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Effects of Different Doses of Dia-V™ MB_{PRO} on Growth Performance, Serum Metabolites and Antioxidant Profiles of Broiler Chickens

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ABSTRACT

Background: *Saccharomyces cerevisiae* and/or essential oils have become increasingly important in poultry production due to improved gut health, enhanced growth performance and boosted immune system.

Methods: A total of 160 one-day old Ross-308 broiler chicks were randomly distributed into four groups, each consisting of four replicates with ten birds per replicate. The chicks were fed a basal diet containing *Saccharomyces cerevisiae* and essential oils at concentrations of 0 MB_{PRO}, 200 MB_{PRO}, 400 MB_{PRO} and 800 MB_{PRO} mg/kg feed respectively. Body weight gain (g), feed intake and feed conversion ratio were recorded. In addition, carcass traits were determined through dressing percentage and carcass parts. Furthermore, blood samples were collected for determination of serum metabolites and antioxidant profiles.

Result: The results showed that dietary *Saccharomyces cerevisiae* and essential oils incorporation improved ($P<0.001$) body weight gain and feed conversion ratio. Carcass traits remained unaffected by the combination treatments if compared to control. Serum metabolites and antioxidant profiles were improved with the combination treatments. It could be concluded that *Saccharomyces cerevisiae* and essential oils incorporation at 400 mg/kg feed proved to be an effective growth promoter, enhancing growth performance, metabolites and antioxidant profiles in broiler chicks.

Key words: Antioxidants, Carcass, Chicks, Feed conversion, Growth, Metabolites, Serum.

INTRODUCTION

The global population is expected to reach 9.7 billion by 2050 and 10.4 billion by 2100 (Mohammed and Alshaibani, 2025; Mohammed *et al.,* 2025). The escalating global population presents a profound challenge to food security, demanding a significant increase in food production and distribution (Abdullahi *et al.,* 2024). This surge necessitates not only expanded food production but also more efficient and sustainable practices to mitigate environmental impacts (Gamage *et al.,* 2024). Furthermore, shifts in dietary preferences, particularly the increased consumption of animal products linked to increase incomes, further strain on resources (Vermeulen *et al.,* 2020). Therefore, ensuring adequate food availability for a growing population requires innovative solutions, including technological advancements in agriculture, reductions in food waste and equitable distribution systems (Pawlak *et al.,* 2020).

Poultry production is essential for providing protein-rich food to the world's increasing urban populations and is a rapidly expanding area of animal agriculture. Therefore, the incorporation of dietary probiotics in broiler chicken diets has gained significant attention due to its potential impact to enhance poultry production and health (Krysiak *et al.,* 2021; Dong *et al.,* 2024; Ayana and Kamutambuko, 2024). Several positive impacts have been confirmed in several studies focused on the inclusion of dietary probiotics in broiler chicken including improvement of feed conversion and nutrient utilization, body weight gain and gut health (Abd El-Hack *et al.,* 2020; Urban *et al.,* 2024; Naeem and Bourassa, 2025).

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The dietary incorporation *Saccharomyces cerevisiae* and/or essential oils into broiler chicken nutrition has gained significant attention due to their potential to improve poultry health and production through several mechanisms (Heinsohn *et al.,* 2024; Movahedi *et al.,* 2024). Yeast culture contains yeast biomass and fermentation metabolites (Shurson, 2018). Yeast culture nutritional and health care functions to stimulate animal growth are attributed to its fermentation metabolites, including micronutrients and/or pro-vitamins (Brake 1991; Callaway and Martin, 1997;

Sun *et al.,* 2020). In addition, essential oils due to their growth-promoting and immunity-boosting properties and antimicrobial and antioxidant activities have gained much interest in the poultry industry (Valdivieso-Ugarte *et al.,* 2019; Movahedi *et al.,* 2024). Essential oil compounds can improve enzymatic activity in the gastrointestinal tract of chickens resulting in better digestion and absorption of nutrients (Su *et al.,* 2021). Consequently, while dietary *S. cerevisiae* and/or essential oils might offer a valuable tool for enhancing growth performance, careful consideration of these combinations is essential for optimal results. Therefore, the aim of the current study was to investigate the impacts of the dietary Dia-V™ MB_{PRO} supplementation (0, 200, 400, or 800 mg/kg feed) on growth performances, carcass traits, serum antioxidant and biochemical profiles of growing broilers.

