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The Effect of Feed Regimen on Ascites Induced by Cold Temperatures and Growth Performance in Male Broilers

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Abstract: A trial was conducted to investigate to effects of feed type (pellet and mash) on ascites in broiler. A total of 208 male chicks were used in this study. Pellet and mash feed group were formed in the study, pellet feed group fed on pellet and mash feed group fed on mash feed. Half of the animals from each group were moved to compartment with 16^{0}C after 21 day. Body weights, feed conversion, weight gain and feed consumption of the chicks were calculated and mortality from ascites was recorded daily. On 42 day, blood samples were collected to determine hematocrit values. End of the study it was determined that feed type has no effect on body weight, weight gain, feed consumption and feed conversion rate. However, mash feed reduced the incidence of ascites.

Key words: Ascites, mash feed, pellet feed, broiler, cold temperature

Introduction

The incidence of ascites in broilers has become of increasing concern to poultry industry in many areas of the world (Silva *et al*., 1988). Ascites is described as a syndrome in which accumulation of severe fluid in the body cavity. Ascites is prevalent in fast-growing strains of broiler, particularly males, from 4 weeks of age (Peckham, 1978; Maxwell *et al*., 1986; Wilson *et al*., 1988). Several factors include housing environment (temperature levels, carbon dioxide and oxygen), rapid growth rates, high basal metabolic rate, high energy rations, high feed intake and feed form are known to influence the occurrence of ascites in broilers (Dale, 1990; Odom, 1992; Bölükbasi *et al*., 2004). Physiological causes behind the ascites syndrome appear to be aforementioned conditions that promote the development of pulmonary hypertension and congestive heart failure. These conditions increase the demand for oxygen and increase the cardiac output. Therefore, the right ventricle of the heart is usually enlarged (Julian *et al*., 1987). The ratio of the right ventricle to the total ventricle (RV/TV) mass has been used to quantitatively correlate the increased blood pressure in the right ventricle. As the right ventricle enlarges as a result of increasing blood pressure and increasing blood flow, the volume of the blood the right ventricle can hold also increased (McGovern *et al*.,1999). Increase in hematocrit and erythrocyte count due to increased demand for oxygen result in higher blood viscosity and cause pulmonary hypertension (Witzel *et al*., 1990). A hypothesis that hematocrit value as an indicator of partial resistance to ascites syndrome. The incidence of ascites is higher in the colder environmental temperatures because birds increase metabolic rate to maintain body temperature (Hernandez, 1984; Maxwell *et al*., 1986; Dale and Villacres, 1988). Wideman and Robert (1999) and Bölükbasi *et al*. (2004) have reported that cold temperature is one of the most effective factors on ascites.

In order to minimize ascites, long term solution as a breeding for resistance to ascites (Shlosberg *et al*., 1991) and short term solutions such as adequate ventilation, avoid excessive exposure to cold, concern to ensure minimum levels of sodium, and lighting programs and feeding regimens are should be recommended (Shlosberg *et al*., 1991, Wideman, 1988). Broilers that consume pellet feed have frequently been shown to have higher incidences of ascites than broilers that consume the same diet in mash form (Silva *et al*., 1988). The aim of the this study investigate of feed regimen might affect the incidence of ascites, growth performance, hematocrit value, heart weight and the RV/TV ratio in broiler flock reared on cold temperature.

Materials and Methods

A total of 208 male broiler (Ross PM3) chickens aged one day were used in this study. Two groups were formed, pellet group and mash feed group with four replicates. 10 cm thick of wood shavings was laid under the poultries. The chickens were weighted on the first day and were placed to the divisions (1x2.1 m^2) each contained 25 chickens in the poultry. The pellet group was received a standard pelleted broiler diet (22.5 % CP and 3060 kcal ME/kg of diet) between 1-21th days. A finisher diet (22% CP and 3180 kcal ME/kg of diet) was fed between 22-42 days (Table 1). Mash group was

Table 1: Composition of experimental feeds

Ingredients and analyses	Starter	Finisher
Ingredients		%
Yellow corn	53.44	60.00
Soybean meal	32.00	23.69
Oil	4.00	4.00
Fish meal	3.50	3.50
Sunflower meal	2.5	4.00
Limestone	1.0	1.0
Dicalcium phosphate	1.0	1.0
Vitamin premix[1]	0.65	0.65
Mineral premix[2]	0.15	0.15
Salt	0.36	0.36
DL-methionine	0.10	0.60
Lysine	1.30	1.15
Total	100.00	100.10
Calculated analyses		
CP	22.5	21
ME, kcal/kg	3060	3226

