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The Effectiveness of Utilizing Certain Ingredients that Enhance the Characteristics of the Old and Used Litter on the Productive Performance of Broilers

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Abstract: ***Research aims to determine if certain modifications can improve the quality of litter and the growth and health of broiler chickens. The trial used various litter-improvement agents selected for their antibacterial properties, moisture absorption, and ability to create a favorable environment for broilers. The study found that broilers raised on treated and reused litter performed considerably better than those raised on untreated litter. These additives reduced microbiological contamination and increased litter absorption, creating a cleaner environment for the broilers. Improved litter conditions also improved broiler development, feed efficiency, and health. Adding specific components to recycled litter may enhance broiler productivity. This benefits the poultry industry by providing a cost-effective and ecologically friendly way to maximize the use of aged and utilized litter and improve broiler performance. The research indicates that litter control is crucial for sustainable poultry production and the health and performance of broiler chickens.***

Keywords: Litter, Broiler, Productive Characters, Health, Behavior.

1. INTRODUCTION

In recent years, advancements have been made in bird care systems to enhance bird well-being and productivity and safeguard the conditions of barns to preserve land, water, air, and other environmental systems. The goal is to lessen ecological harm, specifically, contamination brought on by poultry house pollution (Da Borso and Chiumenti, 1998). Due to its role as the primary container for animal excrement, poultry litter causes pollution. During inclement weather, the presence of litter moisture causes an increase in both the interior and external air

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humidity of the barn. This fosters the proliferation of germs and other pathogens in the barn and its surroundings. The increase in humidity levels may be attributed to factors such as the components of the feeding system, the conversion effectiveness, the processing of litter, and the prevailing ambient conditions. The components in poultry feed and the effectiveness of meat conversion impact litter's physical and chemical characteristics, such as microbial population and oxygen levels. The majority of gaseous pollutants originate from the decomposition of trash (Xin et al., 2011). Factors such as ventilation rates, bird density, age, activity, weight per unit area on the bedding, temperature, humidity, air velocity, season, kind of bedding used, management approach, acidity, and airflow above and through the bedding all have a role in negatively impacting the health of both birds and workers throughout the broiler fattening process. Regional weather worsens the consequences (Coufal et al., 2006). Despite their expensive nature, in-ground poultry care systems use a diverse range of bedding materials. Bedding has a detrimental impact on both health and productivity.

The combination of temperature and the amount of water vapor in the air affects humidity. The air's ability to hold water vapor decreases as temperatures rise, whereas higher temperatures enhance this capability. The elevated relative humidity near rivers, marshes, ponds, and oceans might exacerbate these difficulties in the proximity of barns. Poultry breeders use innovative methods to enhance the quality of winter chicken litter in poultry houses. Sawdust, antibiotics, acetic acid, propionic acid, and superphosphate both absorb moisture and hinder the development of germs in the litter. This mitigates hazardous gas concentrations, such as ammonia, a global concern. The addition of natural zeolite to litter has gained popularity because it enhances its physical, chemical, and biological characteristics, Jilenkerian et al. (2021). It effectively absorbs moisture, maintains cleanliness, and promotes the growth and performance of birds. Scientists are interested in using this practice in farming and poultry due to its beneficial effects on birds and their caregivers.

Litter Specifications

Many types of materials can be used as litter for broiler meat or chicken eggs on the floor, and the type of material used as litter depends on the availability in the area where the project is located. In addition to the price per ton of this material, Ismail (2011).The recommended litter thickness in summer ranges from 5 to 3 centimeters, corresponding to a weight of 150 to 250 kilograms per 100 square meters of the chicken breeding field floor area. In winter, the recommended litter thickness is 10 centimeters, equivalent to a weight of 550 kilograms per 100 square meters of the field floor area (Ezzat, 2001).

Litter Varieties

Material availability, cost, and efficiency during the breeding season determine the types of litter used as chicken coop mattresses. Another consideration is the litter's capacity to resist more than one breeding meal while retaining some of its qualities. Sawdust is the most popular and widely utilized. There are a lot of new materials on the market now, and some have additives that make them better at absorbing moisture, lessen the odors they emit, make them easier to handle and dispose of in the future, and extend their useful life. You can also use them as a fertilizer for vegetables.