MATERIALS AND METHODS

The experimental procedures were approved by the ethical committee concerning experimental animal care guidelines of King Faisal University [KFU-REC-2025-MAR-EA252670]. The procedure of the experiment was executed in the experimental animal research station of King Faisal University.

Site of study and experimental design

The current study was carried out from November 2024 to January 2025. A total of one hundred sixty one-day old Ross308 broiler chicks were randomly classified over four groups, each consisting of four replicates/ten birds (Fig 1). The basal diet was formulated following the strain recommendations by Aviagen (2018). These birds were fed a basal diet supplemented with 0, 200, 400, or 800 mg/kg feed of *Saccharomyces cerevisiae* and essential oil compounds, which were commercially obtained (Dia-V™ MB_{PRO}). The Dia-V™ MB_{PRO} additives were directly mixed into the feed during diet preparation to ensure even distribution. The birds were bred in floor pens measuring 16 square (each single pen) feet. The chicks were kept at 33.0°C for the first three days of age, after which the temperature was gradually reduced to 31.0°C for next 48.0 h. Subsequently, the birds were kept at an average of 31.0°C natural ambient temperature and 60.0% relative humidity during the study. The lighting program was maintained at 23 h light to 1h dark for the first 7 days, followed by 18 h light to 6 dark for the remaining of the experiment. The chicks had *ad libitum* access to feed and water.

Growth and carcass traits

At 7, 14, 21, 28 and 35 days of age, body weight gain (Kg) and feed intake (Kg) were recorded on a pen basis and feed conversion ratios were calculated (Abdel-Moneim *et al.,* 2025). On 35 days of age, eight chicks per group representing the groups' average weight were randomly selected for carcass evaluation to ensure unbiased sampling. The selected chicks were fasted for 12:0 h before weighing followed by slaughtering, de-feathering and eviscerating. The eviscerated carcasses and giblets were weighed for all groups. The eviscerated carcasses and giblets were recorded using a digital balance to ensure accuracy and expressed as a percentage of live body weight (Abdel-Moneim *et al.,* 2025).

Blood sample collection and analyses

Blood samples were collected from the brachial vein of twelve birds of each group at the end of experiment. The obtained blood samples were centrifuged to obtain serum for biochemistry and antioxidant analyses (Analyzer Skyla VB1). The analyzed biochemistry parameters include total proteins,

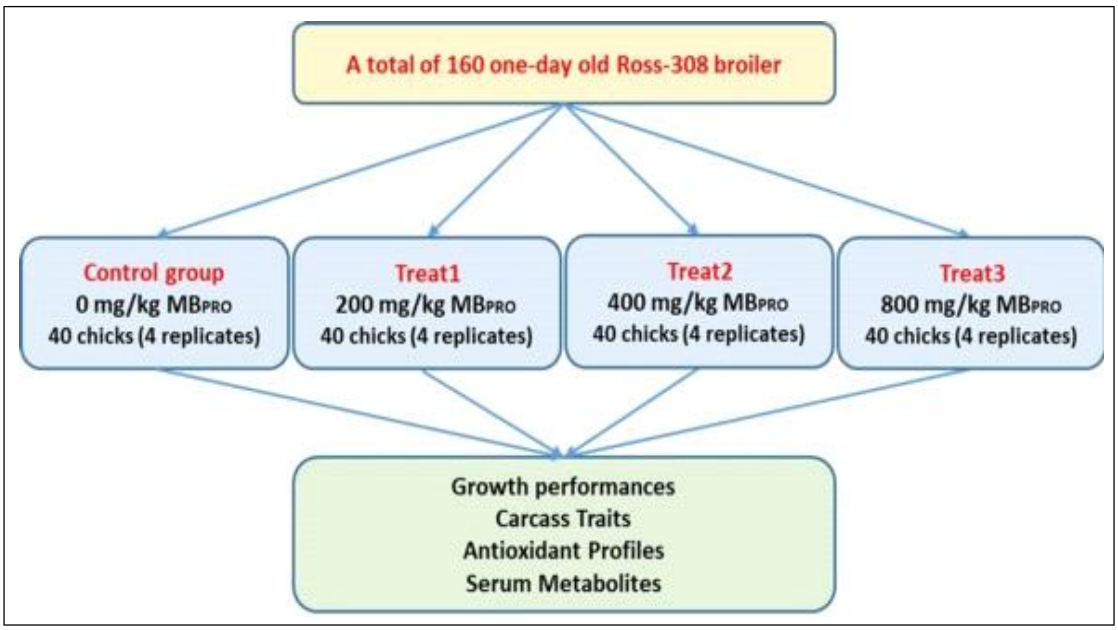


Fig 1: Experimental design of study for Dia-V™ MB_{PRO} additives to chicks.

