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Impact of *Saccharomyces cerevisiae* and Sulfaclozine on lipid profile of broilers chicken

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ABSTRACT

The poultry industry plays a major role in satisfying the nation's meat consumption needs. Broiler meat is readily available and reasonably priced. This study sought to determine how *Saccharomyces cerevisiae*, when co-administered with a sulfonamide derivative (sulfaclozine 30%), affects broiler lipid profiles and protects against deleterious effects. In this experiment, 100 broilers that were 21 days old were split up into five groups. The first group served as a control, and the second group received sulfaclozine (30 mg/kg). Sulfaclozine 70 mg/kg b.w.t. was administered to the third group, followed by 1.5 gm/L of *Saccharomyces cerevisiae* mixed with 30 mg/kg b.w.t. for the fourth group and 1.5 gm/L of *Saccharomyces cerevisiae* combined with 70 mg/kg b.w.t. for the fifth group for 20 consecutive days. Lipid profiles were determined at 26, 31, 36, and 41 days of age, respectively. In the fourth and fifth groups treated with *Saccharomyces cerevisiae* and different doses of sulfaclozine, the lipid profile decreased, except for high-density lipoprotein (HDL). In the second and third groups treated with sulfaclozine, the lipid profile significantly increased, whereas HDL levels decreased. Ultimately, it was determined that *Saccharomyces cerevisiae* is a secure and efficient method for assessing the adverse effects of sulfonamides.

Introduction

Animal proteins play a crucial role in the global diet by supplying energy and certain essential nutrients (Paraskeuas *et al*., 2023). The most economical source of animal protein is poultry meat. Selection techniques are continuously being improved through breeding to satisfy the growing expectations of consumers (Zhou *et al*., 2025). In poultry, antibiotics are widely used as therapeutic, prophylactic, and growth-promoting agents for reproductive purposes (Rafiq *et al*., 2022). Antibiotics are commonly used to treat microorganisms (Shi *et al*., 2018). However, recent research on gut microbiota has focused on the possible negative effects of antibiotic abuse (Blaser, 2016). Antibiotic resistance has become a major concern worldwide (Bhardwaj *et al*., 2022). For many diseases, the first antimicrobial drug, sulfonamides, which hinder microorganisms from synthesizing folic acid and stop their growth and reproduction, is still advised (Tačić *et al*., 2017). The adverse effects of sulfonamides include respiratory tract disorders and digestive disorders, such as diarrhea, nausea, and vomiting, the most serious of which are toxic epidermal necrolysis and Stevens-Johnson syndrome (Ovung and Bhattacharyya, 2021). In order to mitigate the adverse effects of antibiotic use, probiotics, ''classified as live microorganisms'' that confer a health benefit on the host, is employed to treat these problems. This problem can be overcome by enhancing the integrity of the gut barrier and fortifying the intestinal mucosa (Yang *et al*., 2024). Broiler chickens are fed *Saccharomyces cerevisiae* as a probiotic supplement, which produces vitamins, amino acids, and enzymes such as lipases. *Saccharomyces cerevisiae* has been proven to benefit health in several ways (Ahiwe *et al*., 2021). Lipid metabolism in broilers may be enhanced by the addition of live yeasts. Live yeast reduces fat deposition in the blood arteries by preventing cholesterol oxidation (He *et al*., 2021). Additionally, several biochemical characteristics of the experimental birds indicated a significant decrease in blood cholesterol levels compared to the control group (Al-Nasrawi *et al*., 2020). This study aimed to assess *Saccharomyces cerevisiae*'s ability to improve the lipid profile of broiler chickens given sulfaclozine.

Materials and methods

Ethical approval

All experimental procedures were approved by the Animal Welfare and Ethical Committee for live bird sampling at the Faculty of Veterinary Medicine, Assiut University, Assiut, Egypt (approval number: 6/2025/0321).