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Suitable litter materials free of impurities and abrasive textures, such as nails, glass pieces, and extensive wood shards, should be used since this generates tumors and gaps in the chicken giblets. Examples of such materials include bits of wood, stones, and nails. Scratching or contamination of the litter should be avoided at all costs since it can potentially induce lung inflammation. It is necessary to do consistent labor to move the litter and keep the humidity at a level between 25 and 20 percent. The primary materials for this objective are:

1- Coarse Sawdust and Straw. Coarse sawdust has a lower moisture absorption capacity than straw since it can only absorb 145 kg of water per 100 kilograms of sawdust. The text must be more precise and provide more information to be rewritten straightforwardly and precisely. It is used in regions where sawdust is accessible at a low cost. The limitations of the product are its inability to break down the blue color of the birds, the potential presence of sharp fragments in the wood sawdust that could be harmful to chicks if ingested, and the existence of astringent figs that Ahmed completed in 1982, which hurt the birds' intestines. Finely ground sawdust coarse sawdust, for example, can absorb water. The drawback of softwood is its high moisture content, which requires drying before it can be spread over chicken feed and mixed.

2-Wheat Hay is widely available and inexpensive, making it the most often used variety. It is known for its high moisture absorption capacity. By breaking wheat into little bits, it was feasible to use it since every 100 kg of hay can absorb 257 g of water. However, its use is seldom due to several factors, such as the proliferation of fungus on it, mainly when the mattress is damp, and the temperature is elevated, resulting in injuries to the chest of avian creatures. Alternative materials utilized as floor litter for chickens include mineral pebbles, cajero niello pine leaves, coarse and dry sand, fine black sand, and soft dirt with moisture-absorbing properties. Ahmed (1982) also explored unconventional and innovative materials in poultry farming, such as fiberglass, nano treatment, clay-treated wood, dry lemon, ash, burnt materials, agro fiber, and natural gravel. In the following discussion, we will examine each type in detail, highlighting their advantages and disadvantages and relevant research studies.
3-Sand is a naturally occurring substance composed of tiny grains and mineral particles. Sand is classified based on its size as more petite than gravel and makes up 85% of sand particles. The Inland Continental and non-tropical coastal regions often include sand, with the most prevalent forms being calcium carbonate sand and gunite. The sand grains may be anywhere from 62 mm to 2 mm in diameter, and the sand's color can fluctuate from one kind to another, often taking on varying degrees of desert hues. The source cited is Ihsan (2016).

2. RELATED STUDIES

Effect of Different Types of Litter on the Productive Performance of Broiler Chicks:

1-Weight of Body and Feed Conversion

There has been research on how different types of litter affect the productivity of broiler chickens. For example, in a 2014 study by Mahmoud and colleagues, chickens raised on a wheat hay and sand bed had significantly higher body weights at four, five, and six weeks than those raised on sawdust. First, the chicks reared on the sand reached a maximum weight of 1714.9 grams; second, the chicks reared on wheat hay reached 1647.6 grams. At least, breeders'

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sawdust brush has a live weight of around 1331.6 grams. While the researchers found no statistically significant changes in the food conversion rate between weeks one and five, they found that hens fed on the sand litter laid more eggs than those raised on straw or hay.

Anisuzzaman and Chowdhury (1996) carried out a total of 144 Shaver broiler chicks (Starbro 15) were raised from 4 days to 56 days old using four different types of litter: sawdust, paddy straw, sand, and rice husk. The litter was evenly distributed to a depth of 75 mm. Birds raised on rice husk litter demonstrated superior food intake, weight gain, conversion efficiency, and production quantity. The group using rice husk as litter had the highest livability (94.4%); however, it is not believed that the differences in this aspect were influenced by the types of litter used. Interestingly, avian specimens raised on sand (8.3%) exhibited breast blisters.

