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Improving meat quality in SASSO chickens: A study of forage crop and fermented plant juice

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Abstract

Ethical and sustainable practices on rearing free-range chicken not only provide healthful benefits but also satisfaction with meat flavor. Thus, this study evaluated the impact of different forage crops and supplementation of Fermented Mix Plant Juice on the meat quality of SASSO chicken. A total of 144 day-old chicks were randomly assigned to a split-plot design, with four forage crop treatments (control/ no forage, *Arachis pintoi*, *Paspalum conjugatum*, and a mixture of *A. pintoi* and *P. conjugatum*) as the main plot and four FMPJ supplementation levels (control/synthetic, 5 mL, 10 mL, and 15 mL) as the subplot. After 60 days of rearing, chicken meat quality was evaluated through a sensory evaluation by trained panelists, assessing key attributes like color, odor, texture, tenderness, juiciness, and overall acceptability. *P. conjugatum* (A3) and *A. pintoi* (A2) have highly significant effects ($P<0.01$) producing more desirable meat color, odor, juiciness, and overall acceptability. Supplementation of FMPJ has a highly significant effect ($P<0.01$) on meat texture and a significant effect ($P<0.05$) on odor and overall acceptability. Highly significant interaction effects ($P<0.01$) were observed when forage was combined with appropriate FMPJ supplementation levels, particularly in meat odor, texture, tenderness, juiciness, and overall acceptability.

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Introduction

In today's food landscape, consumers are increasingly discerning, demanding not only quality and safety but also ethical and sustainable practices from the producers they support. This shift in consumer consciousness is particularly evident in the poultry industry, where free-range and organic options are gaining popularity. Driven by a desire for healthier, more humane, and environmentally responsible food choices, consumers are actively seeking out products that align with their values.

This includes finding alternative protein sources that are both cost-effective and environmentally friendly. Forages and forage meals, readily available and often inexpensive, present a compelling opportunity to meet these demands (Tufarelli *et al.,* 2018). Among the readily available forages plenty in Camiguin Island, Northern Mindanao, Philippines are *Arachis pintoi* and *Paspalum conjugatum.*

A. pintoi is commonly known as pinto or forage peanut, is used mainly in grass pastures and as a cover plant (de Sousa *et al.,* 2024). It is a potential feed supplement for farm animals due to its high protein content Ampode *et al.* (2020) and rich in high-quality nutrients (Song *et al.*, 2023).

P. conjugatum is a perennial grass, commonly known as Carabao grass, Buffalo grass, T-grass, Sourgrass, Cowgrass and belongs to family Poaceae. Fresh grass is used for pastures and cut and-carry system. It has been known to have phytochemicals that kill microorganisms (Gupta and Ranjan 2020). It is rich in active constituents, including flavonoids and steroids. Flavonoids, a type of polyphenolic compound, exhibit antimicrobial, antioxidant, and anti-inflammatory properties. These compounds have been shown to promote animal growth and development, enhance the quality of animal products, and modify rumen fermentation conditions. Furthermore, flavonoids can reduce chronic inflammation in animals, contributing to improved animal health, well-being, and overall production. The phytochemical analysis that was conducted on *Paspalum conjugatum* revealed the presence of specific bioactive compounds including tannin, coumarin, and alkaloids (Lorenzo *et al.*, 2024).

Moreover, Fermented plant product such as FMPJ is a kind of functional complex containing probiotics and a variety of bioactive substances, which have multiple physiological functions (Tian *et al.,* 2022). Fermented Fruit or vegetable products are part of various diets worldwide. Fermentation processes transform complex carbohydrates, reducing sugar content and anti-nutritional compounds while generating valuable molecules like bioactive peptides, short-chain fatty acids, and polysaccharides. These transformations enhance the bioaccessibility and bioavailability of food components, leading to improved health-related properties through prebiotic and/or probiotic effects (Septembre-Malaterre *et al.,* 2018). The study utilized moringa, banana stalk, and ginger as nutritious substrates for Fermented Mix Plant Juice as supplement.

This study delves into the potential of innovative farming practices to meet these growing demands, investigating the impact of different forage crops and Fermented Mix Plant Juice (FMPJ) supplementation on the meat quality of free-range SASSO chickens. By exploring the interplay between ethical production methods and desirable flavor profiles, this research aims to contribute to a more sustainable and satisfying poultry industry, one that caters to both consumer values and culinary preferences.

