

Sensory Evaluation of Meat of Broiler Poultry Birds Fed with Tomato-supplemented Feed

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Abstract

Tomato is often used as a convenient feed alternative because of its high protein, mineral and vitamin content and also because of its relative low cost. With a steady increase in the demand for poultry products in Nigeria due to increase in population, urbanization, export drive and improved standard of living, it is important that serious attention with regard to the quality of chicken meat available to the Nigeria population be paid. The higher demand for poultry meat has necessitated the need for higher production, and with tomato as a more financially viable alternative in feedstuff for chickens with no adverse effect, there is need to test the general acceptability of broiler chicken meat produced through the replacement in diets of tomato as feed ingredients. This study aims to assess the effect of the use of alternate feeding material (tomato) on the sensory attribute of poultry meat. The experiment was carried out in Babcock University, Ilishan-Remo Ogun State, Nigeria using nine (9) different varieties of tomatoes: dried and blended together to make dried tomato powder. One hundred and fifty (150) broiler chickens were allocated into five (5) feeding groups of 30 birds each. Tomato powder was used as a replacement for premix in the following variations Diet A (40%tomato, 60% premix), Diet B (60% tomato, 40% premix), Diet C (80% tomato, 20% premix) and Diet D (100% tomato, 0% premix). There were significant ($p>0.05$) differences in colour, texture, taste and odour of broiler meat.

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The overall acceptability showed significant ($p < 0.05$) differences, with diet C having the highest value which might be attributed to the lycopene and other bioactive components in the tomato powder. Findings revealed that the texture of the meat was the most significantly affected followed by taste and colour, indicating that tomato as alternate feedstuff material may produce more palatable poultry meat with increased texture, richer colour and improved taste.

Keywords: Tomato; dried tomato pomace; sensory evaluation; poultry; broiler.

1. Introduction

In recent times, worldwide animal feed industry has been experiencing scarcity and high cost of feed ingredients, also current trends show an increasing demand for vegetable protein and energy sources. The amount of the available feed ingredients is hardly enough to feed the rapidly growing population and this has created an increase in the need for use of alternative materials to fill this lacuna. Industrial processing of farm fresh produce destined to animal and human feeding has been responsible for high production of residues, which has nutritional potential to be used to formulate diets for monogastrics [6]. Industrial processing of tomato produces a large amount of by products at various stages. These residues represent one of the most important and promising energy and protein rich sources [10]. From processing most fruits and vegetables, the production of likely by products is estimated to be approximately 30% of the processed material [3], when tomatoes are processed into products, 10% to 30% of their weight becomes waste or “pomace” [8].

Tomato pomace is a mixture of tomato peels, cores culls, pulp, crushed seeds and unprocessed green tomatoes that remain after the processing of tomato for juice, paste, puree, soups and ketchup, by the processing companies. This by-product, after being dried, contains up to 22.1% to 22.4% protein, 14.5% to 15.7% fat and 20.8% to 30.5% fiber and a good source of A, B1 & B2 vitamins & also essential (and non-essential) amino acids [7,14] and this can be used as a convenient feed alternative because of its high protein content & low cost [8].

With a steady increase in the demand for poultry products in Nigeria due to increase in population, urbanization, export drive and improved standard of living, it is important that a serious attention with regard to the quality of chicken meat available to the Nigeria population be paid [1,13,2]. The increase in demand for poultry meat has necessitated the need for higher production, and with tomato as a financially cheaper alternative feedstuff for chickens that has no adverse effect [9,4,10,15] there is need to test the general acceptability of broiler chicken meat produced through the treatment of diets of tomato replacements, it is in light of these facts that this study was carried out to assess the effect of the alternate tomato feeding on the sensory attribute of poultry meat.

2. Materials and method

The experiment was carried out at the Poultry and Livestock unit of the Teaching and Research farm, Babcock University, Ilishan-Remo Ogun State, Nigeria. Babcock University is located in the rain forest vegetation zone of Nigeria with an average annual rainfall of 1500mm and altitude of about 300 meters above sea level; while the mean annual temperature is about 27°C.

Nine varieties of tomato were selected for this study: Roma VF, UC 82-B, Rio Grande, Tropimech, yellow pear, Roma Savannah, Rio Fuego, Beefsteak and Hausa Local; they were assessed for nutritional content. The varieties were left to air dry under the shade for 2 weeks and blended together to make dried tomato powder expectedly to be fed to the poultry birds.

While adopting the method used by [2] 150 broiler chickens were randomly allocated into five (5) feeding groups of 10 birds replicated three times, with a total of 30 broiler birds in each treatment replacement levels: control, Diet A (40% tomato, 60% premix), Diet B (60% tomato, 40% premix), Diet C (80% tomato, 20% premix) and Diet D (100% tomato, 0% premix). After 9 weeks of feeding, the birds were sacrificed and cooked in a similar way.