[1]Supplied the following Per kilogram of vitamin premix: vitamin A, 2,700 IU; cholecalciferol, 940,00 IU; vitamin E, 6,800 IU; menadione, 681 mg; thiamine 454 mg; riboflavin, 1.5 mg; niacin, 13 mg; pantothenic acid, 3.17 mg; pyridoxine,908 mg; folic acid, 363 mg; biotin, 30 mg. [2]Supplied the following per kilogram of vitamin premix: Mn, 150 mg; Zn, 120 mg; Fe, 40 mg; Cu, 13 mg; I, 1 mg.

Table 2: Means of body weight, feed consumption, weight gain and feed conversion of broilers

Body weight	Groups		Signi-ficance
	Pellet[1]	Mash[2]	
1.d	40.60±0.73	38.70±0.70	NS
21.d	590.74±23.64	562.58±43.96	NS
Feed consumption			
1 to 21 d	785.92±14.25	799.44±12.59	NS
Weight gain			
1 to 21 d	550.06±23.06	523.88±44.10	NS
Feed conversion			
1 to 21 d	1.42±0.07	1.53±0.11	NS

NS: Not significant 1: Pellets: Birds received feed pellet form. 2: Mash: Birds received feed mash form

received the same diet in mash form. The pellet and mash feeds were of the same composition and were manufactured from the same stocks of feed ingredients. Commercial broiler rations were provided *ad libitum* from 0 to 42 days. Water was supplied to both groups at *ad libitum* level by refreshing constantly

The chicks were exposed to 24 hours light at the first week and 23 hours light and 1 hour dark to end of the experiment. Feeding was performed at the same hours at night and daylight. On the 16th and 24th days, Gumboro D 78 strain was added to drinking water to prevent from Gumboro disease.

The poultry temperature was adjusted to 35^{o}C, 30^{o}C and 27^{o}C at the 1th, 2nd and 3rd weeks of the experiment respectively. Half of the chickens from all groups were moved to eight cold compartments (16^{o}C constant) at the 21th day and kept there until the end of the study. The poultry temperature was adjusted to 25^{o}C, 24^{o}C and 23^{o}C at the 4th, 5th and 6th weeks of the experiment respectively.

Live weight, feed consumption, feed conversion and weight gain calculated on 1st day, 21st day and 42nd day. 42 day, blood samples were collected to determine hematocrit values. Mortality caused by ascites was recorded daily. Five randomly chosen birds per groups were killed and heart weight was determined. Relative weight of this organ was presented as percentage of live body weight. Ratio of right ventricle weight to total ventricle weight (RV/TV) was also calculated.

Statistical analyses: The data were analyzed by analysis of variance by using the General Linear Models in the SPSS program (SPSS 10.0 for Windows, 1999). Between 1 and 21 d of age, the only comparison was made between pelleted and the mash groups. From 22 to 42 d of age, the temperature effect was also added into model (one- way ANOVA). The significance level was 5%. Mortality rate data were analyzed using the difference between two proportions (Walpole, 1969).

Results and Discussion

From hatch to 21 d of age: From 1 to 21 day, there were no significant differences between the pelleted feed group and mash feed group in body weight gain, feed consumption and feed conversion. At 1 and 21 d of age, body weights of the groups were not different (Table 2).

From 21 to 42 d of age: On 21 day of age, the body weight of the pelleted and mash feed groups were found no different. The chickens in the cold temperature had higher body weight than the control group on 42 day ($P< 0.05$). The feed consumption of chickens in cold temperature were higher than chickens in control ($P<0.01$). There were no significant differences between groups in body weight gains and feed conversion ratio on day 42 (Table 3).

Ascites is the severe syndrome, causing enormous loses, in the broiler industry all over the word. Not only duo to mortality but also caused to reduce body weight and increased condemnations at slaughter (Shlosberg and Bellaiche, 1996, Wideman, 1988).

Feed is the most important and coast item in broiler industry. Silvia *et al.* (1988), found body weight gain and feed conversion ratio in pelletted feed than mash form. However, in this study, we fond there were no significant differences between the pelleted and mash feed group in body weight gain, feed conversion, feed consumption and shouter body weight.