Materials and methods

To ensure adherence to ethical guidelines, the researcher secured a permit from the Institutional Animal Care and Use Committee (IACUC) prior to commencing the study.

Dressing procedure

Chicken dressing requires a sharp knife, a flat surface, hot water, a polythene bag for feathers, and hand gloves for protection. After bleeding the chicken by severing the jugular vein, the bird is scalded, plucked, and soaked in hot water. Once feather-free, the carcass is eviscerated. To remove scales and hard skin from the legs and feet, they are immersed in hot water and squeezed while still hot, allowing for easy peeling. This process must be done immediately, as the skin becomes more difficult to remove once it cools. The entrails, including intestines, proventriculus, gizzards, and giblets, are then cleaned, with the hard coverings of the gizzard and proventriculus removed.

Handling of carcass

On the 60th day of rearing, birds underwent fasting by depriving them of feeds for 12 hours before dressing for carcass yield measurements. Two birds with a similar weight to the average weight per replication were taken for this part of the study. At the time of dressing, the fasted body weight of each bird was recorded before being terminated by exsanguination. Birds were bled for approximately two minutes, scalded at 60°C for about 1 minute and 30 seconds, and were machine de-feathered.

Meat quality evaluation

For the evaluation of meat quality, the breast parts of the birds were oven-cooked for 1 and a half hours at 200°C or 395°F and placed on coded plates for the evaluation of odor, taste, juices, texture, and tenderness. Meat quality was evaluated through a descriptive rating scale by trained panelists from the Food Technology experts.

Data for meat color, odor, texture, taste, tenderness, juiciness, and overall acceptability were gathered and evaluated using a standardized hedonic rating scale. Sliced samples of the oven-roasted breast part of the birds were placed in the coded plates for evaluation through the rating scale below (Table 1)

Table 1. Rating scale

Parameters	Scale	Description	
Color	4.51 – 5.50	Extremely desirable chicken meat color	
	3.51 – 4.50	Moderately desirable chicken meat color	
	2.51 – 3.50	Just normal chicken meat color	
	1.51 – 2.50	Slightly undesirable chicken meat color	
	0.51 – 1.50	Extremely undesirable chicken meat color	
Odor	4.51 – 5.50	Extremely desirable chicken meat odor	
	3.51 – 4.50	Moderately desirable chicken meat odor	
	2.51 – 3.50	Just normal chicken meat odor	
	1.51 – 2.50	Slightly undesirable chicken meat odor	
	0.51 – 1.50	Extremely undesirable chicken meat odor	
Texture	4.51 – 5.50	Very mashy	
	3.51 – 4.50	Very loose fibers	
	2.51 – 3.50	Just loose fibers	
	1.51 – 2.50	Slightly loose fibers	
	0.51 – 1.50	Extremely intact fibers, rigid, tough	
Taste	4.51 – 5.50	Extremely desirable chicken meat taste	
	3.51 – 4.50	Moderately desirable chicken meat taste	
	2.51 – 3.50	Just normal chicken meat taste	
	1.51 – 2.50	Slightly undesirable chicken meat taste	
	0.51 – 1.50	Extremely undesirable chicken meat taste	
Tenderness	Scale	Description	Number of chews
	4.51 – 5.50	Very tender	1 - 5
	3.51 – 4.50	Tender	6 - 10
	2.51 – 3.50	Just tender	11 - 15
	1.51 – 2.50	Tough	16 - 20
	0.51 – 1.50	Very tough	21 – 25
Juiciness	4.51 – 5.50	Extremely juicy	
	3.51 – 4.50	Moderately juicy	
	2.51 – 3.50	Just juicy	
	1.51 – 2.50	Slightly juicy	
	0.51 – 1.50	Extremely juicy	
Over-all acceptability	4.51 – 5.50	Extremely acceptable chicken meat	
	3.51 – 4.50	Moderately acceptable chicken meat	
	2.51 – 3.50	Just normal acceptable chicken meat	
	1.51 – 2.50	Slightly unacceptable chicken meat	
	0.51 – 1.50	Extremely unacceptable chicken meat	

The gathered data were organized, tabulated, and statistically analyzed using the variance analysis of Split-Plot in a Completely Randomized Design. The Least Significant Different Test (LSD) was used to compare observed significant treatment means.