Chemicals

Sulfaclozine (sulfachloropyrazine) sodium monohydrate water-soluble powder (Atcocure) (100 g) containing 30 g of sulfaclozine (sulfachloropyrazine) sodium monohydrate was purchased from Atco Pharma. Cairo, Egypt. Yeast (*Saccharomyces cerevisiae*) was obtained from Angel Yeast (Beni Suef, Egypt). Kits for Cholesterol, Triglycerides (T.G.), low-density lipoprotein (LDL), high-density lipoprotein (HDL) were purchased from Spectrum Diagnostics (Cairo, Egypt). Very low-density lipoprotein (VLDL) ELISA kits were obtained from Novatein Biosciences (Woburn, United States).

Animals

In this study, 100 male Ross broiler chicks aged 14 days were obtained from the Qena poultry farm in Qena, Egypt. Broiler chicks were reared in separate cages, which were cleaned daily to avoid infection. Water and food were available *ad libitum* with a suitable temperature and lighting cycle of 12hours/dark. The treatment diet was given to chickens at 21 days of age. All experimental procedures were performed in accordance with international guidelines for the care and use of laboratory animals.

Experimental design

One hundred male Ross broilers were divided into five groups and treated according to the following protocol:

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Group 1 (G1): Fed on basal diet.
Group 2 (G2): Sulfaclozine (sulfonamide) was administered orally at 30 mg/kg body weight (Golshahi *et al*., 2016)
Group 3 (G3): Sulfaclozine (sulfonamide) orally at 70 mg/kg body weight (Haritova *et al*., 2013).
Group 4 (G4): *Saccharomyces cerevisiae* added to drinking water 1.5 g/liter (Onwurah and Okejim, 2014) plus Sulfaclozine(30 mg/kg body weight).
Group 5 (G5): *Saccharomyces cerevisiae* added in drinking water 1.5g/liter plus Sulfaclozine (70 mg/kg body weight).

Serum collection

Blood samples were taken from the brachial vein using a syringe and then collected at 26, 31, 36 and 41 days of age in clean test tubes. Sterile plain test tubes were allowed to clot at room temperature and centrifuged at 3000 rpm for 20 min then stored at -20°C for further estimation of lipid profile.

Determination of lipid profile

Serum total cholesterol (catalogue No:23006), triglycerides (catalogue No: 314006), HDL (catalogue NO: 266001), and LDL (catalogue NO:280001) were determined calorimetrically according to the manufacturer's instructions using Spectrum Diagnostics Company commercial kits.

VLDL was determined using ELISA commercial kit (catalogue NO: NB-E60001) according to Novatein Biosciences instruction.

Statistical analysis

Results are presented as the mean ±SD. Variations within a set of data were analyzed by one-way analysis of variance (ANOVA) using GraphPad Prism software (GPPS). Statistical significance was set at P<0.05%.

Results

In the current study, total cholesterol level at 26, 31, 36, and 41 days old, all received groups showed significant elevation when compared with the control; G4 showed significant improvement in the cholesterol level as compared with G2, G3, and G5 (Fig. 1).

All groups showed a significant elevation in triglyceride levels compared to the control at 31 and 36 days. At the same time, G4 was not significantly higher compared to the control group on day 41; however, it was lower on day 26 (Fig. 2).

While HDL levels at 26 days of age were significantly reduced in G2 when compared with the control, G4 showed a significant elevation compared to other groups at 31 and 36 days of age. In all groups, G4 displayed a significant decline in HDL levels when compared with the control. The same findings on 41 days of age which showed a significant decrease in all groups, even though G5 displayed a significant decrease when compared with the control, while G4 showed a significant improvement in the HDL level as compared with other treated groups (Fig. 3).

Additionally, there was an increase in LDL levels in all exposed groups except for G4 when compared with the control group at 26 days. The same trend was seen in G1 at 31 and 36 days, with the increase being nonsignificant at 41 days of age (Fig. 4).

