The Quality of Broiler Meat Given Dragon Fruit Peel Juice in its Drinking Water

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Abstract

This experiment evaluated the influence of supplementing broiler drinking water with dragon fruit peel juice (DFPJ) on the chemical and physical quality of the meat. This research consisted of four treatments and four repetitions. Treatments included: drinking water with the inclusion of 2, 4 and 6% DFPJ juice in the drinking water, while the control was drinking water without DFPJ. The meat parameters measured included water content, crude protein, fat, pH, water holding capacity, cooking loss, and dripping loss. Results indicated that meat moisture declined significantly ($P<0.05$) at 4% and 6% supplementation, while protein levels rose across 2–6% inclusion. Fat levels were reduced at 4% and 6%. No notable differences were detected for pH, WHC, cooking loss, or drip loss. In conclusion, incorporating dragon fruit peel juice into broiler drinking water may improve chemical composition by lowering water and fat levels while increasing protein content, without negatively impacting physical traits.

Keywords: Broiler meat; Dragon fruit peel; Drinking water; Meat quality

Introduction

The demand for poultry products continues to rise, not only in terms of quantity but also quality. To meet these expectations, it is necessary to improve both the chemical and physical attributes of meat. From a nutritional perspective, meat with higher protein and lower fat levels is considered healthier. On the physical side, maintaining a good water-holding capacity (WHC) and minimizing cooking loss are crucial for improving consumer acceptance.

Broiler chicken meat is particularly popular in Indonesia because of its efficiency in feed conversion, rapid growth, and affordable price compared with other poultry types such as ducks or free-range chickens. For decades, the growth performance of broilers has often been enhanced using antibiotic growth promoters [1]. However, long-term application of synthetic AGPs has been linked to the emergence of bacterial resistance and the presence of harmful residues in poultry tissue, raising safety concerns for consumers [2]. These issues have prompted efforts to identify safer natural alternatives to AGPs.

One promising candidate is dragon fruit (*Hylocereus* spp.), particularly its peel, which contains higher concentrations of antioxidants than the pulp [3]. Among these, flavonoids—a class of polyphenolic compounds__are of special interest due to their capacity to counter oxidative stress and protect against free radical–induced diseases[4]. In addition, flavonoids are reported to exhibit antimicrobial activity that supports digestion and overall gut health [5,6]. The abundance of flavonoids in dragon fruit peel suggests it could serve both as a natural growth promoter and as a safe additive in poultry nutrition.

The inclusion of DFPJ in drinking water is expected to improve broiler performance by improving nutrient absorption and potentially influencing feed intake and growth.

Infante-Rodríguez et al.[7], emphasized that reduced feed intake leads to lower body weight and carcass yield, which negatively affects meat composition. This experiment evaluated the influence of supplementing broiler drinking water with dragon fruit peel juice (DFPJ) on the chemical and physical quality of the meat.

Materials and Methods

Research Subjects

This study utilized unsexed one-day-old broiler chicks (Cobb strain) supplied by Limited liability company Japfa Comfeed Indonesia Tbk., Wisma Millenia Lt. 7 Jl. MT. Haryono Kav. 16, Jakarta 12810, Indonesia. Birds were selected to achieve a uniform starting weight. A commercial diet was provided throughout the experiment, consisting of BR 10 feed during the starter phase (days 1-20) and BR 11 feed in the finisher phase (days 21-35). Drinking water originated from the local water company and was supplemented with dragon fruit peel juice according to the assigned treatments. All chickens are given free access to feed and water. The nutrient composition of BR 10 and BR 11 diets is presented in Table 1.