Results

Meat color

Table 2, presents the color rating and desirability of SASSO chicken with different forages and varying levels of fermented plant juice supplementation. Statistically, the highest means ($P<0.01$) were obtained from (no forage crop/control), (*A. pintoi*), and (*P. conjugatum*) all have color ratings of around 4.7-4.8 and are classified as Extremely Desirable Color (EDC). However, (*A. pintoi* × *P. conjugatum*) has a lower color rating of 4.47 and is classified as a Moderately Desirable Color (MDC).

Table 2a presents the interaction effect on the mean meat color of SASSO chickens. The results suggest that the type of forage used has a significant impact on the color rating and desirability of SASSO chicken feed, with Pintoi x Carabao grass showing slightly lower desirability. In contrast, the supplementation levels did not have a significant effect on color rating. Most combinations resulted in Extremely Desirable Colors, except for a few instances classified as Moderately Desirable Colors.

Table 2. Meat color, odor, and texture of SASSO chicken feed with different forages supplemented with varying levels of fermented plant juice

Particulars	Color rating	DR	Odor rating	DR	Texture rating	DR
Main Plot (A)	4.83^{a}	EDC	4.47^{ab}	MDO	4.60^{a}	VM
No forage crop (A1)						
A. pintoi (A2)	4.78^{a}	EDC	4.35^{b}	MDO	4.30^{bc}	VLF
P. conjugatum (A3)	4.73^{a}	EDC	4.55^{a}	EDO	4.48^{ab}	VLF
A.pintoi × *P. conjugatum* (A4)	4.47^{b}	MDC	4.50^{ab}	MDO	4.10^{c}	VM
F-test	**		**		**	
CV(a)%	3.88		2.04		3.30	
Sub plot (B)Synthetic (B1)	4.75	EDC	4.50^{a}	MDO	4.38^{a}	VLF
5mL FMPJ (B2)	4.70	EDC	4.47^{a}	MDO	4.22^{b}	VLF
10mL FMPJ (B3)	4.65	EDC	4.40^{b}	MDO	4.47^{a}	VLF
15mL FMPJ (B4)	4.72	EDC	4.50^{a}	MDO	4.42^{a}	VLF
F-test	ns		*		**	
CV(b)%	2.83		2.74		2.83	
T1 = A1B1	4.80	EDC	4.47	MDO	4.67	VM
T2 = A1B2	4.93	EDC	4.60	EDO	4.60	VM
T3 = A1B3	4.67	EDC	4.20	MDO	4.53	VM
T4 = A1B4	4.93	EDC	4.60	EDO	4.60	VM
T5 = A2B1	5.00	EDC	4.53	4.40	4.47	VLF
T6 = A2B2	4.60	EDC	4.27	MDO	4.27	VLF
T7 = A2B3	4.73	EDC	4.13	MDO	4.33	VLF
T8 = A2B4	4.80	EDC	4.47	MDO	4.13	VLF
T9 = A3B1	4.87	EDC	4.40	MDO	4.27	VLF
T10 = A3B2	4.67	EDC	4.53	EDO	4.27	VLF
T11 = A3B3	4.80	EDC	4.80	EDO	5.00	VM
T12 = A3B4	4.60	EDC	4.47	MDO	4.40	VLF
T13 = A4B1	4.33	MDC	4.60	EDO	4.13	VLF
T14 = A4B2	4.60	EDC	4.47	MDO	3.73	VLF
T15 = A4 B3	4.40	MDC	4.47	MDO	4.00	VLF
T16 = A4B4	4.53	EDC	4.47	MDO	4.53	VM
F-test	*		**		**	

ns-Not significant, *- Significant, **- Highly significant

Means followed by the same letter(s) are not significantly different at 5% level of significance based on LSD.

EDC- Extremely Desirable Color, MDC- Moderately Desirable Color, EDO – Extremely Desirable Odor, MDO – Moderately Desirable Odor, VM – Very Mashy, VLF – Very Loose fibers, Factor A = the type of forage crop, Factor B = the level of supplementation of FMPJ

Table 2a. Interaction of forage crop (main plot) and supplementation (subplot) on the meat color of SASSO feed with different forages supplemented with varying levels of fermented plant juice

Treatment	Supplementation of FMPJ				
	Synthetic	5mL FMPJ	10mL FMPJ	15mL FMPJ	MEAN
No Forage	4.80 abyx	4.93 ayx	4.67 abyx	4.93 ayx	4.83
Pintoi peanut	5.00 ayx	4.60 byx	4.73 abyx	4.80 abyx	4.78
Carabao grass	4.87 ayx	4.67 abyx	4.80 abyx	4.60 abyx	4.74
Pintoi ×Carabao Grass	4.33 bcyx	4.60 byx	4.40 byx	4.53 byx	4.47
MEAN	4.75	4.70	4.65	4.72	4.71

Treatment means within each column followed by a common letter (a to c) and within the row (x to y) are not significantly different at 0.05 level of probability (LSD) test.

