Some Welfare Parameters of Ross 308 as affected by bedding types used in broiler houses

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Abstract

The productive performance of broiler chickens is often affected not only by the quality of feed and the optimum conditions necessary for the growth and development, but also by the extent convenience and suitability of the growing environment, especially the space and the bedding for movement. Therefore, this experiment was conducted for (5) weeks with the aim of studying the effect of bedding type in poultry houses on the productive performance of broiler chickens. 375 unsexed Ross 308 hybrid broiler chicks, one day old with an average weight of 40 grams, were used in the study. They were randomly distributed into five treatments with three replicates (25 bird per replicate). The chicks were fed a starter ration for 10 days and a grower ration from 11 to 24 days, then a finisher ration at 25 to 35 days of age. The bedding treatments were T1 (control) sawdust, T2 (cardboard), T3 (rice husk), T4 (sand), and T5 (chopped straw). The results indicated that hock arthritis symptoms (0 normal or 1-4 infected) did not differ among paperboard, rice husks, and sand bedding treatments compared to the control bedding treatment (wood shavings), while a significant deterioration ($P<0.05$) was recorded in the wheat straw bedding treatment T5 compared to the control and sand groups. On the other hand, all bedding treatments did not differ in their effect on plantar fasciitis, while the highest feather hygiene index was recorded in the sand treatment with a significant difference from the rice husks treatment (T3), which recorded the lowest value for this index. The study did not record differences among the treatments regarding the condition of the nostrils and eyes. In general, any of the studied bedding materials can be used in poultry floors, with caution to avoid plantar fasciitis and lower feather health index when using straw and sebum bedding, respectively .

Keywords: rice husks, chicken health, poultry industry ,

Introduction

The poultry industry has witnessed rapid growth globally over the past two decades, playing an important role in providing animal protein (5), coupled with the increasing demand for poultry meat accompanying population growth (6). The poultry industry faces numerous problems, including management issues related to the type of bedding used for rearing. Wet bedding is one of the most significant constraints facing poultry project workers due to the increased number of birds, which is accompanied by increased humidity and an environment conducive to the growth of pathogens, the rise of ammonia and undesirable odors, in addition to the growth and spread of insects (19). This negatively impacts the health and welfare of birds, leading to a decrease in their productivity. Furthermore, wet bedding increases the incidence of plantar fasciitis, dermatitis, and hock arthritis (22.(

Wood industry residues and sawdust are of the most widely used bedding materials in

ISSN 2072-3857

commercial poultry projects due to their qualitative characteristics. The availability of mass sawdust is expected to decrease due to its increasing demand and its unavailability at times, leading to increase costs. In addition, the use of unproper sawdust containing large pieces of wood and nails can cause tumors or crop ruptures, and sometimes be fatal if ingested by birds (2, 16. 18). Therefore, researchers have resorted to finding alternative materials to shavings for use in bedding with similar specifications to wood shavings. Many alternatives have already been used, such as sand, rice husks, straw, and others (3, 4, 8, 10, 14, 16.(

Sand is one of the most studied alternatives, due to its physical properties and coarse particle size, which contribute to efficient moisture absorption, accelerating evaporation and maintaining the dryness of the litter surface (9). Studies have shown that ammonia levels were maintained at acceptable levels in chicken houses when sand bedding was used, and no negative effects on bird health were recorded regarding plantar fasciitis or hock joint inflammation (17, 21). Therefore, this study aims to evaluate the feasibility of using alternative materials to sawdust with technical properties suitable for use as bedding in poultry farming projects, contributing to improving the rearing environment and reducing economic costs.

Materials and methods

The experiment was conducted in the poultry farm of the Animal Production Department, College of Agriculture, University of Kufa, during the period from November 9 to December 13, 2024. The effect of five different types of bedding on the productive performance of broiler chickens was studied. 375 unsexed one-day-old Ross308 hybrid broiler chicks were used, with an average initial chick weight of 40 grams. The chicks were randomly divided into five treatments with three replicates (75 chicks/treatment and 25 chicks per replicate). The treatments included five types of bedding: T1 sawdust (control), T2 cardboard, T3 rice husks, T4 sand, and T5 chopped straw. The chicks were fed a starter ration for 10 days and a grower ration from 11 to 24 days, then a finisher ration at 25 to 35 days of age (Table1 .(

Study measurements

After 35 days of rearing, the study data were taken for the measurements under study at level of 5 random sample birds for each replication (15 birds/treatment). The measurements were boiler welfare parameters including; Achilles tendonitis disease symptoms, plantar fasciitis symptoms, feather cleanliness and quality, humidity, NH3 ammonia and pH levels (4.(

ISSN 2072-3857

Table1. Percentages and calculated chemical composition of feed ingredients used to feed broiler chickens under study for 35 days