liver enzymes, urea, creatinine and mineral values. The antioxidant enzymatic activities of serum malondialdehyde (MDA) was measured using a colorimetric method that involves its interaction with 2-thiobarbituric acid (2-TBA) at a wavelength of 532 nm (Mihara and Uchiyama, 1978). The ferric reducing ability (FRAP) test was conducted as described by Benzie and Strain with modification (Benzie and Strain, 1996). The ABTS radical cation decolorization test was conducted as the recommendation of Re *et al.* (1999). The free radical scavenging activity (FRSA) was assessed as outlined by Blois with modification (Blois, 1958). Total thiol (sulfhydryl group, -SH) concentrations (TTL) were quantified as described by Hu with modification (Hu, 1994).

Statistical analysis

Body weight gain (g), feed conversion (kg/kg), dressing and giblets percentage (%), serum antioxidant and metabolites values of control and Dia-VTM MBPRO treated groups were statistically analyzed using SAS program (SAS 2008) through General Linear Model procedure according to the model:

$$Yij = \mu + Ti + Eij$$

Where,

μ = Mean.

Ti = Effects of Dia-V™ MB_{PRO} levels (200MB_{PRO}, 400 MB_{PRO} and 800 MB_{PRO}).

Eij = Standard error.

To compare the significance among means of control and Dia-V™ MB_{PRO} treated groups, Duncan's multiple range test (1955) was used.

RESULTS AND DISCUSSION

The effects of Dia-V™ MB_{PRO} dietary inclusions **(**200 MB_{PRO}, 400 MB_{PRO} and 800 MB_{PRO}) to Ross-308 broiler chicks ration on feed intake, live body weight, feed conversion, carcass traits, serum metabolites and antioxidant capacity are presented in (Fig 2, 3 and 4) and (Table 1).

Growth performances

The effects of dietary inclusions (200 MB_{PRO}, 400 MB_{PRO} and 800 MB_{PRO}) on growth performance are presented in (Fig 2, 3 and 4). The dietary inclusions (200 MB_{PRO}, 400 MB_{PRO} and 800 MB_{PRO}) resulted in significantly higher final body weight (g) compared to the control group (0 MB_{PRO}) ($P<0.03$). The Dia-V™ MB_{PRO} dietary inclusions resulted in significant growth performance represented by improved body weight gain, feed intake, feed conversion ratio, carcass traits (Fig 2, 3 and 4). In general, dietary inclusions resulted in significant improvement in growth performance parameters concerning live body weight, feed conversion and carcass traits. In addition, 400 MB_{PRO} dietary inclusions gave the highest values in body weight and dressing percentage compared to other groups. While, 200 mg/kg had better feed conversion ratio compared to all other groups.

Serum metabolites and antioxidant capacity

The effects of different levels of Dia-V™ MB_{PRO} in broiler diet on serum metabolites and antioxidant capacity to broiler chickens are presented in (Table 1). The Dia-V™ MB_{PRO} dietary inclusions resulted in significantly higher total protein levels compared to the control group ($P<0.03$). In 200 MB_{PRO} group, albumin value showed a significantly higher value compared to the control and other Dia-V™ MB_{PRO} groups ($P<0.04$). There was no statistically significant differences in creatinine level among the control and Dia-V™ MB_{PRO} groups ($P=0.47$). Groups 400 MB_{PRO} and 800 MB_{PRO} exhibited significantly higher glucose levels compared to the control and 200 MB_{PRO} groups ($P=0.05$). The Dia-V™ MB_{PRO} inclusions significantly reduced total bilirubin levels compared to 0 MB_{PRO} inclusion ($P<0.0001$). Regrading to AST, ALT and GGT enzymes, there were no significant differences in AST ($P=0.54$), ALT ($P=0.89$) and GGT (0.74) levels among the control and Dia-V™ MB_{PRO} groups. Values of ALP were significantly ($P=0.01$) decreased in 400 MB_{PRO} and 800 MB_{PRO} groups compared to 200 MB_{PRO} and control ones. Regarding the antioxidant capacity, the FRAP, FRSA, ABTS and TTL values were not significantly different among groups whereas MDA values were significantly ($P=0.001$) decreased in Dia-V™ MB_{PRO} groups compared to control one.