Table 2b. Interaction of forage crop (main plot) and supplementation (subplot) on the meat odor of SASSO chicken feed with different forages supplemented with varying levels of fermented plant juice

Treatment	Supplementation of FMPJ				
	Synthetic	5mL FMPJ	10mL FMPJ	15mL FMPJ	MEAN
No Forage	4.47abyx	4.60 ayx	4.20 bcyx	4.60	4.47
Pintoi peanut	4.53 aby	4.27 by	4.13cyx	4.47	4.35
Carabao grass	4.40 by	4.53 ay	4.80 ayx	4.47	4.55
Pintoi x Carabao Grass	4.60ay	4.47ay	4.47abyx	4.74	4.57
MEAN	4.50	4.47	4.40	4.57	4.48

Treatment means within each column followed by a common letter (a to c) and within the row (x to y) are not significantly different at 0.01 level of probability (LSD) test.

Table 2c. Interaction of forage crop (main plot) and supplementation (subplot) on the meat texture of SASSO chicken feed with different forages supplemented with varying levels of fermented plant juice

Treatment	Supplementation of FMPJ				
	Synthetic	5mL FMPJ	10mL FMPJ	15mL FMPJ	MEAN
No Forage	4.67 ay	4.60 ay	4.53 by	4.60 ay	4.60
Pintoi peanut	4.47 abyx	4.27 abyx	4.33 abyx	4.13 byx	4.35
Carabao grass	4.27 bcyx	4.27 byx	5.00 ayx	4.40 abyx	4.48
Pintoi x Carabao Grass	4.13 bcyx	3.73 cyx	4.00 bcyx	4.53 ayx	4.10
MEAN	4.44	4.22	4.46	4.42	4.38

Treatment means within each column followed by a common letter (a to c) and within the row (x to y) are not significantly different at 0.01 level of probability (LSD) test.

Meat odor

For the main plot, birds fed with (*P. conjugatum*) as a forage crop have the highest odor rating of 4.55, classified as Extremely Desirable Odor (EDO). Those in (*A.pintoi* × *P. conjugatum*) are rated at 4.50, classified as Moderately Desirable Odor (MDO). However, free-range birds in (*A. pintoi*) have a lower odor rating of 4.35, also classified as MDO. Moreover, those in control A1 (no forage crop) have an odor rating of 4.47, classified as MDO. Analysis of variance reveals a highly significant effect ($P<0.01$) among treatment means.

A significant result ($P<0.05$) is observed in the odor rating of supplementation level (sub plot) (synthetic) and (15mL FMPJ) have the highest odor ratings of 4.50, both classified as MDO. Those supplemented with 5mL FMPJ have an odor rating of 4.47, also classified as MDO. In terms of the interaction effects, a highly significant effect ($P<0.01$) is noticed. Different combinations of forage type and supplementation level result in varying odor ratings, classified as MDO or EDO. Some combinations show significant differences in odor ratings, highlighting the impact of the interaction effect (Table 2b).

Meat texture

Meat fed with *P. conjugatum* has a texture rating of 4.48, classified as Very Loose Fibers (VLF). Control/no forage crop has the highest texture rating of 4.60, classified as Very Mashy (VM). *A. pintoi* has a texture rating of 4.30, classified as VLF. And birds that are free-range in (*A. pintoi* × *P. conjugatum*) have the lowest texture rating of 4.10, classified as VM. Supplementation of 10mL FMPJ has the highest texture rating of 4.47, classified as VLF Synthetic and 15mL FMPJ both have texture ratings of 4.38 and 4.42, respectively, both classified as VM. Chickens that are supplemented with 5mL FMPJ have a lower texture rating of 4.22, classified as VLF.

Table 2c presents the interaction effect of different forage types on the mean meat texture of SASSO chickens. Different combinations of forage type and supplementation level result in varying texture ratings, classified as VLF or VM. Some combinations show significant differences in texture ratings, highlighting the impact of the interaction effect. The interaction between forage type and supplementation level plays a crucial role in determining the texture rating of the chicken feed.