Birds in the mash feed groups had a significantly lower mortality rate due to ascites than birds in the pellet feed groups ($P<0.05$). It was not found out mortality due to

Table 3: Means of body weight, feed consumption, weight gain and feed conversion of broilers

	Body weight		Feed consumption	Weight gain	Feed conversion
Groups	21.d	42.d	21.-42.d	21.-42.d	21.-42.d
Pellet control[1]	590.74 ± 23.6	2164.9 ± 45.8b	2695.8 ± 45.1b	1574.1 ± 58.4	1.71 ± 0.08
Pellet cold[2]	623.00 ± 10.5	2262.9 ± 75.5a	2835.7 ± 37.2a	1639.9 ± 78.7	1.72 ± 0.10
Mash control[3]	562.58 ± 43.9	2164.0 ± 23.2b	2725.1 ± 14.3b	1605.4 ± 28.1	1.69 ± 0.03
Mash cold[4]	636.64 ± 65.6	2288.1 ± 78.8a	2888.3 ± 102.7a	1651.5 ± 93.47	1.75 ± 0.06
Significance	NS	*	**	NS	NS

NS: Not significant *: p<0.05; **: p< 0.01 a,b: Means having different superscripts in a column differ significantly [1]: Pellet: birds received feed pellet form in control house (25°C, 24°C and 23°C at the 4th, 5th and 6th weeks of the experiment respectively). [2]: Birds received feed pellet form in cold house (16°C). [3]: Birds received feed mash form in control house (25°C, 24°C and 23°C at the 4th, 5th and 6th weeks of the experiment respectively). [4]: Birds received feed mash form in cold house (16°C).

Table 4: Mortality rate due to ascites, means of hematocrit, ratio of RV/TV and ratio of heart of broiler

Groups	Mortality %	Hematocrit%	RV/TV	Heart %
Pellet control[1]	6^{b}	$35.0\pm.6^{a}$	0.26 ± 0.007^{c}	0.567 ± 0.01^{c}
Pellet cold[2]	13.3^{a}	35.8 ± 2.6^{a}	0.32 ± 0.008^{a}	0.611 ± 0.008^{a}
Mash control[3]	-	31.8 ± 1.3^{b}	0.26 ± 0.004^{c}	0.552 ± 0.01^{d}
Mash cold[4]	3.3^{b}	$33.5\pm1.3a^{b}$	0.30 ± 0.005^{b}	0.584 ± 0.004^{b}
Significance	*	*	**	**

*: p<0.05; **: p< 0.01 a, b: Means within the same column with no common superscript differ significantly.
[1]: Pellet: birds received feed pellet form in control house (25°C, 24°C and 23°C at the 4th, 5th and 6th weeks of the experiment respectively). [2]: birds received feed pellet form in cold house (16°C after 21 d.). [3]: birds received feed mash form in control house (25°C, 24°C and 23°C at the 4th, 5th and 6th weeks of the experiment respectively). 4: birds received feed mash form in cold house (16°C after 21 d.).

ascites in mash control group. Broilers that consume pellet feed have frequently been shown to have higher incidences of ascites than broilers that consume the same diet in mash form (Silva *et al*., 1988). The relationship between pelleted feed and ascites was recently confirmed by Arce *et al*. (1985), who observed a 15% incidence with pellet feed versus 4% with mash feed. Silva *et al*. (1988), 1.47% and 0.8% in two field trial. We also found, birds that in mash feed groups had a significantly lower mortality rate due to ascites than in pellet feed groups in cold temperature and was not found out mortality due to ascites in mash control group. Hematocrit value of pellet feed group was higher than mash feed group (P<0.05). RV/TV ratio and heart weight ratio were significantly higher in pellet cold group than the other groups (P< 0.01). RV/TV ratio was lower mash control and pellet control groups than the other groups (P<0.01). The lowest values for heart weight were demonstrated in mash control group (P< 0.01). The ratio of the right ventricle to the total ventricle mass is a gross indicator of ascites (McGovern *et al*., 1999). Increases in percentage of heart and RV/TV rate in cold exposed birds suggesting that stressing cold did in fact cause an increase in heart weight and RV/TV rate. RV/TV ratio and heart weight ratio were significantly higher in pellet cold group than the other groups. RV/TV ratio was lower mash control and pellet control groups than the other groups

Increase in hematocrit and erythrocyte count due to increased demand for oxygen result in higher blood viscosity and cause pulmonary hypertension (Witzel *et al*., 1990). Hematocrit value of pellet feed group was higher than mash feed group

Conclusion: In this study we concluded that feed type has no effect on body weight, weight gain, feed consumption and feed conversion rate, however, mash feed reduced the incidence of ascites.

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