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EFFECTS OF MOLASSES SUPPLEMENTATION IN COMMERCIAL FEEDS ON THE GROWTH PERFORMANCE OF SALINE TILAPIA (*Oreochromis niloticus*)

PENGARUH SUPLEMEN MOLASES DALAM PAKAN KOMERSIAL TERHADAP PERTUMBUHAN IKAN NILA SALIN (*Oreochromis niloticus*)

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Abstract

This study aimed to evaluate the effects of molasses supplementation in commercial feed on the growth performance of saline tilapia (*Oreochromis niloticus*) fry. A Completely Randomized Design (CRD) with four treatments and five replications was employed: A (control), B (10 mL molasses), C (20 mL molasses), and D (30 mL molasses). Growth performance parameters included specific growth rate, absolute weight gain, length gain, and survival. Results demonstrated that molasses supplementation had a significant effect ($p < 0.05$) on all parameters. Treatment C (20 ml) achieved the best performance, with a specific growth rate of 1.62%, an absolute weight gain of 1.24 g, and a survival rate of 76%. In contrast, Treatment D (30 ml) yielded the lowest growth performance, indicating that excessive molasses supplementation reduced feed palatability and negatively affected culture outcomes. These findings suggest that supplementation with 20 ml of molasses provides the optimal dosage to enhance the growth and survival of saline tilapia fry.

Keywords: *Oreochromis niloticus*, molasses, growth, survival rate

Abstrak

Penelitian ini bertujuan untuk mengevaluasi efek suplementasi molase dalam pakan komersial terhadap kinerja pertumbuhan benih ikan nila salin (*Oreochromis niloticus*). Rancangan Acak Lengkap (RAL) dengan empat perlakuan dan lima ulangan diterapkan: A (kontrol), B (10 ml molase), C (20 ml), dan D (30 ml). Parameter kinerja pertumbuhan meliputi laju pertumbuhan spesifik, pertambahan berat dan panjang absolut, dan kelangsungan hidup. Hasil menunjukkan bahwa suplementasi molase memiliki efek yang signifikan ($p < 0,05$) pada semua parameter. Perlakuan C (20 ml) mencapai kinerja terbaik, dengan laju pertumbuhan spesifik 1,62%, pertambahan berat absolut 1,24 g, dan kelangsungan hidup 76%. Sebaliknya, Perlakuan D (30 ml) menghasilkan kinerja pertumbuhan terendah, yang menunjukkan bahwa suplementasi molase yang berlebihan mengurangi palatabilitas pakan dan berdampak negatif pada hasil kultur. Temuan ini menunjukkan bahwa suplementasi 20 ml molase memberikan dosis optimal untuk meningkatkan pertumbuhan dan kelangsungan hidup benih ikan nila salin.

Kata Kunci: *Oreochromis niloticus*, molase, pertumbuhan, tingkat kelangsungan hidup

INTRODUCTION

Tilapia (*Oreochromis niloticus*) is one of the most important freshwater aquaculture commodities in Indonesia, owing to its high adaptability, rapid growth, and significant economic value (Gustiano *et al*., 2023). To optimize its utilization in coastal areas, researchers have developed a saline-tolerant strain known as saline tilapia, which can survive and grow in brackish water up to 20 ppt salinity (Zuib, 2023). This strain was produced through a selective breeding and adaptation process and has been officially recognized as a superior variety for aquaculture (Chaidir *et al*., 2023). The development of saline tilapia not only supports the diversification of aquaculture species but also offers a solution to the problem of idle brackish-water ponds resulting from shrimp farming failures (Nurchayati *et al*., 2021; Halim *et al*., 2025).

The demand for saline tilapia seed continues to increase, requiring improvements in both the quality and efficiency of seed production (Aeni, 2023). Feed management is a critical factor influencing growth performance and survival in aquaculture systems (Arifaldianzah *et al.*, 2022). Commercial feed is the primary nutrient source, and its formulation and digestibility significantly affect fish growth and feed conversion efficiency (Kurniasih *et al.*, 2014; Angriani *et al.*, 2020). However, the high cost of feed and the need to maintain water quality remain significant challenges in aquaculture production systems.