Table 3. Meat taste, tenderness, juiciness and overall acceptability) of SASSO feed with different forages supplemented with varying levels of fermented plant juice

Particulars	Meat taste	DR	Tenderness rating	DR	Juiciness	DR	Overall acceptability	DR
Main plot (A)								
No forage crop (A1)	4.38	MDT	4.32	T	4.50^{a}	EJ	4.77^{a}	EA
Pintoi peanut (A2)	4.27	MDT	4.42	T	4.68^{a}	EJ	4.70^{a}	EA
Carabao grass (A3)	4.43	MDT	4.42	T	4.63^{a}	EJ	4.70^{a}	EA
Pintoi × Carabao grass (A4)	4.25	MDT	4.40	T	4.22^{b}	MJ	4.50^{b}	MA
F-test	ns		ns		**		**	
CV(a)%	4.90		4.56		3.84		3.09	
Sub plot (B)								
Synthetic (B1)	4.35	MDT	4.38	T	4.72^{a}	EJ	4.70^{a}	EA
5mL FMPJ (B2)	4.35	MDT	4.40	T	4.52^{bc}	EJ	4.73^{a}	EA
10mL FMPJ (B3)	4.27	MDT	4.37	T	4.37^{bc}	MJ	4.55^{b}	EA
15mL FMPJ (B4)	4.37	MDT	4.40	T	4.43^{bc}	MJ	4.68^{ab}	EA
F-test	ns		ns		**		*	
CV(b)%	4.58		4.43		3.22		3.25	
T1 =A1B1	4.47	MDT	4.20	T	4.80	EJ	4.80	EA
T2 = A1B2	4.40	MDT	4.40	T	4.80	EJ	4.93	EA
T3 = A1B3	4.00	MDT	4.00	T	4.27	MJ	4.73	EA
T4 = A1B4	4.67	EDT	4.67	VT	4.13	MJ	4.60	EA
T5 = A2B1	4.53	EDT	4.80	VT	4.87	EJ	4.87	EA
T6 = A2B2	4.20	MDT	4.40	T	4.67	EJ	4.87	EA
T7 = A2B3	4.27	MDT	4.40	T	4.67	EJ	4.33	MA
T8 = A2B4	4.07	MDT	4.07	T	4.53	EJ	4.73	EA
T9 = A3B1	4.27	MDT	4.27	T	4.53	EJ	4.67	EA
T10 = A3B2	4.60	EDT	4.60	VT	4.47	MJ	4.67	EA
T11 = A3B3	4.53	EDT	4.53	VT	5.00	EJ	4.87	EA
T12 = A3B4	4.33	MDT	4.27	T	4.53	EJ	4.60	EA
T13 = A4B1	4.13	MDT	4.27	T	4.67	EJ	4.47	MA
T14 = A4B2	4.20	MDT	4.20	T	4.13	MJ	4.47	MA
T15 = A4 B3	4.27	MDT	4.53	VT	3.53	MJ	4.27	MA
T16 = A4B4	4.40	MDT	4.60	VT	4.53	EJ	4.80	EA
F-test	*		**		**		**	

ns-Not significant, *- Significant, **- Highly Significant

Means followed by the same letter(s) are not significantly different at 5% level of significance based on LSD test.

MDT- Moderately Desirable Taste, JT – Just Tender, JNT – Just Normal Taste, T – Tender, MJ – Moderately Juicy, MA- Moderately Acceptable, VA- Very Acceptable, Factor A = type of forage crops, Factor B = the varying levels of FMPJ Supplementation

Meat taste

Table 3 presents the meat evaluation rating for taste or flavor. Non- significant finding is observed among treatment means of main plot and sub plot. However, a significant (P<0.05) result is observed in the interaction of factor combinations. For main plot, meat from free-range on *A. pintoi* has a taste rating of 4.43, classified as Moderately Desirable Taste (MDT).

No forage crop/control, *A. pintoi,* and *A. pintoi* × *P. conjugatum* have taste ratings of 4.38, 4.27, and 4.25, respectively, all classified as MDT. In sub plot, synthetic) and 5mL FMPJ have taste ratings of 4.35, both classified as MDT. Those with 10mL FMPJ and 15mL FMPJ have taste ratings of 4.27 and 4.37, respectively, both classified as MDT.

