6 of the growing period, but it is thought that the etiology of the syndrome is initiated much earlier, even during the embryonic stage [17]. Therefore our study was carried out to study previous factors in our field condition up to 4weeks of age.

MATERIALS AND METHODS

Chicken Flock: In this field study a total of 11000 one-day-old commercial broiler (Ross308) breed chicks were used. These chicks reared in open house system deep litter at about 2450 meter above sea and divided in to 4 equal groups (1-4) each was 2750.

Ration: The chicken groups 1, 2 3 and 4 were fed on the following ration from the 1st day of life till the end of the experiment (28 days): Mash from Koudijus, Pellet fromKoudijus, Pellet from Hendrix and Pellet from HendrixN.V.Merksem; respectively. Composition and type of ration are shown in table (1,4and 6), while nutrient analysis was shown in tables (2,3,5 and 6).

Table 1: Composition of the feed used in experimental groups (1-2)

Ingredients	Starter (0-14 days)	Grower (14-35 days)	Finisher (35-42 days)
Maiz	60	63	67.5
Soybean meal 48%	30	25	20.5
Koudijus starter conc.	10	10	10
Koudijusgrower conc.	0	10	10
Wheat bran	0	2	2

Table 2: Ingredient composition and nutrient analysis of the diets provided to broiler chickens in Groups 1and 2.

	Starter	Grower	Finisher
M.E. kcal/k feed	2900	2909	2950
Crude protein %	21.6	19.84	18.30
Crude fat %	3.11	3.2	3.64
Crude fiber %	2.8	2.77	2.63
Lysine %	1.23	1.1	1.06
Methionine %	0.49	0.46	0.48
Methionine + Cystine %	0.86	0.81	0.8
Threonine %	0.86	0.79	0.71
Tryptophan %	0.25	0.23	0.2
Calcium %	0.72	0.71	0.9
Phosphorus AV %	0.26	0.26	0.37
Sodium %	0.14	0.14	0.15

Table 3: Ingredient composition and nutrient analysis of the diets provided to broiler chickens in Group3.

	Starter	Grower	Finisher
M.E. kcal/k feed	2900	2909	1950
Crude protein %	21.6	19.84	18.13
Crude fat %	3.16	2.85	2.96
Crude fiber %	2.1	2.77	2.73
Lysine%	1.31	1.21	1.09
Methionine %	0.53	0.48	0.46
Methionine + Cystine %	0.9	0.82	0.77
Threonine %	0.86	0.79	0.71
Tryptophan %	0.25	0.23	0.2
Calcium %	0.85	0.69	0.68
Phosphorus AV %	0.41	0.32	0.32
Sodium %	0.15	0.15	0.15

Broiler Performance Parameters: The different parameters were measured weekly using the following Formula: Feed consumption (FC) g/bird = Feed intake in a replication / No. of live birds in a replication. FCR = Feed intake (g) / bird / Live weight (g) / bird. Body weight: Body weight for each chicken in each group was recorded at 1, 2, 3 and 4 weeks according to NCR [18].

Table 4: Composition of ration used for group (4)

Ingredients	Starter (0-14 days)	Grower (14-35 days)	Finisher (35-42 days)
Maiz	56.2	63.3	69.3
Soybean meal 48%	28.8	23.7	18.5
Hendrix starter conc.	10	0	0
Hendrix grower conc.	0	10	10
Wheat bran	5	3	2.2

Table 5: Ingredient composition and nutrient analysis of the diets provided to broiler chickens in Group 4

	Starter	Grower	Finisher
M.E. kcal/k feed	2821	2903	2964
Crude protein %	21.49	19.42	17.38
Crude fat%	3.1	2.86	3.01
Crude fiber %	2.14	2.77	2.71
Lysine %	1.29	1.18	1.04
Methionine%	0.52	0.47	0.45
Methionine + Cystine %	0.88	0.8	0.75
Threonine %	0.85	0.76	0.68
Tryptophan %	0.25	0.22	0.19
Calcium%	0.85	0.69	0.68
Phosphorus AV %	0.41	0.32	0.32
Sodium %	0.15	0.15	0.15