Molasses, a by-product of the sugar industry, has gained attention as a feed additive in aquaculture. Molasses contains 40–60% sugar, including sucrose, and is also rich in amino acids, vitamins, and inorganic salts such as Ca^{2+}, Na^{+}, and SO_4^{2-} (Zhang *et al.*, 2021). The sugar composition in molasses includes approximately 39% sucrose, 16% glucose, and 17% fructose, along with essential nutrients such as vitamin B6, calcium, magnesium, iron, and manganese (Palmonari *et al.*, 2020). Its use as a feed additive has also been proven to improve feed efficiency as well as fermentation and silage quality, thanks to its sucrose content serving as an energy source (Zhang *et al.*, 2024). Beyond its nutritional role, molasses possesses functional properties that can enhance water quality by promoting beneficial microbial activity and inhibiting the growth of pathogenic bacteria, making it widely utilized in biofloc and probiotic-based systems (Aswardi *et al*., 2020). Moreover, molasses can enhance feed palatability and digestibility, which may improve feed efficiency and growth rates (Mirna & Tahir, 2023).

Previous studies have reported positive effects of molasses supplementation on fish growth and survival. For instance, in a low-salinity biofloc system, Nile tilapia fingerlings receiving molasses at 30% of their daily feed showed significantly better growth performance, survival, and feed conversion ratio compared to those receiving 50%, leading to a recommendation for the lower dosage (Lima *et al*., 2019). Similarly, in a biofloc system, fry reared with molasses as the carbon source exhibited higher weight gain (1.99 g vs 1.73 g), improved FCR (0.64 vs 0.89), and survival rates exceeding 92 % compared to controls (Zablon *et al*., 2022). In addition, molasses supplementation yielded better increases in weight (32.97 g) and length than sugarcane juice in another biofloc study (Chairunisa *et al*., 2024)

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RESEARCH METHODS

Materials and Tools

The equipment used in this study included 15-liter jars for holding samples, buckets for transferring water, writing tools for recording research data, rulers for measuring fish length, scales for weighing fish, nets for collecting samples from the containers, and an aeration system to supply oxygen. The materials used consisted of saline tilapia as the research organism, water as the culture medium, molasses as a feed additive, and commercial feed as the primary nutrient source for the fish.

Experimental Design

The research was conducted using a laboratory experimental method with a Completely Randomized Design (CRD). The experiment consisted of four treatments, each carried out with five replications, resulting in a total of 20 experimental units. The treatments were as follows: The details of each treatment are as follows:

A: Commercial feed without molasses, administered at 3% of fish body weight.
B: Commercial feed with 10 ml of molasses, administered at 3% of fish body weight.
C: Commercial feed with 20 ml of molasses, administered at 3% of fish body weight.
D: Commercial feed with 30 ml of molasses, administered at 3% of fish body weight.

Preparation of Containers

The containers used in this experiment consisted of twenty jars, each with a capacity of 15 liters. Prior to use, all jars were sterilized by thoroughly washing and drying for approximately 24 hours. After sterilization, each jar was filled with 10 liters of water, serving as the culture medium.

Preparation of Test Organisms

The experimental organisms were saline tilapia (*Oreochromis niloticus*) fingerlings with an average length of 2–3 cm. A total of 200 fingerlings were used, with 10 fish stocked per jar. The fingerlings were obtained from the Brackish Water Aquaculture Development Center (BPBAP) Ujung Bate.

Preparation of Experimental Feed

The feed used in this study consisted of commercial fish feed supplemented with molasses. The preparation process involved dissolving molasses in 50 ml of water according to the assigned dosage, stirring the mixture thoroughly, and then incorporating it into 100 g of commercial feed for each treatment. The feed was subsequently sun-dried to ensure longer shelf life and prevent mold growth.

Maintenance of Test Organisms

Before stocking the fish into the experimental containers, samples were collected to measure initial length and weight as baseline data. Throughout the experiment, fish were fed

the prepared molasses-supplemented diet twice daily at 08:00 and 17:00 at a feeding rate equivalent to 3% of the total biomass.