Table 1. Nutrient content of BR 10 and BR 11 rations

Nutrient	Type of rations$^{1)}$		Standard$^{2)}$
	BR10	BR11	
Metabolizable energy, Kcal/kg	3000-3100	3.056.81	Min 2900
Crude protein, %	23%	18.23	Min 19
Crude fat, %	7.34	7.54	Max 8.0
Crude fiber, %	3.94	4.33	Max 6.0
Calcium (Ca), %	0.96	0.96	0.90-1.20
Phosphorus (P), %	0.67	0.66	Min 0.40

$^{1)}$ Brochure of broiler feed from Limited liability company Japfa Comfeed Indonesia Tbk.
$^{2)}$ Standard nutrient according to [8].

Experimental Design

This research consisted of four treatments and four repetitions. Treatments included: drinking water with the inclusion of 2, 4 and 6% DFPJ juice in the drinking water, while the control was drinking water without DFPJ.

Chemical Analysis

Determination of meat water content follows the oven drying approach, ash with a furnace, and the crude protein content of meat is analyzed using the Kjeldahl method with slight modifications [9]. Crude protein content in meat was analyzed by the Kjeldahl method with slight modifications, Fat levels were estimated by Soxhlet extraction. A 2 g portion of meat (W) was wrapped in filter paper and oven-dried at 105°C for 9 h. A soxhlet flask was pre-dried at the same temperature for 3 h [9].

Measuring the pH of meat using a pH meter, water-holding capacity (WHC), was assessed using a Clement 2000 centrifuge [10], Cooking loss (%) was calculated as: Cooking Loss (%) = (W before-W after)/W before x 100; and drip (weep) loss was measured on 20 g meat samples cut to 2 cm thickness, trimmed of fat and connective tissue. Samples were tied with thread and suspended at room temperature for 24 h without contact with plastic or other surfaces. Surface moisture was blotted, and the sample was weighed. Drip loss (%) was obtained from: Weep Loss (%) = (W initial-W final)/W initial × 100

Data Analysis

Data were analyzed using SPSS (Statistical Product and Service Solutions) software version 25. When the data distribution was homogeneous, further testing was performed using one-way ANOVA at a 5% confidence level (P<0.05). If a significant effect was found, Duncan's test was used [11].

Results and Discussion

Chemical Properties of Meat

The addition of DFPJ to drinking water significantly affected (P<0.05) the chemical profile of broiler meat. Meat moisture content decreased at levels of 4 and 6% DFPJ in drinking water, suggesting that higher inclusion rates reduce water retention in muscle tissue (Table 2). The normal water content of broiler chicken meat ranges between 70-75%, and can be influenced by age, feed (especially the type of fiber and salt content in the diet), and drinking water intake, the present findings indicate that supplementation improved nutrient absorption and metabolic processes, leading to greater deposition of protein and fat-free dry matter, thereby lowering moisture. A similar trend was described by [12], who reported enhanced protein digestibility and energy utilization in poultry supplemented with dragon fruit extracts (Table 2).

Table 2. Chemical properties of broiler meat fed DFPJ through drinking water.

Variable	DFPJ level in drinking water (%)			
	0	2	4	6
Water content (%)	66.70^{a}	66.28^{a}	63.45^{b}	61.87^{c}
Crude protein (%)	23.34^{b}	28.00^{a}	29.45^{a}	30.26^{a}
Fat content (%)	5.24^{a}	4.68^{a}	3.43^{b}	3.31^{b}

Values with different letters (^{a,b,c}) in the same row indicate a significant difference (P<0.05).

Crude protein levels showed a marked rise in groups 2, 4 and 6% compared with the control. This indicates that supplementation at 2-6% supports better protein deposition in muscle tissue. Comparable findings were reported by [13], who observed higher body weight gains in broilers receiving dragon fruit peel juice. Likewise, [14] demonstrated that dragon fruit peel meal improved carcass weight, while [15] confirmed that red dragon fruit infusion at 2% promoted faster growth within three weeks. These improvements may be associated with flavonoids in dragon fruit peel, which enhance nutrient absorption and stimulate growth-regulating mechanisms. Previous studies have shown that flavonoids can improve growth performance, regulate the hormone IGF-I and support muscle development [16,17,18].

