# INFLUENCE OF COLOURANTS (TURMERIC AND *JA'WA* POWDER) ON THE PROXIMATE COMPOSITION OF BROILER MEAT

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**ABSTRACT**
*This study evaluated the influence of natural and synthetic food colourants on the proximate composition of broiler chicken meat. Natural colourant, including Turmeric powder and the synthetic dye, Ja'wa powder (Sudan Dye) were used as the treatments. Proximate analysis of the colourants and broiler chicken meat were carried out. Data obtained on proximate composition of broiler chicken meat processed with different colourant were analyzed using Analysis of variance while significant differences were compared using Duncan multiple range test. Results revealed that Turmeric powder significantly enhanced meat quality, evidenced by the highest dry matter (92.50%) and crude protein (50.79%), indicating better retention of solids and protein synthesis. Broilers meats cured with Ja'wa powder exhibited the highest fat content (6.79%), impacting flavor but posing concerns for lean meat preferences. Ash content remained unaffected across treatments, while NFE was highest in the control group, suggesting minimal glycogen storage in broiler meat cured with Turmeric powder. In conclusion, Turmeric powder proved to be the most beneficial natural colourant for enhancing protein and overall nutritional quality, while the synthetic Ja'wa showed potential for increasing fat deposition which can lead to health implications. The findings highlight the utility of natural additives in improving meat quality for health-conscious consumers.*
**Keywords**: Chemical composition, Colourants, Broiler meat, Turmeric, J*a'wa* Powder

## INTRODUCTION

Food and meat colourants significantly contribute to consumer preferences, influencing the acceptability, perception, and purchasing decisions of food products (Pang *et al*., 2022). Natural food colourants, such as carotenoids, anthocyanins, and chlorophylls, are derived from plants, algae, and microorganisms, providing not only aesthetic appeal but also nutritional benefits (Gómez-Mejía *et al*., 2021). Synthetic colourants, predominantly developed from petroleum-based products, are used extensively due to their stability, cost-effectiveness, and vivid coloration; however, their potential health effects have elicited growing concerns among consumers and researchers alike (Deshmukh *et al*., 2021).Health implications related to synthetic colourants, like *Ja'wa* (Sudan dye) including hyperactivity, allergenicity, and carcinogenicity, have been highlighted, leading to increased advocacy for the use of natural alternatives (El-Sharkawy *et al*., 2020).

The global reliance on synthetic food and meat colourants has raised concerns due to their potential health risks, including cytotoxicity and chronic diseases (Khan *et al*., 2021). Additionally, their production often involves non-renewable resources, raising environmental sustainability questions (Martins *et al*., 2022). Natural colourants, apart from their colour-enhancing properties, often exhibit antioxidative, antimicrobial, and anti-inflammatory properties, enhancing their appeal in functional food applications (Dutta *et al*., 2022). A comparative analysis of these colourants is essential to evaluate their nutritional and safety profiles, considering the widespread adoption of such additives across global food industries.

Despite their benefits, natural colourants face challenges related to production scalability, stability under processing conditions, and cost implications (Shi *et al*., 2020). Limited research comparing the comprehensive nutritional and safety profiles of natural and synthetic food colourants poses a challenge to informed decision-making for consumers and industry stakeholders (Hazarika and Kalita, 2021). Addressing this gap can facilitate the identification of safer and nutritionally superior alternatives.

A comparative analysis of natural and synthetic colourants is essential to determine their impacts on food quality, safety, and human health (Pal *et al*., 2022). Understanding the nutritional attributes of natural colourants relative to their synthetic counterparts can encourage the use of safer and healthier alternatives in the food industry (Sharma *et al*., 2023). Moreover, addressing the limitations of natural colourants can pave the way for innovations in food technology, supporting the development of sustainable and health-promoting food products (Li *et al*., 2021). This

study aligns with global goals of promoting food safety, consumer health, and environmental sustainability. Therefore, this study aims to evaluate and compare the nutritional profiles and safety implications of selected natural and synthetic food and meat colourants.

## MATERIALS AND METHODS

### Experimental Area

The research was conducted at Animal Products and Processing Laboratory of the Department of Animal Science, Ahmadu Bello University, Zaria, Kaduna-State. The laboratory is located on 11°.16"N, longitude 07°.63"E (Google map). The area is characterized with a relative humidity of 36% in dry season and 78.5% for wet season as stated by Institute for Agricultural Research (IAR Meteorological Station, 2024).

### Experimental Samples

The natural colourant utilized in this study was curcumin from turmeric (*Curcuma longa*). The turmeric was purchased from Samaru market, it was washed, air dry and processed into powdered form. The synthetic colourant used was Sudan dye (locally referred to as *Ja'wa*), a non-food-grade synthetic dye known for its intense color. This was procured from a recognized chemical supplier under controlled conditions for research purposes at Samaru market and twelve (12) kg of broiler meat was bought from Animal product laboratory of Animal Science Department, Ahmadu Bello University, Zaria. A completely randomized design (CRD) was used.