Experimental Observation Parameters

Specific Growth Rate (SGR)

The specific growth rate can be calculated using the following formula:

$$SGR = \frac{lnW_t - lnW_0}{T} x\ 100\%$$

Description:

SGR = Specific growth rate of fish during the experiment (%)

LnW_t = Average daily fish weight on day t of the experiment (grams)

LnW_0 = Average fish weight at the beginning of the experiment (grams)

Absolute Weight Growth

Absolute weight growth can be calculated using the following formula:

$$W = W_t - W_0$$

Description:

W = Absolute weight growth of fish during the experiment (grams)

W_t = Fish weight at the end of the experiment (grams)

W_o = Fish weight at the beginning of the experiment (grams)

Survival Rate (SR)

Survival Rate can be calculated using the following formula:

$$SR = \frac{N_t}{N_o} x\ 100\%$$

Description:

SR = Fish survival rate (%)

N_t = Number of fish at the end of the experiment

N_0 = Number of fish at the beginning of the experiment

Data Analysis

The data obtained will be analyzed using data processing software, including Analysis of Variance (ANOVA). Subsequently, the data will be further tested using Duncan's test with a 95% confidence interval.

RESULT AND DISCUSSION

Specific Growth Rate (SGR)

The specific growth rate (SGR) of saline tilapia (*Oreochromis niloticus*) ranged from 1.15 to 1.62 g (Figure 1). One-way ANOVA analysis indicated that different molasses supplementation levels in commercial feed had a significant effect on SGR ($p < 0.05$). Further analysis using Duncan's multiple range test showed that Treatment C (20 ml) resulted in the

highest SGR (1.62 g), followed by Treatment B (10 ml) at 1.54 g, the control group (Treatment A) at 1.33 g, and Treatment D (30 ml) at 1.15 g.

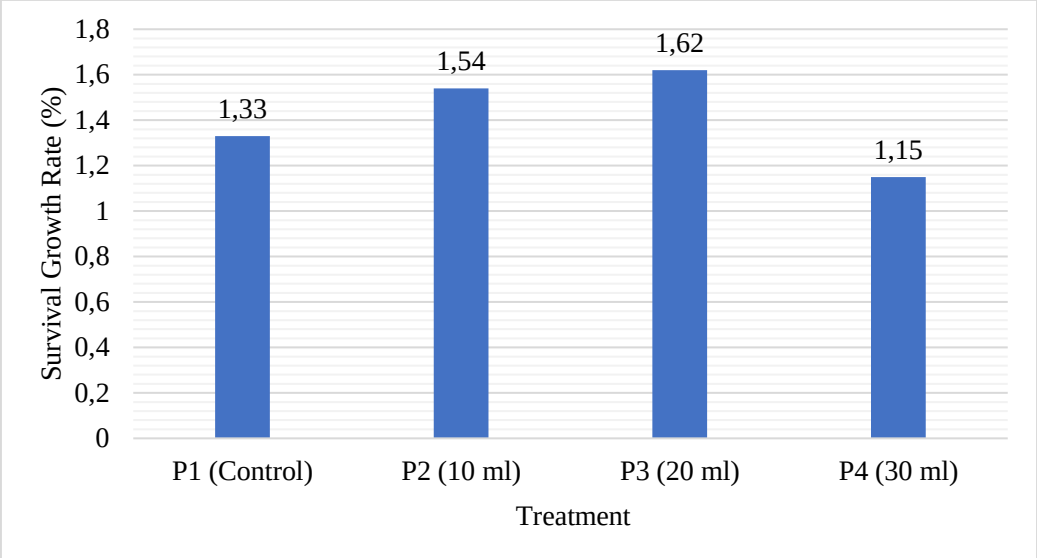

Figure 1. Survival Growth Rate

The superior SGR in treatment C was likely due to optimal utilization of dietary nutrients as an energy source, allowing protein to be allocated primarily for growth (Das *et al*., 2023). Conversely, the lowest SGR observed in Treatment D may have resulted from reduced feed palatability due to excessive molasses addition, leading to suboptimal feed utilization (Mordenti *et al*., 2022).

