# Effect of different litter materials on broiler production and occurrence of pneumonia


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# Abstract

The study was conducted with the aim to find the effect of litter materials on broiler production and occurrence of pneumonia. Data was collected from 22 broiler farms with a total of 33040 birds .Data was collected on the following parameters types of litter materials used (sawdust, wood-shavings),pneumonia, feed conversion ratio (FCR) and mortality. Data was analyzed by t-test on STATA and Chi square test on Microsoft Excel. Litter material treatment had no significant impact on FCR and mortality rate ($p>0.05$). So Sawdust and Wood-shavings has no relation on the broiler feed conversion ration and mortality rate. On the other hand, a significant relation was found between litter materials and pneumonia occurrence in birds ($p<0.05$) on Chi square test. Pneumonia occurrence was found to be higher in the farms that used wood-shavings as litter materials than the other ones. So it was concluded that litter materials have a significant role in broiler farming and that there are potential risks associated with the use of different types of litter materials.

Keywords: Litter materials, FCR, mortality, pneumonia.

# Chapter-I

# INTRODUCTION

In contemporary broiler production processes, the proper disposal of poultry litter is essential for the health of birds and the overall success of the production process. The term "poultry litter" refers to a mixture of bedding materials, animal by-products, feathers, and food debris (Chen et al., 2014). Litter is used for comfort, absorbing moisture from dropping, diluting droppings, reducing dust & contamination, maintaining equilibrium in the thermal environment by decreasing production of fermentation heat in the growing condition. Good litter must be well-absorbent, comfortable, non-toxic, durable, free from disease agents and parasites, free from dust or any foreign particles, should have optimum moisture(20-25%), pH of 8-10, ammonia content not exceeding 25 ppm. dry(not dusty), economical and easy to dispose (Rizt et al.,2017; Gençoğlan and Gençoğlan, 2017). The quality of the litter also has a direct impact on the skin condition of the birds. The primary source of ammonia emissions in broilers is the accumulation of wet litter, which is among the most significant performance and environmental issues affecting the production of broilers today (Rizt et al.,2017). Therefore, controlling the bird's environment, especially in terms of house humidity and ammonia, along with litter moisture, is essential for the birds' welfare. High water-holding capacity litter materials, like wood shavings are thought to produce better litter quality than those with less absorption capacity, such as straw. Two types of poultry litter are found; deep litter & fresh litter. Fresh litter which is about 3-4 cm in depth (1 inch) is mainly used for broiler rearing. The purpose of good litter in broiler is to avoid direct contact between the bird and the ground and to help absorb the fecal matter (Garcia RG et al., 2010). Poultry litter is a highly effective organic fertilizer and feed supplement due to its high levels of nitrogen and phosphorus. The poultry manure increases soil's physical, chemical, and biological fertility by providing adequate organic matter levels, water retention capacity, and oxygen diffusion rate (Musa et al., 2017). So, if poultry litter is properly managed it can be used as a important source of nutrient for soil but inadequate litter management can lead to a range of challenges, including the outbreak and spread of diseases. The risk of disease transmission is one of the primary reasons for poor poultry litter management. Warm and humid conditions in poultry houses are a breeding ground for bacteria, viruses and parasites. Inadequate management of poultry litter can lead to an increase in the prevalence of certain pathogens,

which can spread rapidly through the flock. These pathogens can cause a decrease in growth rates, an increase in mortality, and a decrease in feed efficiency, all of which can lead to the spread of diseases associated with poultry litter, including coccidiosis, bacterial infection, and respiratory diseases. Litter is also a breeding ground for a variety of human pathogens including *Salmonella, Campylobacter jejuni, Listeria monocytogenes (Wilkinson et al., 2011).* These bacteria can infect fresh produce or contaminate the environment, and are often linked to food borne diseases.

This report examines the fundamental principles of poultry litter in relation to broiler production and the significance of appropriate litter management practices for the maintenance of a healthy flock of broilers. Additionally, it examines the association of inadequate litter management with the emergence of diseases which can have a detrimental effect on the health of birds and the efficiency of production. Purpose of this report is to provide broiler producers with information, strategies, and advice that will enable them to take proactive steps to reduce risks, maximize production, and maintain the health and environmental integrity of their birds. Understanding the interdependent relationship between poultry litter and disease (pneumonia) control will enable broiler producers to adopt sustainable and effective poultry farming practices.