In addition, there was a significant increase in the VLDL level of all exposed groups when compared with the control at 26, 31, 36, and 41 days of age, while G4 VLDL displayed a significant decrease compared with other treated groups and comparable to G1 at 31,36 days, and non-significantly increased at 41 days, as demonstrated in Fig. 5.

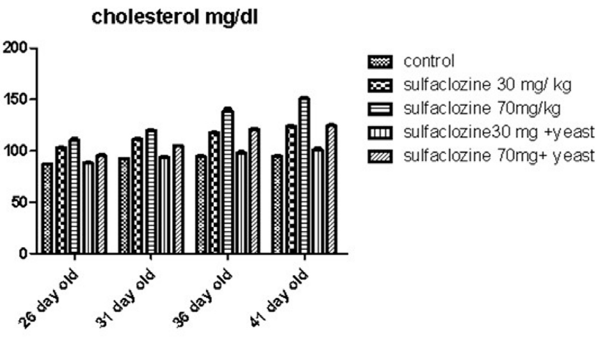

Fig. 1. Total cholesterol level in the investigated groups.

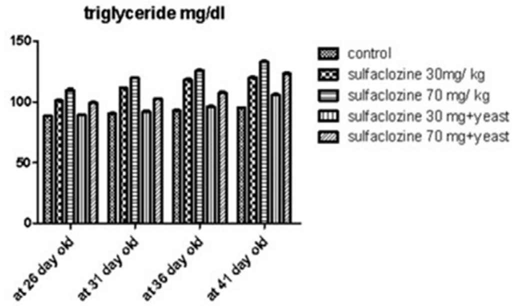

Fig. 2. Triglycerides level in the investigated groups.

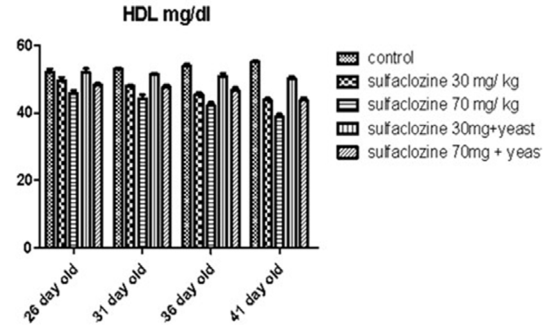

Fig. 3. High density lipoprotein level in the investigated groups.

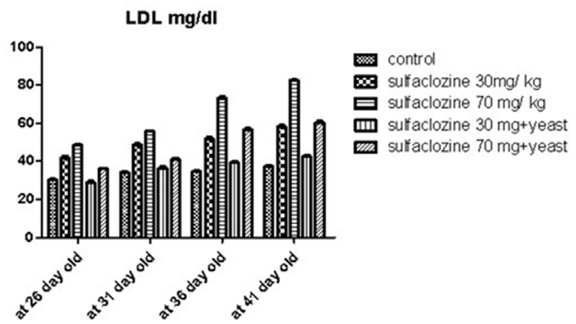

Fig. 4. Low density lipoprotein level in the investigated groups.

Discussion

Probiotics can help reverse the negative effects of antibiotics and preserve optimal host health (Yang *et al*., 2024). Assessing the potential applications of probiotic yeasts in chicken feed as well as their role in immunomodulation and productivity therefore (Fathima *et al*., 2023), it is vital to speculate about synergistic utilization that may affect the health of birds. In the current study, lipid profile was affected by sulfaclozine, as indicated by the significant increase of total cholesterol, T.G., LDL, and VLDL levels, leading to compromised liver function, while HDL rapidly de-