Constituents	Starter Ration1-10 days	Growth Ration 11-24 days	Final Ration 25-35 days
Ground yellow corn	50.50	54.00	58.00
Soybean meal	36.00	32.00	27.50
Ground wheat	8.00	8.00	7.00
Premix	2.50	2.50	2.50
Corn oil	1.50	2.00	3.50
Dicalcium phosphate	0.1	0.1	0.1
Limestone	1.1	1.1	1.1
Salt	0.3	0.3	0.3
Total %	100	100	100
	Chemical composition		
Energy (kcal/kg)	3015	3081	3210
Crude Protein %	23.11	21.51	19.58
Total Calcium %	1.102	1.09	1.08
Available Phosphorus %	0.74	0.72	0.71
Energy to Crude Protein Ratio	130.5	143.2	163.9

*The feed contained a commercial protein concentrate with an energy content of 4900 kcal/kg, 18% crude protein, 1.1% fat, 15-19% calcium, 9.4% lysine, 6.8% phosphorus, 4.8% sodium, 5.8% chlorine, 7.8% methionine, 7.8% cysteine, 0.55% threonine, and a blend of vitamins and trace minerals, inorganic dicalcium phosphate (22% calcium and 8% phosphate. The chemical composition was calculated according to Ross (2019) (20.(

Statistical analysis

The experimental data were statistically analyzed using the computing software statistical program GenStat 12th edition (24), and the averages were compared for significant differences according to Duncan's multiple range tests (P≤0.05.(

The experiment was complete randomized design CRD following the standard equation Yij=μ+ti+ei

Where:

Yij = the value of the j observation of the treatment

μ = average of the studied trait

Ti = the effect of treatment i, which is five treatments for the experiment

eij = random error

Results and discussion

The results (Table 2) show a slight effect of bedding type on hock arthritis across the different ages of the birds. At the end of rearing, the hock arthritis index (HCI) under normal conditions did not differ between the control group (wood shavings) and treatment T4 (sand). However, both treatments differed significantly from the hock arthritis cases recorded in treatment T5 (wheat straw), which recorded a clear deterioration and a significantly higher disease index than the other treatments .

ISSN 2072-3857

Table 2. Effect of bedding type on broiler Ross 308 welfare indicated by hock arthritis symptoms (normal or infected 1-4) after 35 of raring (mean ± standard error(

Treatments Litter type	Hock arthritis symptoms				
	Normal	Abnormal symptomatic level			
		1	2	3	4
Wood shavings	5.000 ± 0.666 a	0.000± 0.000 B	None	None	None
Paperboard	3.660 ± 0.666 ab	1.333 ± 0.333 Ab	None	None	None
Rice husk	4.330 ± 0.333 ab	0.666 ± 0.000 Ab	None	None	None
Sand	5.000 ± 0.000 a	0.000± 0.000 B	None	None	None
Wheat straw	3.333± 0.666 b	1.666 ± 0.666 A	None	None	None
Significance	*	*	NS	NS	NS

*Values are means of three replications. Means followed by different letters within a column are significantly different according to Duncan's multiple range tests (P≤0.05(

However, the treatments did not record a clear difference in their effect on plantar fasciitis in broiler chickens (Table 3). The results of the statistical analysis indicated no significant differences (p≤0.05) in the normal condition (0) compared to 4, 3, 2, and 1, as the disease index was low and did not differ between bedding treatments compared to the control bedding treatment with sawdust (Table 3.(

ISSN 2072-3857

Table 3. Effect of bedding type on broiler Ross 308 welfare indicated by plantar fasciitis symptoms (normal or infected 1-4) after 35 of raring (mean ± standard error(

Treatments Litter type	Plantar fasciitis symptoms			
	Normal	Abnormal symptomatic level		
		1	2	3	4
Wood shavings	4.333 ± 0.333 a	0.660± 0.000 B	None	None	None
Paperboard	3.666 ± 0.666 ab	0.333 ± 0.000 Ab	None	None	None
Rice husk	4.000 ± 0.000 ab	1.000 ± 0.000 Ab	None	None	None
Sand	5.000 ± 0.000 a	0.000± 0.000 B	None	None	None
Wheat straw	5.000± 0.000 b	1.666 ± 0.666 A	None	None	None
Significance	*	*	NS	NS	NS

*Values are means of three replications. Means followed by different letters within a column are significantly different according to Duncan's multiple range tests (P≤0.05(

From the results of the treatment effect test on feather cleanliness (Table 4), the statistical analysis results indicated a significant superiority (p≤0.05) for birds in the sand litter treatment (T4), which recorded the highest feather cleanliness index (3.667) in the normal condition index compared to the lowest value of this index (0.667) recorded in birds reared on the rice husks litter treatment (T3). Similarly, the latter (rice husks bedding) recorded the highest index value of the abnormal feather cleanliness compared to the lowest abnormal index value in the sand birds (Table 4). Meanwhile, the control group did not differ from the litter treatments under study in terms of feather cleanliness. However, individual birds were at level 2 abnormal feather cleanliness especially in the control wood shavings, but did not differ from the undetectable level in the other treatments (Table 4). Regarding the effect of bedding types treatments on the condition of the nostrils and eyes, the results (Table 5) indicate that the general condition of the nostril and eye health index did not differ between birds in the control treatment raised on sawdust litter compared to birds in the other litter treatments under study.