# Chapter-II

# MATERIALS AND METHOD

**Study area**:

This study was conducted at Chakaria Upazilla such as Boroitoli, Paharchada, Pekua and North Patenga of Chittagong District, Bangladesh. This region was chosen for the purpose of data collection due to the establishment of numerous small and large-scale broiler farms past few years.

**Duration of work**:

Duration of the study was between 29th July and 25th August 2022 at the time of NGO placement and Chittagong placement of our internship.

**Sources of information**:

A pre-established questionnaire was employed to record the data. Data was obtained randomly from twenty-two farm through interviews of the farm owners, staff and observation of their operations in order to assess the broiler farm's comparative litter management system. A pre-made questionnaire was filled out in person by asking questions. The questionnaire provided the following details i.e. farmers information, weight gain, total feed intake, no of birds reared, no of days reared, type of litter materials, no of times litter changed (in a single batch), disease prevalence, litter thickness and its disposal, weight gain, FCR and mortality of the birds.

**Data analysis**:

The collected raw data were compiled into Microsoft Excel 2007. The data were analyzed by Independent t-test was and chi square test. Statistical effects were considered statistically significant when $p < 0.05$. All statistical test were performed by using STATA 13.

# Chapter-III

# Results

Table: Effect of litter materials on FCR and mortality

| Title | Mean±SD | | SEM | | T value | P value |
|---|---|---|---|---|---|---|
| | Saw dust | Wood shavings | Saw dust | Wood shavings | | |
| FCR | 1.325±.1981245 | 1.19833±.074135 | 0.049531 | 0.0302673 | 1.5073 | 0.1474 |
| Mortality | 4.281562±4.47842 | 6.8075±6.732499 | 1.11962 | 2.748531 | 1.0274 | 0.3165 |

SD= Standard deviation; SEM=Standard error of mean

Mean feed conversion ratio of Sawdust and Wood shavings was 1.325±0.049531 and 1.19833±0.0302673 respectively. Mean mortality rate of Sawdust and Wood shavings was 4.281562±1.11962 and 6.8075±2.748531. So there is no significant effect of litter materials on broiler performance and mortality ($p>0.05$).

Effect on disease occurrence (pneumonia):

A chi square test was performed to examine the relation between litter materials and pneumonia occurrence in broiler farms. The obtained result was $\chi^2= 34.92514533$, $p= <0.00001$. So the occurrence of pneumonia (at first week of age) was strongly influenced by the types of litter material used.

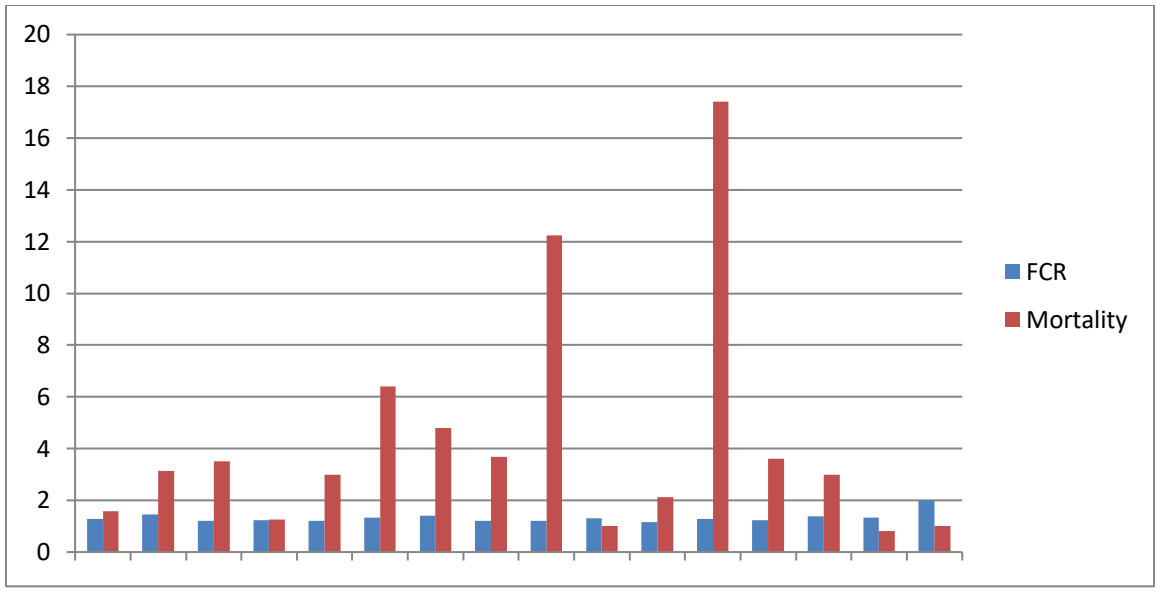


Fig 1: FCR and mortality of broiler on saw dust litter materials on different farms

