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### Article Title

**Impact of Corn and Wheat Modulated Diet on Hepatic Physiology and Oxidative Stress Levels in Broiler Birds**

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#### Abstract

The objective of this study was to investigate the impact of corn and wheat on broiler liver health. Hundred one-day-old birds were divided into two groups. A standard diet was fed to Group I while corn (50%) with new wheat (50%) was fed to Group II. Blood samples were collected from five birds from each group on the 21st and 35th days to determine serum ALT, TAC, and TOS levels. ALT levels did not show significant differences between the groups on the 21st or 35th day. On the 21st day, Group II had lower TOS levels, with no significant change on the 35th day. TAC levels were similar on the 21st day but lower in Group II on the 35th day. Corn and wheat intake decreases TOS levels without affecting liver function highlighting the potential to improve productivity.

**Keywords:** Liver, Reactive Oxygen Species, Oxidative Stress, Antioxidants, Transaminases, Poultry.

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### Title

## Impact of Corn and Wheat Modulated Diet on Hepatic Physiology and Oxidative Stress Levels in Broiler Birds

### Abstract

The objective of this study was to investigate the impact of corn and wheat on broiler liver health. Hundred one-day-old birds were divided into two groups. A standard diet was fed to Group I while corn (50%) with new wheat (50%) was fed to Group II. Blood samples were collected from five birds from each group on the 21st and 35th days to determine serum ALT, TAC, and TOS levels. ALT levels did not show significant differences between the groups on the 21st or 35th day. On the 21st day, Group II had lower TOS levels, with no significant change on the 35th day. TAC levels were similar on the 21st day but lower in Group II on the 35th day. Corn and wheat intake decreases TOS levels without affecting liver function highlighting the potential to improve productivity.

**Keywords:** [Liver](#), [Reactive Oxygen Species](#), [Oxidative Stress](#), [Antioxidants](#), [Transaminases](#), [Poultry](#)

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### Introduction

The liver serves as the primary organ for many vital physiological functions, including immune system support, endocrine signalling, and the metabolism of macronutrients. It is essential for preserving general health because of its critical roles in regulating glucose synthesis and storage as well as processing macronutrients for energy (Trefts et al., 2017), (Rui, 2014) Hepatocytes are the primary source of reactive oxygen species (ROS), which are produced by cytochrome P450 enzymes in the mitochondria and

endoplasmic reticulum (Cichoń-Lach, 2014) (Lee et al., 2022).

Improvements in nutrition have benefited the poultry industry greatly by increasing productivity and driving broiler birds toward their physiological limits (Korver, 2023). Cereal grains are like the go-to comfort food for poultry birds, being a staple in their diet because they provide a lot of energy and are easy for them to digest. (Padmanaban, et al 2023)

In wheat (*Triticum aestivum*), there are two recognizable protein fractions: glutenin and gliadin



(Zhao et al., 2020), which combine to form the seed storage protein known as gluten, accounting for 75% of the total protein content (Šramková et al., 2009) (Sawaya et al., 1984). Broiler birds' diets commonly include corn (*Zea mays subsp. mays*) and wheat in different formulations (Selle et al., 2022) – (Munyaka et al., 2016), exerting discernible impacts on growth rate (Sanchez et al., 2021), (Mohammadigheisar et al., 2021), (Muniyappan et al., 2022), (Kama, 2023) hepatic functions (Li et al., 2019), (Mangi et al., 2021), and oxidative stress markers (Sun et al., 2022), (Ali & Al-Saedi, 2022).

The Pakistan Economic Survey for the year 2022-2023 mentions that the poultry industry employs more than 1.5 million individuals, which makes it the major employer in the country. It also receives investment of more than Rs. 1056 billion with the annual growth rate of 7.3% in the last ten years. Pakistan is now the eleventh largest chicken producer in the world with 1.3% of its GDP contributed by the poultry industry.

Given this burgeoning poultry industry, the escalating demands for meat production driven by rapid population growth have become increasingly apparent. This study was motivated by the need to comprehensively analyze the effects of a diet incorporating corn and wheat modulation on hepatic physiology, and oxidative status levels in broiler birds. This was done by examining the effect of the corn and wheat modulated diet on serum Alanine Transaminase (ALT) levels, assessing Total Oxidative Stress (TOS) levels, and investigating Total Antioxidant Capacity (TAC) levels in broiler birds on the 21<sup>st</sup> and 35<sup>th</sup> days.

### Materials and Methods

This completely randomized trial was conducted at Poultry Research Center, University of Agriculture, Faisalabad. A total of 100-day-old ROSS 308 chicks

were allocated into two groups, each comprising 5 replicates, each with 10 chickens.

In group I, a standard diet comprising corn and soybean was offered, whereas in group II, the diet included soybean along with a modulation of corn (50%) and new wheat (50%). Effective housing management was implemented by adhering to the prescribed vaccination schedule.

Due to change in feed composition, on the 21<sup>st</sup> and 35<sup>th</sup> days of the experiment, a representative bird was chosen from each of the five replicates (n=5) for slaughtering, facilitating the collection of blood samples. This coincided with the transition of poultry birds' diet from a starter to a finisher formulation on those days, reflecting alterations in both energy and protein content of the diet. These samples were then utilized to assess serum Alanine Transaminase (ALT) levels by commercially available kit Bioclin®, thereby investigating their impact on liver health, as well as to measure serum Total Antioxidant Capacity (TAC) and Total Oxidative Stress (TOS) levels by using an automated colorimetric method by Erel (Erel, 2005) for the evaluation of oxidative stress.