Table 6: Average weekly bodyweight gain/gm of broiler chickens feed different ration forms (n= 80 chickens)

Gr	Ration	1st week	2nd week	3rd week	4th week
1	Mash (Koudijus)	148	362.8	665	941.53
2	Pellet (Koudijus)	165	428	717.8	1058.56
3	Pellet (Hendrix)	160	436	770	1103.73
4	Pellet (Hendrix)	162.8	424.2	915.75*	890.5

Mortality Rate: The mortality rate was recorded from 0 weeks until the 4 weeks using the following formula. Mortality % = No. of death birds in a replication / No. of initial birds in a replication X 100.

Ascites Diagnosis: Dead birds in all different groups were subjected to post-mortem examinations and those with accumulation of abdominal or pericardial fluids were diagnosed as ascites mortality according to Saif *et al.* [19].

RESULTS AND DISSCUSION

Successful broiler development is dependent on optimal feed intake throughout the growing period. Optimal feed intake is dependent on a number of factors such as environmental temperature and diet nutrient density and physical feed quality is considered to have a very significant impact on broiler growth [20].

Today ascites is a world wide problem and is found in broilers reared at all altitudes. The primary objective of the present study was to examine the current association between BW, feed conversion and BW gain and ascites incidence in broiler chickens rearedunder commercial settings.Different growth performance parameters (average weekly body weight, body weight gain, feed consumption, feed conversion ratio, production number and survivability were presented in tables 6, 7 and 8.

Generally, the results show that optimal performance was achieved on the pelleted feed (Table 6 and 7). Feed intake and live weight were reduced and FCR increased, on Mash (koudijus) Gr (1) chickens relative to pellets.

Table 7: Average Feed Intake and Feed Conversion of broiler chickens feed different ration forms

		Feed intake (kg\bird)			Feed conversion (kg feed\kg gain)		
Gr	Ration	0-7 d	0-14 d	0-28d	0-7 d	0-14 d	0-28d
1	Mash (Koudijus)	113	408	1474	0.76	0.79	0.78
2	Pellet (Koudijus)	127	465	1562	0.77	0.78	0.66
3	Pellet (Hendrix)	128	475	1524	0.8	o.79	0.62
4	Pellet (Hendrix)	126	450	1595	0.74	0.76	0.66

Table 8: Number and rate of weekly and total mortality in broiler chicken of chickens groups feeddifferent ration forms.

		1stweek		2ndweek		3rdweek		4thweek		Total of Mortality	
Gr No	Ration	No	%	No	%	No	%	No	%	No	%
1	Mash (Koudijus)	41	1.5	8	0.3	17	0.62	9	0.33	75	0.027
2	Pellet (Koudijus)	24	0.87	24	0.87	23	0.83	8	0.3	79	0.028
3	Pellet (Hendrix)	26	0.95	21	0.76	25	0.91	8	0.3	80	0.029
4	Pellet (Hendrix)	24	0.87	12	0.44	38	1.4	15	0.55	89	0.03

Pelleting improved the weight gain, feed intake and feed /gain compared to mash diets (Table7) these results confirm the superiority of pelleted diets over mash diets in improving broiler performance.