The results of the current study indicated the highest significant improvement of Dia-V™ MB_{PRO} dietary inclusions to Ross-308 broiler chicks on growth performance, serum metabolites and antioxidant capacity at level of 400 mg/kg. The effect of Dia-V™ MB_{PRO} could be attributed to several factors including improved gut health, boosted immune system and reduction of pathogens (Mazziotta *et al.,* 2023; Chandrasekaran *et al.,* 2024).

Growth performances

The effects of *Saccharomyces cerevisiae* (*S. cerevisiae*) and essential oils dietary inclusions to broiler chicks on growth performances have been explored in several studies (Lin *et al.,* 2023; Okasha *et al.,* 2023). Our results indicated that dietary 400 mg/kg MB_{PRO} inclusion gave the highest body weight compared to all groups. Higher feed conversion ratio was recorded for chicks fed diet containing 200 mg/kg compared to other groups. The negative or positive changes of growth performances over *S. cerevisiae* supplementation to broiler chicks were dependent on the given doses (Haldar *et al.,* 2011; Swamy and Upendra 2013). Okasha *et al.* (2023) found that 0.25, 0.5 and 0.75% *S. cerevisiae* supplementation decreased body weight gain. On the other, significant increase of broilers BW fed diet added containing 0.1, 0.5, 0.75 and 1.0% *S. cerevisiae* compared to control one (Swamy and Upendra, 2013; Okasha *et al.,* 2023).

Additionally, essential oils are characterized by biological useful properties in the diet of broiler chickens reflected in improved growth performance and increase the body's immune response (Ezzat *et al.,* 2016; Giannenas *et al.,* 2018; Puvača *et al.,* 2015, 2022).

Collectively, dietary *Saccharomyces cerevisiae* and essential oils inclusion might provide comprehensive benefits to poultry of all ages and types, fostering a healthy gut environment that leads to improved digestion and enhanced growth performance (Lin *et al.,* 2023; Movahedi *et al.,* 2024; Abd El-Ghany 2024). They achieve this by balancing gut bacteria, strengthening the intestinal lining and stimulating the immune system while reducing harmful inflammation. The *S. cerevisiae* provides valuable proteins, vitamin B-complex and other beneficial factors that have been reported to increase phosphorus availability and utilization in animals (Moore *et al.,* 1994; Medina *et al.,* 2002).Furthermore, it has been indicated in several studies that dietary *S. cerevisiae* inclusion reduced disease infections and improved feed efficiency (Line *et al.,* 1997; Santin *et al.,* 2001).

Serum metabolites and antioxidant capacity

The values of serum metabolites and antioxidant capacity (Table 1) were improved in Dia-V^{TM} MB$_{PRO}$ groups comparedto control group as in other studies (Paryad and Mahmoudi, 2008; Okasha *et al.,* 2023). Total protein and

Table 1: Effects of dietary *Saccharomyces cerevisiae* and essential oils (Dia-V^{TM} MB$_{PRO}$) on plasma biochemistry profiles of broiler chickens at 35 d of age.