The data obtained was subjected to rigorous statistical analysis using the student's t-test, conducted within GraphPad Prism version 9, to ascertain the existence of statistically significant distinctions, with significance levels set at P≤0.05. The dataset underwent comprehensive analysis to ensure it met all prerequisites for a parametric test beforehand.

### Results

In comparing groups I and II (Fig. 1), statistical analysis showed no significant difference for ALT between them on either the 21<sup>st</sup> or 35<sup>th</sup> days of the trial.

Figure 1

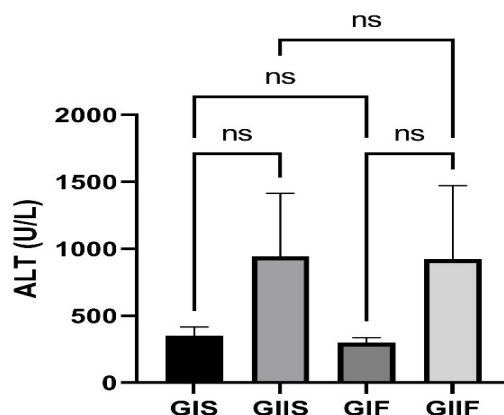




Figure 1: Impact of corn and wheat modulated diet on ALT (U/L) in broiler birds. The values are depicted as Mean  $\pm$  SD. GIS: Group I at 21<sup>st</sup> day of trial; GIIS: Group II at 21<sup>st</sup> day of trial; GIF: Group I at 35<sup>th</sup> day of trial; GIIF: Group II at 35<sup>th</sup> day of trial. 'S' and 'F' stand for starter and finisher, respectively. ns= non-significant; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

The TOS level was significantly and non-significantly different in group I from group II on 21<sup>st</sup> ( $P < 0.001$ ) and 35<sup>th</sup> days of trial, respectively (Fig. 2A). However, TOS

level in group II on 21<sup>st</sup> and 35<sup>th</sup> days of trial was found notably lower ( $P < 0.001$ ) on 21<sup>st</sup> day while non-significant difference was observed in group I.

There was no significant change in TAC level either between groups I and II on the 21<sup>st</sup> day of trial or in both groups on either day of the trial. Nevertheless, a significantly high TAC level was calculated on the 35<sup>th</sup> day of the trial ( $P < 0.01$ ) between both groups (Fig. 2B).

Figure 2

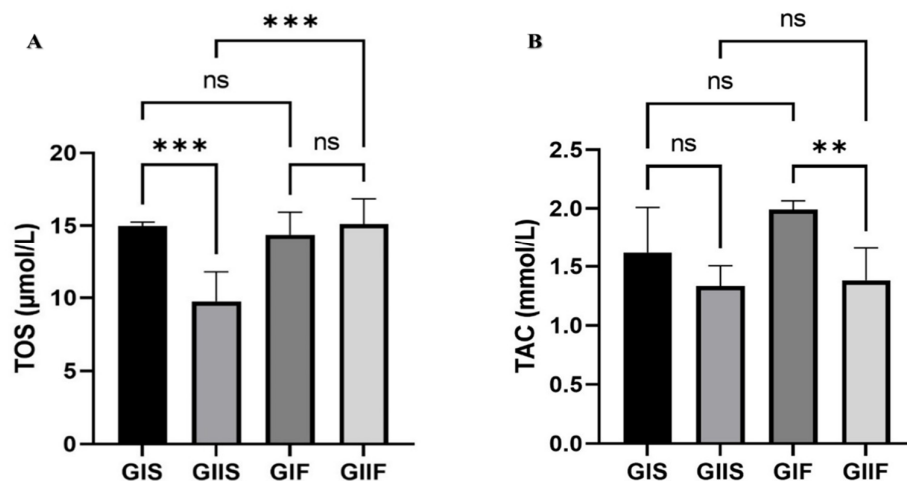


Figure 2: Impact of corn and wheat modulated diet on [A] TOS ( $\mu\text{mol/L}$ ) and [B] TAC ( $\text{mmol/L}$ ) in broiler birds. The values are depicted as Mean  $\pm$  SD. GIS: Group I at 21<sup>st</sup> day of trial; GIIS: Group II at 21<sup>st</sup> day of trial; GIF: Group I at 35<sup>th</sup> day of trial; GIIF: Group II at 35<sup>th</sup> day of trial. 'S' and 'F' stand for starter and finisher, respectively. ns: non-significant; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

## Discussion

As the epicenter of metabolic and various physiological processes, the liver generates reactive oxygen species (ROS), which can inflict cellular damage. The unquestionable impact of nutrition on the body's ability to reach physiological thresholds (Capelli et al., 2023).

In the present investigation, it was observed that the dietary manipulation involving corn and wheat did not exert any discernible impact on ALT level, indicative of the liver operating at its optimal physiological capacity.

On the 21<sup>st</sup> day of the trial, there was a notable decrease in TOS level in group II, which could potentially be attributed to the consumption of a high-carbohydrate diet by group I birds, potentially leading to the induction of ROS (Gao et al., 2023) and inclusion of new wheat lowers the nutrient utilization (Anwar et al., 2023) in group II, while no difference was found in TAC level. On the 35<sup>th</sup> day of the trial, group II birds exhibited a reduced TAC level, while there was no discernible distinction in TOS level between the two groups.

This study also revealed that TAC and TOS levels were no change between birds of group I on 21<sup>st</sup> and 35<sup>th</sup> day. However, TOS level was high between birds of Group II on 21<sup>st</sup> and 35<sup>th</sup> day owing to high carbohydrate contents of diet.

## Conclusion

This research concludes that a diet rich in corn and new wheat has been shown to decrease TOS level in

broiler birds, all the while ensuring that liver functions remain within their physiological threshold.

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### **Conflict of Interest**

The author declares no conflicts of interest.

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