Sensory evaluation was done using a 7-point hedonic scale ranking rated on a seven-point sensory evaluation scale (1=dislike very much, 2=dislike moderately, 3=dislike slightly, 4=neither like nor dislike, 5=like slightly, 6=like moderately, 7=like very much) by ten (10) randomly selected experienced panellists. Bite portion of broiler meat samples weighing 10g from each diet was served at room temperature, with a bottle of water to the panelists. Results from the hedonic scale of ranking were collected on the following: colour, texture, odour, taste, Overall choice and acceptability.

Data collected were analyzed using Statistical Package for the Social Sciences (SPSS) employing the method outlined by [12]. Treatment means that are statistically different were separated by Duncan’s Multiple Range Test (DMRT) at 5% level of significance.

3. Results and discussion

Tomato varieties had an average Vitamin C content of 14.24 mg/100g, β-Carotene content at 440.67 µg/100g, Lycopene content of 2.699 mg/100g, B3 content of 0.80 mg/100g and a 2.94% sugar content (Table 1).

Table 1: Nutritional content of selected tomato varieties

SAMPLE	VIT.C (mg/100g)	β-Carotene (µg/100g)	LYCOPENE (mg/100g)	B3 (mg/100g)	SUGAR %
ROMA VF	14.02	439.96	2.666	0.71	2.83
U C 82-B	13.79	441.23	2.703	0.73	2.84
RIO GRANDE	13.85	439.56	2.662	0.75	2.94
TROPIMECH	14.88	438.34	2.698	0.86	2.92
ROMA SAVANAH	14.33	441.91	2.674	0.67	2.93
RIO FUEGO	14.35	441.79	2.739	0.97	3.04
YELLOW PEAR	13.95	439.93	2.651	0.73	2.69
BEEFSTEAK	14.44	441.88	2.754	0.93	3.05
HAUSA LOCAL	14.11	440.32	2.687	0.76	2.92
Mean	14.24	440.67	2.699	0.80	2.94
SEM	0.14	0.53	0.01	0.04	0.03

Findings from the hedonic scale instrument revealed that the colour assessment ranged from 5.94 to 6.77 with the poultry meat of birds fed with Diet D(100% tomato 0% premix) having a significant higher value (6.77) compared to the control Diet which had the least significant value (5.94), this is an indication of significant

increase in colour saturation of the poultry meat with increased inclusion of tomato in diet, this conforms with the study conducted by [11] where the increased Lycopene content in tomato increased the darkness and the contribution of redness, which led to an increase in colour saturation and hue values of the evaluated samples, improving the colour parameters on the external surface and along the cross-section of processed meat. Likewise, birds fed with Diet D (100% tomato 0% pre-mix) had the significantly higher value of texture while the control diet had the least value recorded.

Findings showed significant differences in the odour and taste assessment, with data revealing increased value with increased tomato inclusion in diet, however, bird fed with 80% replacement had a higher significant value compared to birds fed with 100% replacement of tomato in diet, indicating an increase in the tomato replacement above 80% may negatively affect taste of broiler bird meat, this finding was supported by [11] where it was concluded that the specific flavour of tomatoes deteriorated the sensory attributes of the final products (Table 2).

Table 2: Sensory values of tomato inclusion of chicken

	Control Diet	Diet A (40% T, 60% P)	Diet B (60% T, 40% P)	Diet C (80% T, 20% P)	Diet D (100% T, 0% P)	SEM
Colour	5.94 ^c	6.53 ^b	6.18 ^b	6.59 ^b	6.77 ^a	0.059
Texture	5.53 ^b	6.35 ^a	6.06 ^{ab}	6.47 ^a	6.65 ^a	0.069
Odour	6.29 ^c	6.82 ^{ab}	6.35 ^{bc}	6.94 ^a	6.77 ^{ab}	0.056
Taste	5.94 ^c	6.47 ^b	6.12 ^b	6.82 ^a	6.41 ^b	0.060
Overall Acceptability	6.35 ^c	6.65 ^b	6.35 ^c	6.82 ^a	6.71 ^{ab}	0.059

a, b, c: Means on the same row with the same superscript are not significantly different (P>0.05). T = tomato, P = pre-mix

SEM=Standard Error of Mean

The overall assessment documented a range of 6.24 to 6.76 with the Diet D (80% tomato, 20% pre-mix) recording the significantly higher overall value while the control sample and Diet B (60% tomato 40% pre-mix) had significant lower value. Acceptability of the broiler chickens ranged from 6.35 to 6.82 with Sample D (80% tomato 20% pre-mix) also recording a significantly higher value than the other Diet categories while there were no significant difference in the acceptability level of the control diet and Diet B (60% inclusion)

4. Conclusion

The effects of tomato-supplemented feeding on the sensory attribute of poultry meat had statistically significant improvement on overall meat acceptability by 4.5% to 6.89%. Tomato based diets significantly increased the colour of the meat by 12.25%, texture by 16.84%, odour by 9.37% and taste by 12.9%. Findings also revealed

that the texture of the meat was the most affected, followed by taste and colour respectively: indicating that tomato as alternate feedstuff produce more palatable poultry meat with increased texture, richer colour and improved taste. However, there is need for further studies on overall consumer acceptability of the tomato-included feedstuff.