### Proximate Composition Analysis of Colourants

Samples of natural, synthetic colourants, and processed broiler chicken meat were subjected to proximate analysis following standard procedures by the Association of Official Analytical Chemists (AOAC, 2019).

### Data Analysis

Data collected from proximate analyses were subjected to one-way ANOVA using SPSS software (version 22.0). Significant differences between treatment means were separated using Duncan's Multiple Range Test at a significance level of $p<0.05$.

## RESULTS AND DISCUSSION

Table 1 shows the proximate composition analysis of natural and synthetic food and meat colourant. It reveals key differences between the natural and synthetic colourants, highlighting their nutritional and functional potentials. Significant differences ($P < 0.05$) are observed in ash content, with Turmeric exhibiting the highest mineral concentration, reflecting its potential as a mineral-dense colourant, consistent with earlier findings by Singh *et al*. (2020). Similarly, the ether extract (fat content) is highest in *Ja'wa* (Sudan dye), marking it as the most fat-dense among the colourants. Crude protein and carbohydrates content are significantly higher in Turmeric, indicating its superiority as a protein-rich and energy source option, as corroborated by Oladipo and Adekanmi (2019), who reported similar results for turmeric-based products. *Ja'wa* shows the highest crude fiber and ether extract content, suggesting its applicability in formulations requiring higher fiber, emphasizing its suitability for energy-oriented applications. These findings collectively suggest that natural colourants, particularly Turmeric, offer superior nutritional advantages over synthetic options like *Ja'wa*. Conversely, the elevated ether extract and crude fiber in *Ja'wa* could raise concerns about its potential use, aligning with concerns reported in the literature regarding the safety and health implications of Sudan dye (Bello *et al*., 2021).

**Table 1: Proximate composition of the colourants (Turmeric and *Ja'wa* powder)**

| Parameters (%) | Turmeric | *Ja'wa* | P value |
|---|---|---|---|
| Dry Matter | 93.69±0.01 | 93.83±1.10 | 0.10 |
| Ash | 2.84±0.02 | 1.28±0.02 | 0.01 |
| Ether Extract | 6.84±0.02 | 13.76±0.07 | 0.01 |
| Crude Protein | 9.39±0.01 | 4.12±0.02 | 0.01 |
| Crude Fibre | 4.62±0.02 | 12.41±0.03 | 0.01 |
| Carbohydrates | 70.01±10.02 | 60.29±5.85 | 0.01 |

The inclusion of colourants, significantly affects the proximate composition of their meat (Table 2), highlighting nutritional and functional impacts. Broilers meat with Turmeric powder demonstrated the highest dry matter (92.50%) and crude protein (50.79%), indicating improved moisture retention and protein synthesis, which align with enhanced meat quality. These findings are consistent with Shahidi *et al*. (2020), who noted Turmeric's role in protein stability. Broilers meat cured with *Ja'wa* powder exhibited the highest ether extract (6.79%), suggesting

increased fat deposition, which may enhance flavor but contrasts with consumer demand for leaner meat (Rahman *et al*., 2021). There were no differences in ash content among treatments, implying stable mineral composition irrespective of colorant type. Nitrogen-free extract (NFE) was highest in the control group, with lower values in Turmeric cured with broiler meat, possibly indicating altered glycogen storage or metabolism, as suggested by Kumar *et al*. (2019), who reported similar effects with phytochemicals on muscle carbohydrate dynamics. The lack of crude fiber across groups was anticipated, as muscle tissues naturally lack fiber content. Collectively, these results suggest that Turmeric is a promising dietary supplement for improving protein and overall meat quality, while *Ja'wa* high-fat deposition could influence flavour but might be less suitable for consumers seeking lean options.

**Table 2: Effect of colourant on the proximate composition of broiler chicken meat**

| Parameters (%) | Control | Turmeric | *Ja'wa* | SEM | P-value |
|---|---|---|---|---|---|
| **Dry Matter** | 92.00[b] | 92.50[a] | 91.39[b] | 0.22 | 0.04 |
| **Crude Protein** | 45.70[b] | 50.79[a] | 46.20[b] | 2.47 | 0.01 |
| **Ether Extract** | 4.10[c] | 5.10[b] | 6.79[a] | 1.25 | |
| **Ash** | 5.83 | 5.88 | 4.98 | 0.62 | 0.12 |
| **Nitrogen Free Extract** | 44.37[a] | 38.23[c] | 42.03[b] | 2.72 | 0.01 |

[abc] means on the same row with different superscripts are significantly (P<0.05) different

## CONCLUSION

The study revealed that inclusion of turmeric powder enhances the nutritional quality of broiler chicken meat by increasing it crude protein content and improving dry matter retention, making it a superior natural colourant choice. In contrast, the synthetic colorant *Ja'wa* significantly raises fat deposition, which may appeal to specific culinary preferences but raises concerns for health-conscious consumers. Hence, turmeric powder can be used both as natural colourant and quality enhancer in meat products.

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