Parameters	Control	Treat 1	Treat 2	Treat 3	SEM	P value
Biochemical parameters						
Total protein, g/dl	3.95^{b}	4.12^{a}	4.40^{a}	4. 23^{a}	0.075	0.03
Albumin, g/dl	2.13^{b}	2.22^{b}	2.41^{a}	2.24b	0.055	0.04
Creatinine, mg/dl	0.77	0.86	0.83	0.085	0.04	0.47
Glucose, mg/dl	150.25^{b}	148.0^{b}	162.0^{a}	164.25^{a}	2.50	0.05
Total bilirubin, µmol/l	13.20^{a}	11.22^{b}	11.16^{b}	11.60b	0.66^{b}	<0.0001
Aspartate aminotransferase, U/l	66.46	64.60	63.70	63.10	0.45	0.54
Alanine aminotransferase, U/l	58.25	56.33	55.28	54.95	0.45	0.89
γ-glutamyl transferase, U/l	43.0	44.00	45.30	42.0	0.92	0.74
Alkaline phosphatase, U/l	11.86^{a}	11.67^{a}	11.44^{b}	11.41^{b}	0.05	0.01
Antioxidant capacity						
FRAP, µM	820.6	842.0	853.0	886.3	7.22	0.67
FRSA, Inh.%	86.31	86.04	85.37	81.22	0.62	0.33
ABTS, µM	1.710	1.710	1.716	1.716	0.002	0.97
TTL, µM	143.12	138.24	137.64	130.92	1.313	0.05
MDA, mMol/dl	1.625^{a}	1.423^{b}	1.40^{b}	1.236^{b}	0.040	0.001

^{ab} Values between groups at the same row with different superscripts significantly differ at P<0.05.

SEM: Standard error; FRAP: Ferric reducing antioxidant power; FRSA: Free radical scavenging activity; ABTS: 2,2'-Azino-bis(3-ethylbenzothiazoline-6-sulfonic acid); TTL: Total thiol levels; MDA: Malondialdehyde.

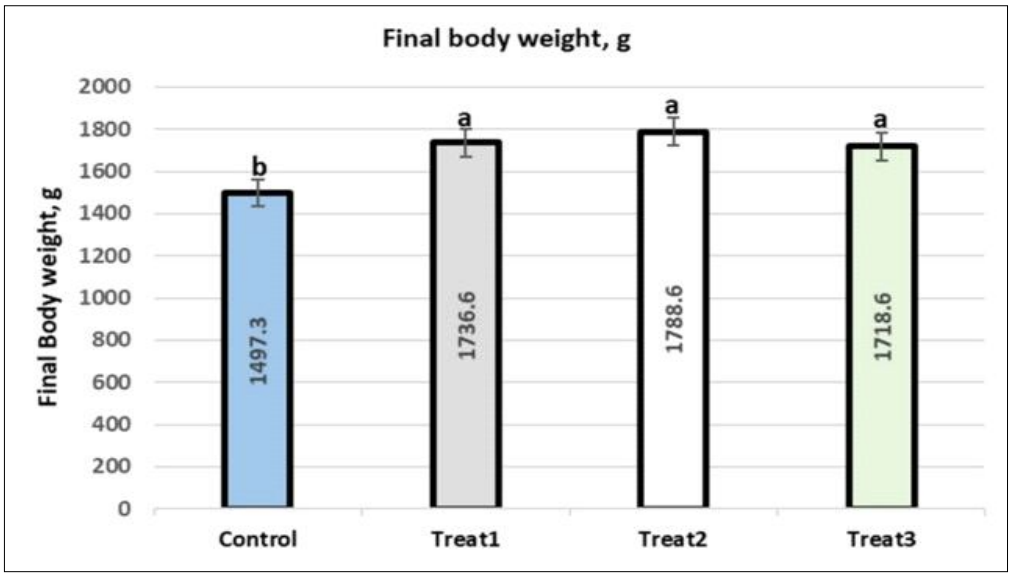


Fig 2: Effect of dietary Dia-V^{TM} MB$_{PRO}$ on final body weight of broiler chickens at 35 d of age.