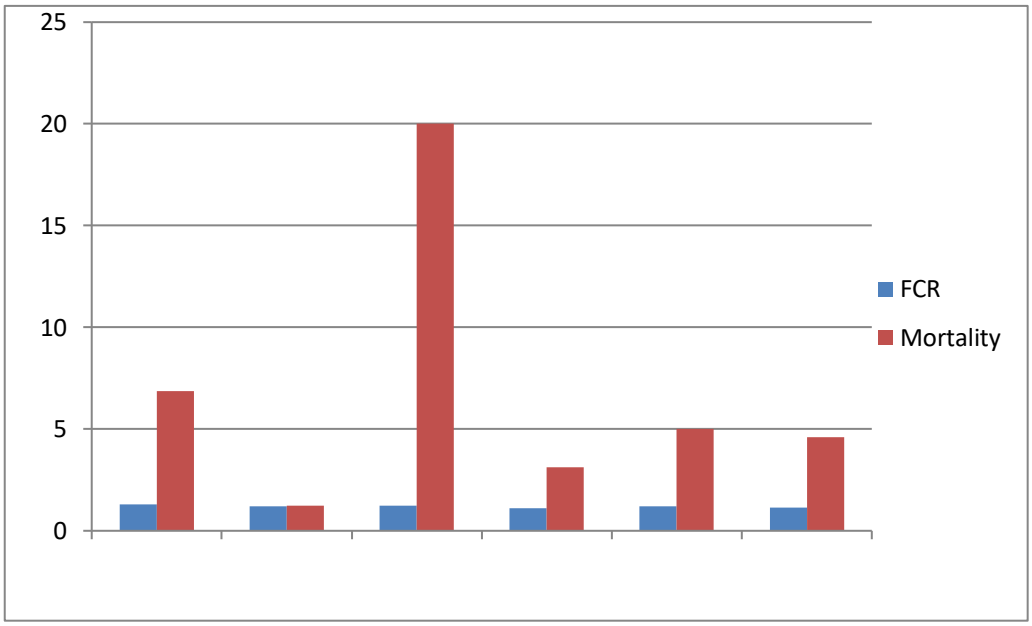


Fig 2: FCR and mortality of broiler on wood shavings litter materials on different farms

Disposal system of litter:

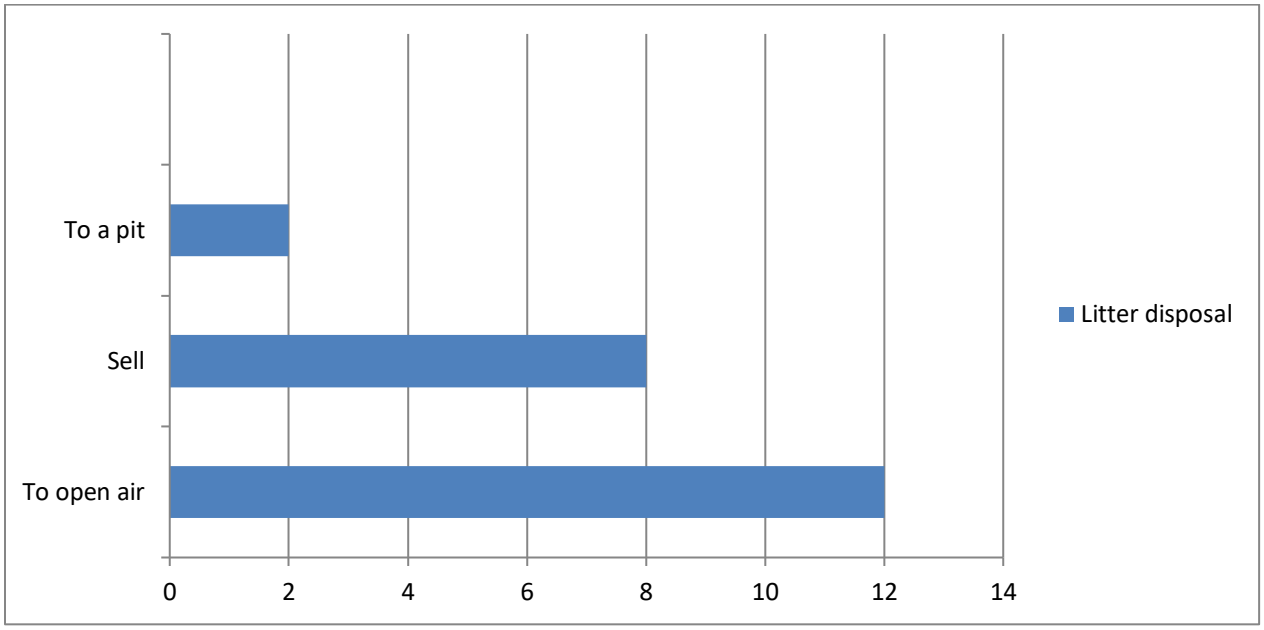


Fig 3: Types of waste disposal management in different broiler farms

# Chapter IV
# Discussion

Effect on feed conversion ratio and mortality:

After the comprehensive analysis of the data revealed a number of remarkable findings. The impact of various litter materials, particularly sawdust and wooden shavings on both the feed conversion ratuo and mortality were quantified using independent T-tests. The t-values for feed conversion ratio 1.5073 and mortality 1.0274were statistically indistinguishable from each other, and the respective p-values for mortality 0.1474 and feed conversion ratio 0.3165 were also not statistically significant. Therefore, within the scope of the study, the selection of litter material does not appear to have a significant effect on these specific performance metrics. The results of this study concur with Hafeez et al. (2009); Kuleile et al. (2009); Davis et al. (2010); Mendes et al. (2011); Villagra et al. (2011); van Harn et al. (2012); Bjedov et al. (2013); Taherparvar et al. (2016) and Shepherd et al. (2017) findings that various litter material sources did not influence feed conversion efficiency and mortality. They further reported that growth rate and feed intake was also not influenced by the types of litter materials used. This is in contrast to the findings of Anonymous (1992); Asaniyan et al. (2007); El- Toghyani et al. (2010) which indicated that the litter material significantly ($P<0.05$) affected the feed conversion ratio as well as mortality. In one of the studies, a different depth of litter was observed during their study whereas in our data, the same depth of litter was observed in all farms. The finding that there was no statistically significant difference between broiler raised on various litter materials (e.g. sawdust, wood-shavings) in terms of FCR or mortality rates, may be due to a variety of factors. It is possible that the observed performance metrics may have been affected by a confluence of factors outside of the scope of the present study, including but not limited to genetics, feed composition, environment conditions, and agricultural management practices. Furthermore, the limited sample size may have played a role in the lack of significance of these metrics in the present study. Future studies may provide a different outcome if the sample size is larger or the experimental design is more refined.

Effect on occurrence of pneumonia:

Our study revealed that the association between litter material and pneumonia incidence demonstrated a statistically significant relationship with a p value of $<0.05$, indicating that the selection of litter material may have a direct effect on the prevalence of pneumonia in broilers. No reports regarding pneumonia and litter materials could be found. During our observation we found that the occurrence of pneumonia is higher in the farms that used wood-shavings as their bedding materials than the other one. During our observation we found that the occurrence of pneumonia is higher in the farms that used wood-shavings as their bedding materials than the other one. This could be attributed to the fact that wood shavings tend to retain more moisture, which can lead to a damp environment that encourages the growth of bacteria and fungi, this microorganism can cause irritation the respiratory tract of broilers, which can result in respiratory distress and infections. Also the presence of high levels of moisture in wooden shavings may result in an increase in ammonia emissions due to the breakdown of the litter. Ammonia has been linked to respiratory irritations in poultry and can increase the risk of respiratory illnesses. Additionally, the presence of sawdust may provide better ventilation and control of microbial activity, thus decreasing the risk of pneumonia. Therefore, it is essential to properly manage litter moisture and environment conditions in broilers in order to avoid respiratory issues.

Disposal system of litter:

The observed variation in litter disposal methods among different farms open air disposal, selling, and pit disposal-underscores the complex decisions broiler producers must make in managing waste. The choice of disposal method can have multifaceted impacts, including potential environmental contamination, disease transmission, and even economic considerations. Farms that dispose of litter to open air may inadvertently contribute to environmental pollution and disease spread. On the other hand, selling litter might provide economic benefits (25-60tk/50kg bag) but could also indirectly influence disease transmission if not managed properly.