Fat content decreased significantly at the 2 and 4% DFPJ levels, with values ranging between 3.31 and 5.24%. The fat content of this meat is lower compared to the results of research by [19] on broilers given *Meniran* extract supplements. The reduction in fat deposition may be linked to the antioxidant compounds in dragon fruit peel, particularly phenolic substances, which can modulate hormonal activity, reduce cholesterol synthesis, and shift nutrient utilization toward protein accretion. The observed increase in protein levels in this study also supports the inverse relationship between protein and fat content in meat, producing leaner carcasses that are generally preferred by consumers.

Physical Properties of Meat

The pH values obtained (5.6-5.87) did not differ significantly between treatments. This finding is consistent with the normal postmortem meat pH range for broiler meat, which is between 5.4-5.8 [20]. Although [21,22] reported slightly higher values, the results of this study indicate that supplementation with dragon fruit peel juice did not disturb postmortem glycolysis. Feed intake and glycogen reserves were sufficient to maintain normal rigor mortis, resulting in stable pH across treatments [23]. (Table 3).

Table 3. Physical properties of broiler meat given DFPJ in drinking water.

Variable	DFPJ level in drinking water (%)			
	0	2	4	6
pH of meat	5.71[a]	5.72[a]	5.68a	5.87[a]
Water Holding Capacity (%)	25.11[a]	26.85[a]	29.05[a]	29.50[a]
Cooking Loss (%)	41.57[a]	40.70[a]	40.51[a]	35.86[a]
Weep Loss (%)	8.20[a]	8.44[a]	8.08[a]	5.30[a]

Values with the same letter ([a]) in the same row indicate no significant difference ($P<0.05$).

The results of this study (Table 3) indicate that the inclusion of DFPJ in drinking water had no impact on the WHC of broiler meat. However, there was a noticeable trend of increasing water holding capacity from the control group to the treatment groups (2, 4 and 6% DFPJ). The variation of WHC of broiler meat is influenced by the protein and carbohydrate content of the meat. Higher levels of meat protein are generally associated with higher water binding capacity. In this study, the protein levels in broiler chickens increased when given dragon fruit juice in their drinking water, which might have contributed to the observed trend of increased WHC. Meat quality which affects various physical characteristics of meat, such as tenderness, color, texture, freshness, and shrinkage is greatly influenced by the WHC of meat [20]. The water holding capacity values in this study ranged from 20% to 60%, indicating that the WHC of the meat was within the normal category.

The CL value in this study yielded statistically insignificant results with $p>0.05$. However, there was a quantitative tendency of meat cooking losses to decrease. This decrease in cooking shrinkage of meat can be attributed to the observed increase in the WHC of the meat. Soeparno [10] supports this finding by stating that cooking losses are influenced by the WHC where higher WHC results in lower CL. Measuring the cooking loss value can serve as an indicator to determine meat quality. During the cooking process, a certain amount of water and nutrients are released from the meat. Therefore, a lower cooking loss value suggests better meat quality. According to [10], the cooking loss value for meat typically varies between 1.5% to 54.5%.

The statistical analysis of the weep loss value in this study found no significant effect. This suggests that inclusion of DFPJ had no effect on the shrinkage value of raw meat in this study. The lack of significance in weep loss might be attributed to the fact that the water holding capacity and nutritional value of cooked meat in this study were also not significantly different. It is important to note that the value of raw losses is directly related to the value of cooking losses. If the value of cooking losses decreases, the value of raw losses will also decrease.

Conclusions

Adding DFPJ to broiler drinking water has the potential to lowers the water content of the meat, elevates its protein levels, and reduces the fat content. The inclusion of DFPJ in broiler drinking water also has no adverse effects on the physical properties of the meat.

Suggestions

Future research should focus on analyzing specific nutritional components (e.g., amino acid profiles, vitamin levels, specific fat types) in different feeds to determine which components have the greatest impact on performance and feed efficiency.

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