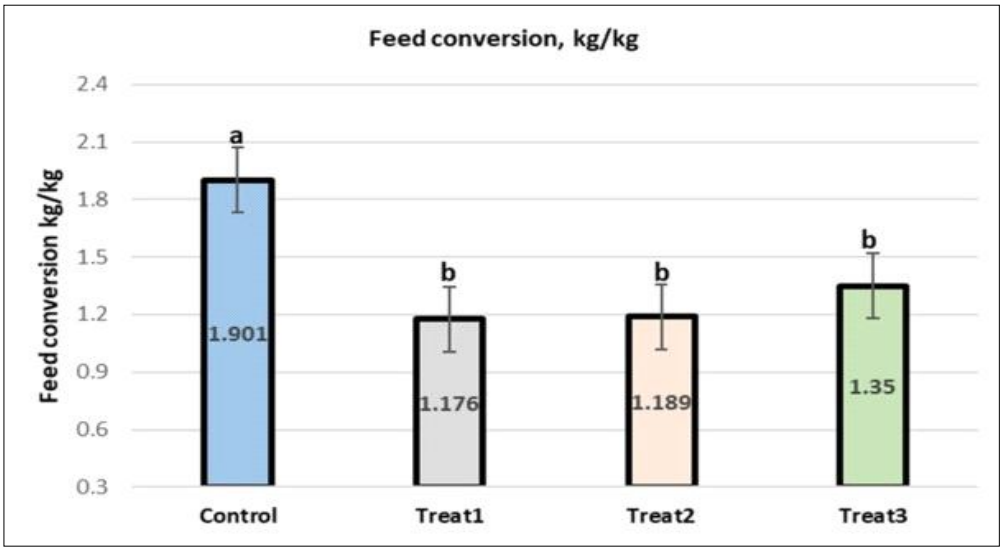


Fig 3: Effect of dietary Dia-V™ MB_{PRO} on feed conversion of broiler chickens at 35 d of age.

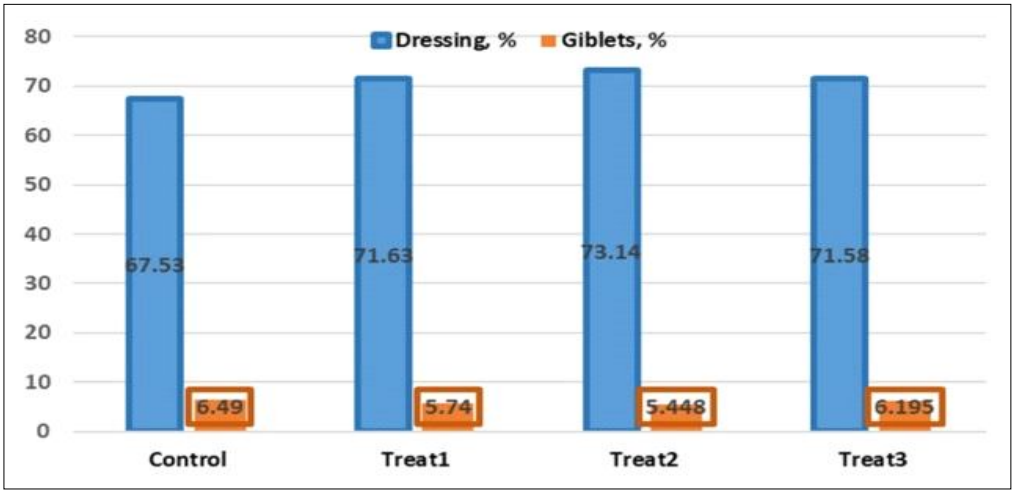


Fig 4: Effect of dietary Dia-V™ MB_{PRO} on dressing and giblets percentage of broiler chickens at 35 d of age.

albumin (g/dl) were significantly increased in Dia-V™ MB_{PRO} groups compared to control one. This could be attributed to the significant improvement of feed intake and feed conversion obtained in those groups, which subsequently resulted in increased glucose and creatinine values. Total bilirubin values were decreased (P=0.0001) in Dia-V™ MB_{PRO} groups compared to control groups. Both *S. cerevisiae* and essential oils have shown potential to improve liver health in poultry. By maintaining healthy liver function, these additives may contribute to efficient bilirubin processing and excretion in addition to unchanged liver enzymes (Table 1).

The antioxidant capacities were gradually decreased in Dia-V™ MB_{PRO} groups with increasing doses if compared to the control group except ABTS, µM. *S. cerevisiae* contains components, such as beta-glucans, that can stimulate the poultry's immune system, which enhances antioxidant defenses. Some studies have shown that *S. cerevisiae* can enhance the activity of antioxidant enzymes in poultry. Additionally, the essential oils are rich in bioactive compounds, such as terpenes and phenols, which possess potent antioxidant properties and modulate the activity of antioxidant enzymes (De Sousa *et al.* 2023; Sequeda-Castañeda *et al.,* 2025).

CONCLUSION

It could be concluded that Dia-VTM MBPRO supplement modulates growth performance, serum metabolites and antioxidant capacity. The best dietary supplement was 400 MB_{PRO} compared to 200 MB_{PRO} and 800 MB_{PRO} levels.

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Conflict of interest

All authors declared that there is no conflict of interest.

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