5. Recommendation

It is recommended that tomato can be included in the diets of broiler birds as a supplement to improve poultry meat texture, colour and to improved taste of poultry meat for human consumption.

References

- [1] Abdullah, A. Y.; Obeidat, B. S.; Muwalla, M. M.; Matarneh, S. K.; Ishmais, M. A. A., 2011. Growth performance, carcass and meat characteristics of black goat kids fed sesame hulls and *Prosopis juliflora* pods. Asian-Aust. J. Anim. Sci., 24 (9): 1217-1226
- [2] Chioma, G. O., Akinsoyinu, A. O., Tayo, G. O., Abdullah, A. O., Nwangburuka, C. C. and Akinboye, O. E. Phytochemical Components And Sensory Evaluation Of Broilers Fed Cymbopogon Citratus Leaf Meal (Lm) As An Alternative To Mycotoxin Binder. International Journal of Agriculture and Environmental Research. 3(5): 1-7(2017).
- [3] De las Fuentes, L., Sanders, B., Lorenzo, A., Alber, S. AWARENET: Agro-Food Wastes Minimisation and Reduction Network. In Total Food Exploiting Co-Products—Minimizing Waste.-Workshop Report; Total Food Exploiting co-products—Minimizing waste; Proceedings Volume; Waldron, K.W., Faulds, C.B., Smith, A.C., Eds.; Institute of Food Research: Norwich, UK, 233–244. (2004).
- [4] Dotas, D., Zamanidis, S. & Balios, j. Effect of dried tomato pulp on the performance and egg traits of laying hens. Br. Poult. Sci. 40, 695–697. (1999).
- [5] Ezekiel, C. N., Nwangburuka, C. C., Ajibade, O. A. & Odebode, A. C. Genetic diversity in 14 tomato (*Lycopersicon esculentum* Mill.) varieties in Nigerian markets by RAPD-PCR technique. African Journal of Biotechnology 10(25): 4961-4967(2011).
- [6] Ezequiel, J. M. B. ; Cruz e Silva, O. G. da ; Galati, R. L. ; Watanabe, P. H. ; Biagioli, B. ; Faturi, C., Effects of partial replacement of ground corn with soyabean hulls or maize germ meal on production of Nelore steers. Rev. Bras. Zootec., 35 (2): 569-575 (2006)
- [7] Fallahi, M. Tomato alteration industry (tomato paste),” Barsava edition, Tehran (1996).
- [8] King, A. J. & Zeidler, G. Tomato pomace may be a good source of vitamin E in broiler diets, Calif. Agric. 58(1): 59-62 (2004).
- [9] Persia, M.E. ; Parsons, C.M. ; Schang, M. ; Azcona, J., 2003. Nutritional evaluation of dried tomato seeds. Poult. Sci., 82 (1): 141-146
- [10] Salajegheh, M. H., Ghazi, S., Mahdavi, R. & Mozafari, O. Effects of different levels of dried tomato pomace on performance, egg quality and serum metabolites of laying hens. African Journal of Biotechnology, 11(87), 15373-15379 (2012).
- [11] Skiepkko, N., Chwastowska-Siwiecka, I., Kondratowicz, J. & Mikulski, D. The Effect of Lycopene Addition on the Chemical Composition, Sensory Attributes and Physicochemical Properties of

- Steamed and Grilled Turkey Breast. *Brazilian Journal of Poultry Science*. 18(2): 319-330 (2015).
- [12] Steel, R. G. D., and J. H. Torrie. *Principles and procedures of statistics. A biometrical approach*. 2nd ed. McGraw-Hill, New York. (1980).
- [13] Steinfeld, H., 2003. Economic constraints on production and consumption of animal source foods for nutrition in developing countries. *J. Nutr.*, 133: 4054S-4061S.
- [14] Tgengi, A. Use of wastage produced in tomato productions plant as a source of oil. master project of agricultural engineering (nutritional industry), faculty of agriculture, Tehran University. (1995).
- [15] Yitbarek, M. B. The effect of feeding different levels of dried tomato pomace on the performance of Rhode Island Red (RIR) grower chicks. *International Journal of Livestock Production* Vol. 4(3), 35-41 (2013).