These findings align with those of Abd El-Hack *et al*. (2022), who reported that optimal fish production requires high-quality feed that meets the nutritional needs of fish. Growth occurs when digested and absorbed nutrients exceed maintenance energy needs (Maria, 2024). Similarly, Angriani *et al*. (2020) emphasized that fish growth is influenced by both internal factors, such as the ability to utilize residual energy and protein, and external factors, including feed quality and environmental conditions. The balance between these factors plays a critical role in supporting growth performance.

Water quality is a critical determinant of fish growth performance. Siegers *et al.* (2019), highlighted that environmental factors, including temperature, dissolved oxygen, salinity, nutrient concentration, and pollutant levels, must be maintained within the species' tolerance limits to avoid adverse effects on growth. Similarly, Putri *et al*. (2016) emphasized that suboptimal water conditions can induce stress, slow growth, and elevate susceptibility to disease outbreaks and mortality in aquaculture systems.

Absolute Weight Gain

The absolute weight gain of saline tilapia (*Oreochromis niloticus*) ranged from 1.15 to 1.62 g. One-way ANOVA analysis showed that the addition of molasses at different doses in commercial feed had a significant effect ($p<0.05$) on absolute weight gain. Duncan's multiple range test indicated that treatment C (20 mL) produced the highest weight gain (1.62 g),

followed by treatment B (10 mL; 1.54 g), the control (1.33 g), and treatment D (30 mL; 1.15 g).

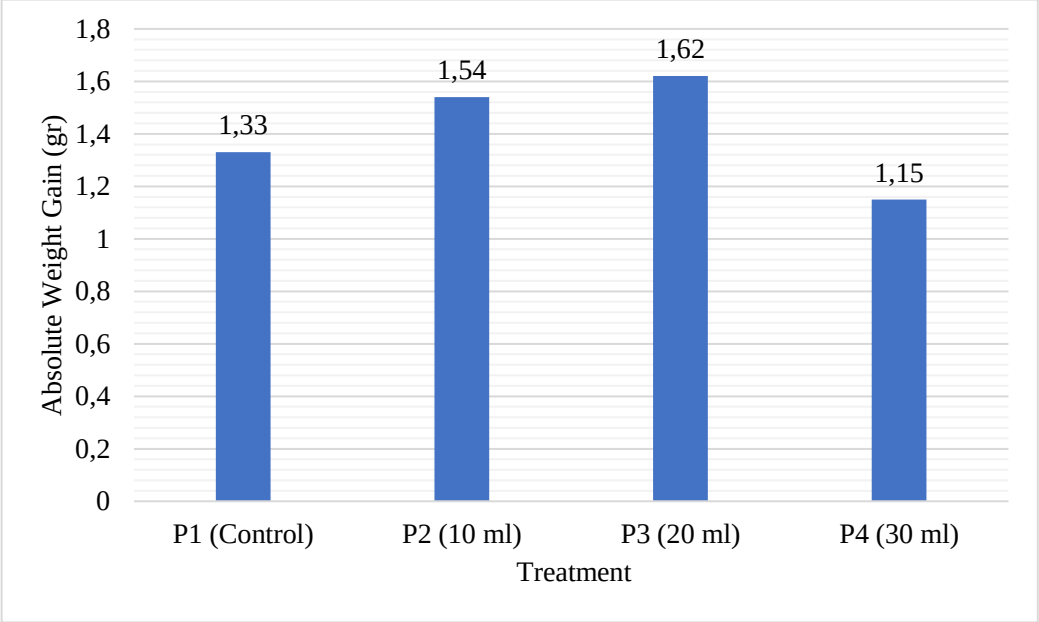

Figure 2. Absolute Weight Gain

The highest weight gain in treatment C was likely due to optimal feed utilization and the molasses-stimulated growth of natural feed organisms, which enhanced intake and digestibility. In contrast, the lowest gain in treatment D was associated with reduced palatability, incomplete feed consumption, and accumulation of uneaten feed, which deteriorated water quality by increasing ammonia and lowering dissolved oxygen, leading to stress, slower growth, and lower feed conversion efficiency (Rafeay *et al*., 2023). These results emphasize the importance of feed quality and water management in aquaculture.