In conclusion, this study gives us a basic understanding of the complex relationship between litter material, disease incidence and broiler production measurements. While some results were

not statistically significant, they serve as a starting point for more detailed studies. The strong association between litter material and disease occurrence highlights the importance of careful litter management practices. The variability of litter disposal methods also highlights the need for sustainable and informed practices in broiler farming. Broiler producers can take advantage of this study by making informed decisions regarding litter management practices that improve the health and productivity of their flocks and contribute to a more sustainable and more productive poultry industry.

# Chapter V

# Conclusion

The management of poultry litter is essential for both the welfare of birds and the success of the production. In this report, we examined the relationship between poultry litter materials and their effects on the production of broilers and their health. The statistical analysis revealed a strong correlation between litter material choice and broiler chicken pneumonia prevalence. This suggests that the selection of litter materials plays a significant role in broiler pneumonia prevalence. The higher prevalence of pneumonia in farms using wood shavings for litter compared to sawdust highlights the practical implications of the findings. This report has provided an in-depth analysis of the complex relationship between the production of poultry litter and the production of broilers. It has highlighted the role of litter management in the success of poultry farming, and has identified the potential risks associated with the use of litter materials. By understanding the correlation between the transmission of disease and the production efficiency of poultry litter, producers are able to make more informed decisions that will help to sustain their operations in the long term. By incorporating effective litter management techniques into the poultry industry, the balance between production objectives and the welfare of the birds can be achieved, leading to a more sustainable and prosperous future.

# Chapter-VI

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# Appendix

```
. ttest FCR, by ( Farm)

Two-sample t test with equal variances

   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      16       1.325   .0495311    .1981245    1.219427    1.430573
       1 |       6    1.198333   .0302673    .0741395    1.120529    1.276138
---------+--------------------------------------------------------------------
combined |      22    1.290455    .038542    .1807781    1.210302    1.370607
---------+--------------------------------------------------------------------
    diff |            .1266667   .0840332               -.0486235    .3019569
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   1.5073
Ho: diff = 0                     degrees of freedom =       20

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9263         Pr(|T| > |t|) = 0.1474          Pr(T > t) = 0.0737

. ttest Mortality, by ( Farm)

Two-sample t test with equal variances

   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      16    4.281562    1.11962    4.478482    1.895148    6.667977
       1 |       6      6.8075   2.748531    6.732499   -.257824    13.87282
---------+--------------------------------------------------------------------
combined |      22    4.970455     1.09636    5.142383    2.690449    7.25046
---------+--------------------------------------------------------------------
    diff |           -2.525938   2.458474               -7.654225     2.60235
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -1.0274
Ho: diff = 0                     degrees of freedom =       20

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.1582         Pr(|T| > |t|) = 0.3165          Pr(T > t) = 0.8418

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Ready
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| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | | **Observed** | | | |
| 2 | | | | | |
| 3 | | Diseased | Non diseasesd | Total | |
| 4 | Saw dust | 66 | 20874 | 20940 | |
| 5 | wood shaving | 95 | 12005 | 12100 | |
| 6 | Total | 161 | 32879 | 33040 | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | **Expected** | | | |
| 10 | | | | | |
| 11 | | Diseased | Non diseasesd | Total | |
| 12 | Saw dust | 102.0381356 | 20837.96186 | 20940 | |
| 13 | wood shaving | 58.96186441 | 12041.03814 | 12100 | |
| 14 | Total | 161 | 32879 | 33040 | |
| 15 | | | | | |
| 16 | | | | | |
| 17 | | **X^2 test** | | | |
| 18 | | p value | 3.42627E-09 | | |
| 19 | | X^2 value | 34.92514533 | | |
| 20 | | | | | |
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# Biography

I am Hossen Murad Shaoun, son of Nazir Ahmed and Taslima Begum doing my graduation on Doctor of Veterinary Medicine (DVM) at Chattogram Veterinary and Animal Sciences University under the Faculty of Veterinary Medicine. I passed my Secondary School Certificate Examination (SSC) in 2014 from Nasirabad Government High School, Chattogram, and then Higher Secondary Certificate Examination (HSC) in 2014 from chattogram Chattogram City College,Chattogram. Currently, I am doing my year-long internship programe. In future, I would like to work in Pet Animal Medicine since I have huge interest in it.