During their study in 2007, Alhomidan and Robetrston found that sawdust yielded higher weights than straw and sand, contradicting what these researchers Anisuzzamau and Chowdhery found in 1996. In that earlier study, they determined that rice husk litter was more effective in promoting the growth rate of meat chickens. At the sixth week of life, weights were recorded at approximately 1933 grams for hay and 1870 grams for straw and sand, respectively.

In 2012, Mohamed Morsi and his team conducted a study examining the impact of different types of brushes on the performance of broiler chickens. They specifically compared sawdust brushes with sugarcane sizes. There were notable variations in the feed consumption, food conversion rate, and final weight. There were noticeable variations in the water content between the brush and the sugarcane.

Anticipated outcomes include an undesirable feed conversion ratio and a decrease in final body weight (Martland 1984). This study aimed to investigate the influence of feed particle size, namely finely and coarsely ground diets, on the maturation of the digestive system, growth performance, and pododermatitis in broiler chickens. Moreover, to evaluate the influence of perforation on these factors, it is essential to ascertain the duration of the perforation and examine if regions often exposed to substandard litter quality might serve as a solution in the future. In the development of the gastrointestinal tract, food has a more prominent function than housing.

In 2016, Intisar and others experimented to evaluate the impact of two different types of litter (sand and mulch litter) on the productive performance of broiler chickens. An advantageous effect was noted on the pace of daily weight gain and the final weight. It resulted in harmful effects on both measures of live body weight. The researchers attributed this phenomenon to the bird's propensity for gathering sand particles when searching for food on the ground. This activity facilitates the breakdown and assimilation of food, resulting in improved nutritional uptake in the digestive tract. Therefore, these findings are evident in the observed characteristics of the broilers.

Aktan and Sagdic conducted the ongoing investigation in 2004. Their objective was to evaluate the effects of using dried rose dreg (DRD) as an alternative litter material on broiler performance and the microbiological characteristics of the litter. Broiler chicks aged 225 days were raised with pine wood shavings (PS), deep litter rearing (DRD), and a combination of PS and DRD until they reached 42 days old. The kind of litter material utilized did not have a discernible impact on broiler performance or feed conversion ratio. At 42 days, the microbiological data showed a statistically significant disparity between the treatment, including DRD, and the other medications. After 42 days, the DRD group showed a decrease

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in total aerobic mesophilic bacteria, including Enterococci, Enterobacteriaceae, and Staphylococcus aureus. The findings indicate that DRD may be a suitable alternative to litter material for controlling microbial characteristics without negatively affecting the performance of broiler chicks.

In 2016, Intisar and her students conducted a study investigating the impact of wood shavings and sand as litter materials on the growth and development of broiler chicks. The research used random assignment to separate newly hatched chicks into two groups (A and B) and supplied them with either sand or shaving wood as litter material. The bird species ingested two types of diets: starter and finisher. The findings revealed substantial food consumption disparities and body mass increases across the various experimental cohorts. Nevertheless, there was no notable difference in the death rate or the weight of internal organs. The liver weight exhibited a notable disparity between the groups, with Group A weighing 40.93g ± 1.87 and Group B measuring 35.62g ± 2.16. Group A had a markedly higher-end body weight. As the researchers Kriewitz et al. (2020) pointed out in a recent study, no impact was observed on gizzard and pancreas weights when broilers were housed on various flooring designs. Employing a fully slatted floor resulted in increased body weight but did not have any impact on reducing the occurrence of foot pad dermatitis.

2-Health and Well-Being Behavior

The quality of the litter is a crucial component in broiler output. Litter serves several crucial functions, including absorbing moisture, providing thermal insulation, and facilitating bird scratching (Bilgili et al., 2009; Shepherd et al., 2010). The well-being of broilers is influenced by several factors, including their overall health, productivity, carcass quality, and welfare (Eichner et al., 2007; Bilgili et al., 2009; Garcês et al., 2013). Animal welfare audits in Europe often use foot, hock, and breast burn lesions to measure the birds' housing circumstances and overall well-being (Haslam et al., 2006). The condition of the footpad is a crucial factor in ensuring the well-being of poultry. In extreme situations, it may lead to discomfort and agony (Berg, 2004), which can cause the birds to have an unstable gait (Hester et al., 1997). and reduced weight growth resulting from decreased feed intake caused by discomfort (Martland, 1984; Zikic et al., 2017)