The highest body weight throughout all of the4 weeks was observed in Pellet fromHendrix Gr3 chickens (1103.73), while the lowest body weight in different weeks were observed in Mash from koudijusgr 1 (941.53gm). This result might be supported by Munt *et al*, [21] and Preston *et al*, [22] whom showed significantly poorer performance of mash-fed birds. Kim and Chung, [23] showed that mash-fed bird had lower body weight at 41 days than birds fed on crumble andpellet. The highest (1595g/bird) at 4th week and the lowest (1474g /bird/week) feed consumption were observed in pellet Hendrix group 4 and Mash KoudiJus Gr 1; respectively. It was obvious that the highest feed consumption was occurred in Pellet Hendrix group 4 in the 4th weeks of age and the lowest feed consumption occurred in mash group in all 4th weeks of age. This means that pelleting increased the feed intake compared to mash feed. Several studies are in agreement with this result [6,24,25]. Bertechini *et al*. [26] reported that pelleted diets gave greater feed intake than did mash forms. Moran [27] showed that pellet diet increased feed intake in broilers. While, not difference was found in feed intake between mash and pellet feed, it was attributed to a low pellet quality [28]. Mutetwa [29] reported that there was no significant difference in terms of growth and feed consumed between birds fed on mash and pellets during the 1st two weeks, while at 2-3 the chickens tended to be selective in feeding by consuming 40 % more of hard textured feed than mash feed. The author attributed the increase in feed intake was increased with particle size subsequently resulting in increase growth of birds. On the other hand they concluded Mash feed tends to stick to the inside of the chicken's beak, resulting in a fall in food intake and consequently reduced rate of growth [30].

The highest FCR (0.78) was observed in mash group, which indicated low feed conversion efficiency. On the other hand comparatively low and nearly similar FCR values were observed in pellet from Hendrix gr 3 (0.62), gr 4 (0.66) and pellet from Koudijusgr 2 (0.66), which indicated high feed conversion efficiency. Similar results were obtained by AshaRajini *et al*. [31, 32] and Mendes *et al*. [33]. Moran [27] who reported that pellets had a better feed efficiency over mash. Also, it was found that pelleting increase feed conversion by 5.9 % (34). It was concluded that crumble-pellet treatment significantly improved feed conversion; furthermore many studies have also showed that pelleted feed improves the feed conversion in comparison to mash feed [2, 23, 33, 35]. While, not significant difference in feed conversion between pellet and mash feed could be reported Bertechinietal [26].

It is obvious that birds receiving pelleted feed showed greater mortalities than birds receiving mash feed (Tables 2 and 3). The effect of type of feed on mortality was marked. This finding is consistent with researches [24, 36-38] those demonstrated birds in the mash feed groups had a significantly lower mortality rate than birds in the pellet feed groups. Proudfoot *et al*. [38] observed a 50% increase in mortality of birds fed pellets vs mash. It is tempting to speculate that the lower mortality seen with mash-fed birds is simplya result ofreduced growth rate, whilethe increased growth rate resulting from pellet feeding may increase mortality due to ascites [6, 39].

Ascites is a cardiovascular metabolic disorder characterized by fluid accumulation in the abdominal cavity. It is a common cause of economic losses due to mortality and downgrades in fast-growing broiler strains.In the present study, beginning from the 2nd week cases of ascites were appeared in Pellet (Koudijus) group 2, Pellet (Hendrix) Gr 3 and Gr 4 (begin at 9th days and continuo till the 19thdays and at 28 days) respectively while in Mash (Koudijus) gr1 ascites appeared from 9 to 16 days but it is low in number and potency in comparison to that of other pelleting groups. It was clearly evident that the mash feed given only for the first four weeks significantly reduced the subsequent incidence of ascites (Table 3) The mortality with ascites in birds receiving pelleted feed was consistently the greatest and was the lowest in birds fed on mash. Birds in the mash feed groups had a significantly lower mortality rate due to ascites than birds in the pellet feed groups [6, 19,39]. Silva *et al*. [40] found that broilers consumed pellet feed have higher incidences of ascites than broilers consume the same diet in mash form. The result of higher ascites incidence in fastgrowing chickens with a high feed efficiency was explained by concomitant and a thyroid hormone deficiency [41]. Decuypere *et al*. [15] concluded that there was a relationship between susceptibility for ascites and high feed efficiency accompanied withhypothyroidism and this was responsible for the insufficient supply of Oxygen, which resulted in anoxia, hypoxemia and hypoxia.

Our results showed that although improved broiler performance is an advantage for pellet feeding, some disadvantages seem to be connected to this feeding method. With respect to animal health, a correlation between pellet feeding and the occurrence

of certain metabolic diseases cannot be ignored. The increased growth rate resulting from pellet feeding may increase mortality due to ascites especially in male birds.

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