These results are consistent with Agustina (2022), who reported that tilapia growth increases when feed provides adequate energy, and Fathul *et al*. (2023), who emphasized the importance of supplying feed according to fish requirements. Additionally, Aslianti & Nasukha (2019), reported that sugarcane molasses in the rearing medium can promote the growth of microorganisms as a natural feed. Meanwhile, Aswardi *et al*. (2020), noted that low concentrations of molasses enhance probiotic activity, thereby supporting fish growth.

Survival Rate (SR)

The administration of feed supplemented with molasses resulted in survival rates ranging from 66% to 76%, which is considered reasonable based on standard criteria (>50% = good; 30–50% = moderate; <30% = poor). The highest survival rate was observed in Treatment C (20 mL), followed by Treatment B (10 mL), Treatment D (30 mL), and Treatment A (control). The superior survival in Treatment C is likely attributable to optimal water quality, efficient feed utilization, and the fish's good adaptability to both feed and environmental conditions. Nutritionally adequate feed plays a crucial role in supporting fish survival (Amaliah *et al*.,

2018), as it ensures that energy and nutrient requirements are met, enabling fish to maintain their health and resist stress.

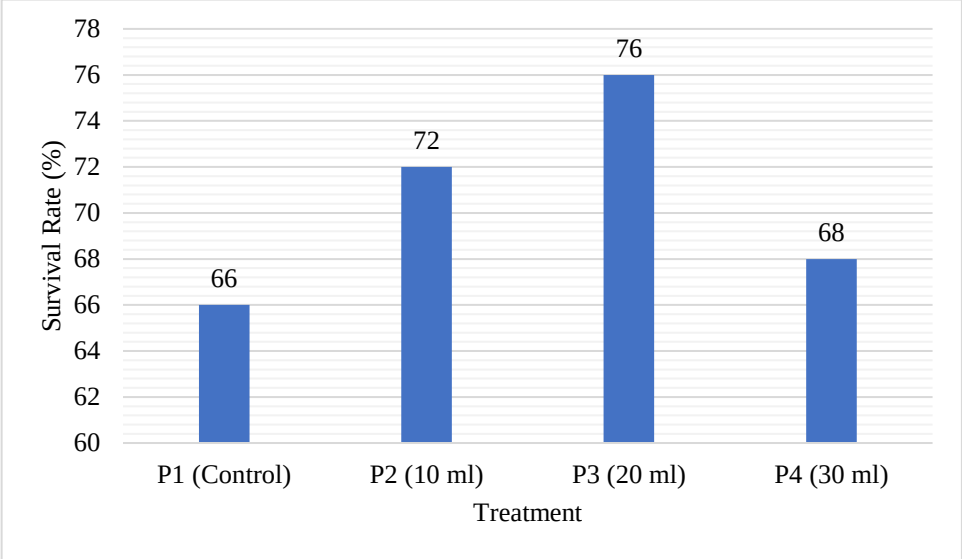

Figure 3. Survival Rate

Water quality and gradual salinity adjustment are also crucial for survival. During the study, water parameters were within optimal ranges, with a temperature of 27°C and a pH of 7–8, consistent with the recommended conditions for tilapia (Yonarta *et al.*, 2023). Poor water quality forces fish to expend energy on environmental adaptation rather than growth, which can induce stress, reduce feeding, and increase disease susceptibility (Caldini *et al*., 2011). Gradual acclimation to salinity changes prevents environmental shock, whereas rapid changes can elevate it. Overall, the combination of balanced feed and appropriate water management contributed to high survival rates, highlighting the importance of integrated nutritional and environmental strategies in aquaculture systems.

CONCLUSION

Molasses supplementation in commercial feed had a significant effect on the growth performance of saline tilapia fry ($p < 0.05$). The highest specific growth rate (1.62%), absolute weight gain (1.24 g), length gain (1.34 cm), and survival (76%) were consistently obtained in Treatment C (20 ml), followed by Treatment B (10 ml), the control, and Treatment D (30 ml). In contrast, Treatment D showed the lowest growth performance and survival, suggesting that excessive molasses supplementation reduced feed palatability and negatively impacted culture outcomes.

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