Litter quality has attracted considerable attention because of its use as a bedding material in industrial chicken production (Bilgili et al., 2009). It promotes animal comfort via behaviors like pecking and scratching (Sandilands and Hocking, 2012). According to Farghly et al. (2018), litter often decreases birds' contact with waste and soaks more moisture. Furthermore, substandard litter quality contributes to developing pod-developed-developing dermatitis, causing pain and raising concerns about animal welfare (Shepherd et al., 2010; Swiatkiewicz et al. 20et al., Factors such as diets, management tactics, and housing circumstances could influence litter quality (Mayne et al., 2007; Dunlop et al., 2016). Several research studies have been conducted to improve the quality of litter and reduce the severity of pododermatitis by examining different litter materials or using floor heating (Abd El-Wahab et al., 2013). According to Bilal et al. (2014) and Çavuşoğlu et al. (2018), slatted flooring has recently become common in broiler poultry products. A plastic-slatted floor demonstrates remarkable resilience and cost-efficiency. It remains durable, does not need replacement, and is easy to install and maintain.

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Furthermore, it can decrease foot pad injuries (Farghly et al., 2018). This method has been used worldwide to reduce the contact between birds' feet and their waste. However, it is crucial to recognize that the floor patterns might affect animal welfare. The existence of necrotic and ulcerative lesions on the foot pads may cause considerable pain, trigger stress (de Jong et al. 2014), and act as a gateway for pathogenic organisms, resulting in a decline in the general health condition of the animals.

Few studies have compared conventional litter and perforated flooring (netting) systems in commercial manufacturing. As in Li et al.'s 2017 study of eastern China, two broiler houses were extensively evaluated for output, welfare, and living conditions. New perforated plastic flooring was compared to litter floors. The eight-month trial included four flocks. Both broiler barns employed negative pressure ventilation and averaged 31,700 broilers per flock. All homes were cleaned of trash and manure before monitoring. Continuous records of ambient conditions, gas concentrations, and ventilation were taken. Weekly production and welfare data were collected. The results showed that building levels did not affect indoor temperature or relative humidity when all dwellings had equal ventilation systems and management. Due to manure accumulation beneath the floor, the netting flooring house had 15.02 ppm ammonia, whereas the litter home had 10.44. Compared to the litter system, the netting floor did not affect broilers' live weight, feed conversion, or mortality. Birds raised in the netted flooring facility may also have more breast blisters. The two flooring systems in this study had similar welfare quality criteria, including hock and foot pad lesions, lameness, and fearfulness.

According to Đukić Stojči et al. 2026, broilers raised on chopped straw had noticeably healthier legs, with fewer cases and less severe footpad dermatitis (FPD) at 3 and 5 weeks of age. Additionally, using Micropan at six weeks of age greatly enhanced the quality of the footpad.

In a separate investigation conducted by Alabi et al. in 2024, the researchers examine the effects of pododermatitis (FPD) on broiler chickens, specifically in humid tropical areas. The experiment included 180 male broilers derived from 200-day-old hens reared on deep litter. Three treatments were administered, with litter management approaches changing every week. The results indicated that broilers fed t-An exhibited superior performance compared to t-B and t-C in terms of the impact of FPD on the performance and behavior of humid tropic broiler chickens. The degree of this impact is contingent upon the management method.

After three weeks of age, chickens' panting habits remained consistent, according to research by Li et al. in 2017. The prevalence of panting was below 7% in netting homes and below 12% in litter houses. The research showed that the thermal environment in the netting house mainly remained the same compared to the same management practices in the litter house. This conclusion was based on observations of thermal behavior and data collected about the thermal environment. Mostly the same compared to the same management practices in the litter house. This is based on observations of thermal behavior and data collected about the thermal environment.