ISSN 2072-3857

Table 4. Effect of bedding type on broiler Ross 308 welfare indicated by feather cleanliness (normal or abnormal 1-2) after 35 of raring (mean ± standard error(

Treatments Bedding types	Feather cleanliness		
	Normal	Abnormal symptomatic level	
		1	2
Wood shavings	2.667 ± 0.881 Ab	2.000±0.577 bc	0.333± 0.333
Paperboard	1.333 ± 0.666 Ab	3.666 ± 0.666 ab	0.000± 0.000
Rice husk	0.667 ± 0.666 B	4.333 ± 0.666 a	0.000± 0.000
Sand	3.667 ± 0.881 A	1.333±0.881 c	0.000± 0.000
Wheat straw	2.000± 0.577 Ab	3.000± 0.577 abc	0.000± 0.000
Significance	*	*	NS

*Values are means of three replications. Means followed by different letters within a column are significantly different according to Duncan's multiple range tests (P≤0.05(

The results showed a slight decrease in the health indicators of birds raised on the T5 wheat straw bedding treatment compared to the control group, the rice husks and the sand treatments. This may be due to the fact that straw is a medium with low moisture absorption and therefore maintains higher moisture levels in the bedding compared to sawdust and sand, which have a higher capacity for moisture absorption (1, 9, 21.(

ISSN 2072-3857

Table 5. Effect of bedding type on broiler Ross 308 welfare indicated by nostrils and eyes conditions (normal or abnormal 1-2) after 35 of raring (mean ± standard error(

Treatments Bedding types	Condition of the nostrils			Condition of eyes		
	Normal	Abnormal symptomatic level		Normal	Abnormal symptomatic level	
		1	2		1	2
Wood shavings	4.666 ± 0.333	0.333± 0.333	None	4.666 ± 0.333	0.333± 0.333	None
Paperboard	5.000 ± 0.330	0.000± 0.000	None	5.000 ± 0.000	0.000± 0.000	None
Rice husk	4.666 ± 0.333	0.333± 0.333	None	5.000 ± 0.000	0.000± 0.000	None
Sand	5.000 ± 0.330	0.000± 0.000	None	5.000 ± 0.000	0.000± 0.000	None
Wheat straw	4.666 ± 0.333	0.333± 0.333	None	4.666 ± 0.333	0.333± 0.333	None
Significance	NS	NS		NS	NS	

*Values are means of three replications. NS refers to nonsignificant difference between means according to Duncan's multiple range tests (P≤0.05(

This is consistent with what indicated by Youssef et al. (2010) (25), that wet or hard bedding may contribute to an increased risk of inflammation or damage to the hock joint due to prolonged exposure to moisture. Regarding the use of sand as a bedding, the results showed no injuries to the heel joint or the sole of the foot, which contradicts Farhadi et al. (2016) (7) who indicated that hard bedding such as sand may increase the risk of foot injury, and as Kuleile et al. (2019) (14) reported about the higher rate of heel joint inflammation in poor bedding such as sand compared to good bedding such as sawdust.

Regarding the use of paperboard in poultry bedding, the results of the current study showed higher incidence of plantar fasciitis than in control treatments fertilized with sawdust or compared to rice bran. This is consistent with the results of Vargas-Galicia et al. (2017) (23), which indicated that moist bedding, such as paperboard, may increase the risk of plantar fasciitis compared to dry bedding, such as sawdust.

Although the use of rice husks bedding was effective in reducing the risk of hock arthritis symptoms and plantar fasciitis, it also had an undesirable effect on overall feather hygiene. The results of the study showed significant feather contamination in birds reared on rice husks bedding, which is consistent with Garcia et al. (2012) (10), who reported that birds raised on moist bedding, such as rice bran, were more prone to developing soiled feathers than those raised on dry bedding, such as sawdust

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Conclusion

Based on this study findings, poultry rearing bed can be applied using other than wood shavings or sawdust, these including rice husks, paperboard, sand, and wheat straw. The rice husks and sand beddings were most favorable in maintaining broiler welfare parameter compared that of less effective when using wheat straw or paperboard beddings. On the other hand, these materials used in poultry bedding in this study are economically at low cost beside of their availability. In conclusion, such materials can be used as an alternative to wood shavings for bedding in poultry houses without concerning about bird's health performance.

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ISSN 2072-3857