As to the interaction effect, the different combinations of forage type and supplementation level result in varying taste ratings, classified as MDT or Extremely Desirable Taste (EDT). Some combinations show significant differences in taste ratings, highlighting the impact of the interaction effect. The taste ratings of the chicken meat vary slightly across different forage types, with all falling under the Moderately Desirable Taste category. The different levels of FMPJ supplementation do not significantly impact the taste ratings, as all are classified as Moderately Desirable Taste. The interaction effect shows some variations in taste ratings based on the combination of forage type and supplementation level. Table 3a presents the interaction effect of different forage types on the mean meat taste of SASSO chickens raised under a coconut production system, comparing the meat taste at each level of supplementation.

Table 3a. Interaction of forage crop (main plot) and supplementation (subplot) on the meat taste of SASSO chicken feed with different forages supplemented with varying levels of fermented plant juice

Treatment	Supplementation of FMPJ				
	Synthetic	5mL FMPJ	10mL FMPJ	15mL FMPJ	MEAN
No Forage	4.47 abyx	4.40 abyx	4.00 byx	4.67 ayx	4.38
Pintoi peanut	4.53 ayx	4.20 abyx	4.27abyx	4.07 byx	4.27
Carabao grass	4.27 aby	4.60 ay	4.53 ay	4.33 aby	4.43
Pintoi × Carabao Grass	4.13 by	4.20 by	4.27 aby	4.40 aby	4.25
MEAN	4.35	4.35	4.27	4.37	4.33

Treatment means within each column followed by a common letter (a to c) and within the row (x to y) are not significantly different at 0.05 level of probability (LSD) test.

Table 3b. Interaction of forage crop (main plot) and supplementation (subplot) on the meat tenderness of SASSO chicken feed with different forages supplemented with varying levels of fermented plant juice

Treatment	Supplementation of FMPJ				
	Synthetic	5mL FMPJ	10mL FMPJ	15mL FMPJ	MEAN
No Forage	4.20 bcyx	4.40 abyx	4.00 bcyx	4.67ayx	4.32
Pintoi peanut	4.80 ayx	4.40 abyx	4.40 abyx	4.07 bcyx	4.42
Carabao grass	4.27 byx	4.60 ayx	4.53 abyx	4.27 byx	4.42
Pintoi × Carabao Grass	4.27 bcyx	4.20 bcyx	4.53 abyx	4.60 ayx	4.40
MEAN	4.38	4.40	4.36	4.40	4.39

Treatment means within each column followed by a common letter (a to c) and within the row (x to y) are not significantly different at 0.01 level of probability (LSD) test.

Table 3c. Interaction of forage crop (main plot) and supplementation (subplot) on the meat juiciness of SASSO chicken feed with different forages supplemented with varying levels of fermented plant juice

Treatment	Supplementation of FMPJ				
	Synthetic	5mL FMPJ	10mL FMPJ	15mL FMPJ	MEAN
No Forage	4.80 ayx	4.80 ayx	4.27 bcyx	4.13 byx	4.50
Pintoi peanut	4.87 ayx	4.67abyx	4.67 abyx	4.53 abyx	4.68
Carabao grass	4.53 abyx	4.47 byx	5.00 ayx	4.53 abyx	4.63
Pintoi x Carabao Grass	4.67 abyx	4.13 bcyx	3.53 cdyx	4.53 abyx	4.22
MEAN	4.72	4.52	4.37	4.43	4.51

Treatment means within each column followed by a common letter (a to c) and within the row (x to y) are not significantly different at 0.01 level of probability (LSD) test

Meat tenderness

Non-significant results are observed in main plot and sub plot as shown in Table 3. However, a highly significant (P<0.01) result is for that factor combinations. Table 3b showcases the interaction effect of different forage types on the mean meat tenderness of SASSO chickens.

No forage crop/ control shows a fluctuating pattern of meat tenderness with different supplementation levels, with the highest meat tenderness observed at B4. *A. pintoi* forage type shows a decreasing trend in meat tenderness with increasing supplementation levels, except for a slight increase at B3. *P. conjugatum* forage type shows a significant increase in meat tenderness at B2, while other supplementation levels show relatively lower meat tenderness. *A. pintoi* × *P. conjugatum* forage type shows a fluctuating pattern of meat tenderness with different supplementation levels, with the highest meat tenderness observed at B4. Supplementation level of synthetic shows a general trend of decreasing meat tenderness with increasing forage type, with A2 showing the highest meat tenderness. Those with 5mL FMPJ supplementation levels show a similar trend of decreasing meat tenderness with increasing forage type, with A3 showing the highest meat tenderness. 10mL FMPJ supplementation level shows a significant increase in meat tenderness for A3, while other forage types show relatively lower meat tenderness. B4 (15mL FMPJ) supplementation level shows a fluctuating pattern of meat tenderness across different forage types, with A1 showing the highest meat tenderness.