In 1992, Akpobome and Fanguy conducted a study to assess the effects of various types of flooring on cage broilers. The study examined wire mesh, perforated floors, doweling, and a solid wood floor with wood shaving litter as a control. Results showed that birds raised on wire mesh floors experienced a significant reduction in live body weight at 6 and 8 weeks of age, and the mesh floors had the highest incidence of breast blisters. The padded dowel group had the most minor incidence. Feather silage was only an issue with perforated wood and

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Styrofoam floor systems, and abdominal fat was unrelated to the floor type. Wing breakage during processing was more common than leg breakage for all floor systems tested, and mortality was only a concern with wire-mesh floors.

3. METHODOLOGY

This meticulous research study aims to revolutionize the broiler farming industry by evaluating the impact of various components on chicken litter quality and productivity. Using a comprehensive methodology, the research combines quantitative and qualitative methods to provide valuable insights.

The study aims to comprehend how various litter materials and management strategies affect broiler performance by examining bird care systems, environmental factors, and the impact of litter on bird health. The research will compare the pros and cons of using coarse sawdust, wheat hay, and sand and measure broiler weight increase, feed conversion efficiency, and productivity among different litter types to provide quantitative data.

Qualitative data will be obtained by assessing bird behavior, health indicators, and pod dermatitis incidence. The study will also observe foot, hock, and breast burn lesions to understand broiler health and well-being. The impact of litter quality on bird comfort, scratching, and well-being will also be assessed.

4. RESULTS AND DISCUSSION:

Influence of Litter Type on Broiler Performance:

Mahmoud and colleagues (2014) found that wheat, hay, and sand-fed chicks were heavier than sawdust-fed ones. Alhomidan and Robertson (2007) found that sawdust weighed more than straw and sand. Intisar et al. (2016) found that sand and mulch litter increased daily and final weight, while sand particles decreased live body weight.

Rice husk and sugarcane diameters affect broiler performance, according to Anisuzzaman and Chowdhury (1996) and Mohamed Morsi et al. (2012). Rice husk litter outperformed in food intake, weight increase, and output. In contrast, sugarcane sizes affected feed consumption, food conversion, and ultimate weight. Aktan and Sagdic (2004) observed no effect on broiler performance or feed conversion ratio using dried rose dreg (DRD) as litter. At 42 days, DRD significantly reduced total aerobic mesophilic bacteria.

Impact of Feed Particle Size and Perforation:

Kriewitz et al.'s 2020 research stressed the relevance of feed particle size in broiler chicken digestive system maturation, growth performance, and pod dermatitis. They suggested that acceptable- and coarse-ground diets may affect these characteristics.

In 2016, Intisar and colleagues studied wood shavings and sand as litter. Food intake, body mass, and liver weight differed significantly. The research also revealed that completely slatted floors may raise body weight without improving foot pad dermatitis.

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Health-Wellness Behavior:
Litter quality became critical to broiler health. Good litter quality promotes scratching, moisture absorption, and thermal insulation.
Foot, hock, and breast burn lesions often measure broiler health. Harmful litter may induce pod dermatitis, which can cause pain, an unsteady stride, weight loss, and death.
Chopped straw, Micropan, and slatted flooring have been tested to increase litter quality and minimize pododermatitis. Đukić Stojčić et al. (2026) discovered better legs in broilers reared on chopped straw, whereas Alabi et al. (2024) examined the influence of litter management on pododermatitis in humid tropical locations. In 2017, Li et al. compared perforated plastic flooring to litter floors, finding equivalent welfare quality but significantly more breast blisters in birds reared on netting flooring.
Floor Type and Broiler Performance:
Akpobome and Fanguy (1992) tested cage broiler flooring. Wire mesh flooring reduced live body weight and caused the most breast blisters. The research found that perforated wood and Styrofoam floor systems also caused feather silage.

5. CONCLUSIONS

Litter type, feed particle size, and flooring design affect broiler performance, health, and welfare. Conflicting results show the complexity of these factors. Further research is needed to optimize production systems while ensuring bird welfare. Broiler housing design and management should address microbial characteristics, litter moisture, and pod dermatitis.

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