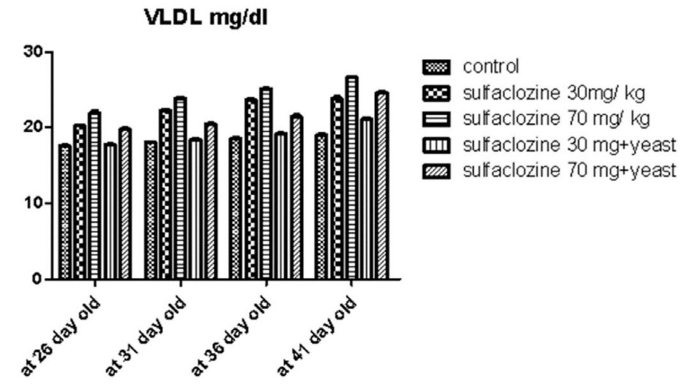

Fig. 5. Very low density lipoprotein level in the investigated groups.

creased in sulfaclozine-treated groups only. Liver is crucial for protecting the body against oxidative stress and dangerous chemicals including antibiotics and other medications. These findings are consistent with Singh and Kumar (2017) and Hafth *et al.* (2019). Regarding the yeast- and sulfaclozine-treated groups, the total cholesterol and triglyceride levels in the sulfaclozine-treated groups only increased significantly ($P<0.05$), as confirmed by Gupta *et al.* (2014). This is explained by the fact that antibiotics hinder the absorption of fat in the gastrointestinal tract via suppression to the intestinal mucosal mast cell (Sato *et al.*, 2016)

In this study, treatment with sulfaclozine and yeast led to a decrease in triglyceride and cholesterol production, whereas the serum HDL level increased steadily with more dietary yeast, as noted by Amer and Khan (2012). However, probiotic treatment dramatically increases blood cholesterol levels in broiler chicks (Owosibo *et al.*, 2013). Probiotics may lower overall cholesterol and triglyceride levels through their ability to enzymatically break down bile acids with the help of bile salt hydrolase, as described by Surono (2003). Additionally, probiotic organisms inhibit hydroxymethylglutaryl-coenzyme A, an enzyme essential for cholesterol production, which results in reduced cholesterol synthesis (Haque *et al.*, 2017). Our findings showed that broiler chickens in groups treated with *S. cerevisiae* and sulfaclozine, especially group 4, had considerably higher blood levels of HDL after consuming yeast. This is consistent with the findings of Priya and Babu (2013) and Paryad and Mahmoudi (2008) who found that broilers fed a diet containing 1.5% Saccharomyces had significantly higher HDL levels than those in the control group. Thus, lipid metabolism may be influenced by yeast. This is in line with a study conducted by Liu *et al.* (2025) supplemental yeast in the diets of broiler chickens significantly reduced circulating cholesterol LDL due to β-glucan, a component of the cell wall of *Saccharomyces cerevisiae*, which improves the gut microbiota's lipid metabolism function and boosts immunity, which is consistent with previous studies (Sarkar *et al.*, 2025). Moreover, yeast beta-glucan modifies the gut microbiota, bile acid metabolism, and signaling pathways by stimulating fecal bile acid excretion and reducing blood cholesterol levels (So *et al.*, 2021) . Yeast nutrients produce low-cholesterol meat with high-quality protein for consumers and stimulate the accretion of lean muscle tissue (Wang *et al.*, 2024). Probiotics have the potential to reduce the risk of lipid-related diseases, boost immunity, eliminate harmful bacteria, and restore bacterial balance in the gastrointestinal tract (Khan *et al.*, 2023).

Conclusion

Supplementation with *Saccharomyces cerevisiae* and sulfaclozine decrease cholesterol, triglycerides, VLDL-C, and LDL-C, while increasing HDL-C. This help in regulating lipid metabolism in a way that was beneficial to consumer health by providing high-quality protein meat with low total lipid content.

Further research is required to determine the effects of combination therapy. *Saccharomyces cerevisiae* and sulfaclozine on 3-hydroxy-3-methylglutaryl-CoA reductase gene expression and their effects on amino acid and fatty acid content of broiler muscle.

Conflict of interest

The authors have no conflict of interest to declare.

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