Meat juiciness

A. pintoi and *P. conjugatum* forages have affected meat juiciness ratings of 4.68 and 4.63, respectively, both classified as Extremely Juicy (EJ). Meat under A1 (no forage crop) also has a juiciness rating of 4.50, falling under the Extremely Juicy (EJ) category. While meat that is free-range on A4 (*A. pintoi* × *P. conjugatum*) has a juiciness rating of 4.22, classified as Moderately Juicy (MJ). Statistical analysis revealed a highly significant (P<0.01) difference among treatment means.

Highly significant (P<0.01) effect is observed in juiciness rating by supplementation level (sub plot). Meat supplemented with B1 (synthetic) has a juiciness rating of 4.72, falling under the Extremely Juicy (EJ) category. B2 (5mL FMPJ), B3 (10mL FMPJ), and B4 (15mL FMPJ) have juiciness ratings of 4.52, 4.37, and 4.43, respectively, all classified as Extremely Juicy (EJ) or Moderately Juicy (MJ).

For the interaction Effects (T1 to T16), a highly significant (P<0.01) finding is observed. Different combinations of forage types and FMPJ supplementation levels result in varying juiciness ratings, classified as Extremely Juicy (EJ) or Moderately Juicy (MJ). Some combinations show significant differences in juiciness ratings, highlighting the impact of the interaction effect.

A. pintoi and *P. conjugatum* are perceived as Extremely Juicy, highlighting their impact on meat juiciness. B1 (synthetic) and varying levels of FMPJ supplementation contribute to the juiciness of the chicken meat, with most levels falling under Extremely Juicy. The interaction effect between forage types and supplementation levels plays a significant role in determining the juiciness of the chicken meat.

Table 3c presents the interaction effect of different forage types on the mean meat juiciness of SASSO chickens raised under a coconut production system, comparing the meat juiciness at each level of supplementation.

Meat overall acceptability

Highly significant (P<0.01) effects were noticed in main plot and the interaction of factors while a significant difference (P<0.05) is observed in Sub plot.

No forage crop/control, *A. pintoi*, and *P. conjugatum* have overall acceptability ratings of 4.77, 4.70, and 4.70, respectively, all classified as Extremely Acceptable (EA). *A. pintoi* × *P. conjugatum* has an overall acceptability rating of 4.50, classified as Moderately Acceptable (MA).

Sub plot: Synthetic, 5mL FMPJ, 10mL FMPJ, and 15mL FMPJ have overall acceptability ratings of 4.70, 4.73, 4.55, and 4.68, respectively, all falling under Extremely Acceptable (EA) or Moderately Acceptable (MA).

When combined, the interaction effect has a highly significant finding (P<0.01). Different combinations of forage types and FMPJ supplementation levels result in varying overall acceptability ratings, classified as Extremely Acceptable (EA) or Moderately Acceptable (MA). Some combinations show significant differences in overall acceptability ratings, indicating the impact of the interaction effect.

Discussion

Paspalum conjugatum contains carotenoids, plant pigments responsible for yellow, orange, and red colors. Carotenoids are known for their antioxidant properties and their role in animal nutrition. When consumed by animals, these pigments can be absorbed into their tissues, potentially leading to a yellowish tint in meat due to carotenoid deposition in muscle and fat (Afrose *et al.,* 2024). This is because green forage plants like *P. conjugatum* are rich in carotenoids, primarily found in the chloroplasts of their leaves (Islam and Adjesiwor, 2018). This suggests that feeding chickens *P. conjugatum* could potentially affect the color of their meat, potentially making it more desirable.

Arachis pintoi may contribute to changes in the meat color in a similar way as grasses, but likely through a different mechanism, such as influencing the fatty acid profile or the antioxidant content. A higher content of antioxidants could potentially prevent oxidative stress in muscle tissues, maintaining a fresher appearance for the meat (de Sousa-Machado, *et al*., 2018). Among the treatments, those chickens having *P. conjugatum* in their diet had the highest desirable meat odor. *P. conjugatum* grass might contain volatile compounds that could influence the odor of chicken meat (Yusoff *et al*., 2017). These compounds could be absorbed by the chickens and deposited in the meat, potentially affecting its aroma.

The fat composition of chickens could be influenced by carabao grass when birds are pastured or when carabao grass is included in their diet. Changes in fat composition could potentially impact the development of volatile compounds that contribute to meat odor. The gut microbiome of chickens could be altered by the inclusion of carabao grass in their diet (Wessels, 2022). Changes in the microbiome could potentially impact the production of volatile compounds that contribute to meat odor.

Based on the result *P. conjugatum* and *A. pintoi* also affects the juiciness of chicken meat. Panprasert, (2012) states that feeding system and forage diets can impact positively on the meat quality especially juiciness on meat.

Grasses like *P. conjugatum* can influence the fat composition in the chickens that consume them. Typically, chickens fed on grass-based diets like *P. conjugatum* and *A. pintoi* may have different fat profiles than those fed conventional grain-based diets. The type of fat (e.g., more unsaturated fats from the grass) can affect the texture and juiciness of the meat, as fat plays a crucial role in moisture retention in muscle tissues during cooking (Miller, 1994; Gómez *et al.*, 2020). The use of Fermented Plant Juices and Products may also affect the desirability and quality of chicken meat.

Sun *et al.* (2022) reported that the quality of the chicken meat consumed affects human health. The fatty acids yielded by the feed were changed by fermentation. Stearic acid (C18:0), palmitic acid (C16:0), oleic acid (C18:1), and linoleic acid (C18:2) are the principal fatty acids in poultry meat, accounting for 85–95% of the total. Unsaturated fatty acids are the principal mediators of the flavor of the muscle, and the effect of fermented feed on the fatty acid composition of chicken meat suggests that it has the potential to alter the flavor.

FPJs are rich in bioactive compounds, vitamins, and minerals that can enhance the overall health of chickens. This improvement may lead to better nutrient assimilation, resulting in higher-quality meat with improved protein content, tenderness, and juiciness (Hossain *et al.,* 2014). Fermented plant products often introduce beneficial microorganisms and enzymes that can affect gut health and metabolism in chickens. Improved digestion and nutrient uptake may enhance the flavor profile of the meat (Ogbuewu and Mbajiorgu, 2024). FPJs are natural, reducing the need for synthetic antibiotics or growth promoters. This ensures that the meat is free from harmful residues, which is desirable for health-conscious consumers (Chai *et al.*, 2019).

Sirilun *et al.* (2018) suggest that dietary interventions like FPJs can modify the lipid profile of chicken meat, potentially increasing beneficial unsaturated fats and reducing unhealthy saturated fats. The natural antioxidants in fermented plant products can contribute to reducing lipid oxidation in meat, thereby enhancing its shelf life and sensory qualities.

Conclusion

This study investigated the potential of *Paspalum conjugatum* and *Arachis pintoi* forage crops, supplemented with varying levels of Fermented Mix Plant Juice (FMPJ), to enhance the meat quality of SASSO chickens. Trained panelists evaluated the meat using a standardized hedonic scale.

The results indicated that *P. conjugatum* inclusion in the diet significantly improved the odor, color, juiciness, and overall acceptability of chicken meat. Similarly, *A. pintoi* showed potential for enhancing consumer satisfaction. Supplementation with FMPJ also emerged as a promising technology for improving meat quality.

Importantly, the study revealed that different combinations of forage crops and supplementation levels yielded varying meat quality ratings. Some combinations demonstrated significant differences, highlighting the importance of optimizing both supplementation levels and forage types to achieve optimal consumer satisfaction.

Recommendation(s)

Based on the findings of the study, the following recommendations were drawn:

1. By including *Paspalum conjugatum* and *Arachis pintoi* in free-range chicken systems, we could potentially improve meat quality attributes like color, odor, juiciness, and overall consumer satisfaction.
2. Incorporating FPJs into poultry diets can positively affect chicken meat's nutritional and sensory attributes, aligning with consumer preferences for healthier, natural, and sustainable food products.
3. Encourage the integration of beneficial forage crops like *P. conjugatum* and *A. pintoi* into poultry production systems through extension services and farm demonstration.
4. Conduct longer-duration studies to assess the sustained impact of forage types and FMPJ supplementation on growth performance, health, and profitability.
5. Investigate other locally available forage crops that may offer similar or superior benefits
6. Assess the environmental sustainability of integrating forage crops and FMPJ supplementation, including effects on soil health and biodiversity.

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