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EFFECTS OF *Trichanthera gigantea* LEAF MEAL ON THE GROWTH AND PRODUCTION OF QUAILS SUPPLEMENTED WITH ALOE VERA EXTRACT AND ACID CHEESE WHEY

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ABSTRACT: This study was conducted to evaluate the effects of *Trichanthera gigantea* leaf meal on the growth and egg production of quails supplemented with Aloe vera extract (AVE) and acid cheese whey (ACW) in drinking water. A total of 300 quails distributed to 15 treatments with four replications using randomized complete block design (RCBD). Levels of TGLM were T_0 (0%), T_1 (15%) and T_2 (25%), while the water supplements included; 0, 15 and 25 ml per gallon of water of AVE and ACW, respectively. Results revealed that birds fed 15% (T_1) *T. gigantea* leaf meal in the diet performed well in terms of final weight gain and productions. Feed consumption, feed conversion ratio values and water consumption increased in birds fed with 15% *T. gigantea* than the control. Birds with 15% and 25% *T. gigantea* in their feed have delayed point of lay than those in the control. The economic analysis showed that birds fed 15% *T. gigantea* leaf meal with 25 ml ACW had higher return on investment and higher net benefits than other treatments. Results suggests that 15% *T. gigantea* leaf meal in the diet of quail with aloe extract and acid cheese whey supplementation can improve growth and egg production performance in quails.

Keywords: Quail, *T. gigantea* leaf meal, Aloe vera extract, Acid cheese whey, Plant proteins.

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INTRODUCTION

The use of growth-promoting substances to farm animals is now recognized and has been part of the production system management to effect faster growth of fowls. Farmers are getting aware of the production of organic and low cost animal products utilizing indigenous feed ingredients. Thus, new product preparations out of local and indigenous herbs, shrubs, enzymes and probiotics are being investigated to test their efficacy and profitability when fed or supplemented to farm animals. Plant proteins are abundantly available somewhere in the environment. One of the potential sources is the *Trichanthera gigantea* which contain proteins, fibers, calcium and saponins in their leaves (Rosales, 1997). This multi-purpose tree *Trichantera gigantea* (Madre de agua) contains high crude protein content of the foliage particularly the leaves and the thin stems, which are also consumed by the animals and apparently most of that is true protein and has a good amino acid balance, Hong Nhan (1997) cited by Lacayanga (2015). A potential source of protein, its leaves contain 18-22% crude protein in dry matter form (De la Cruz, 2001).

Likewise in the area of vitamins and mineral supplementation, Aloe Vera (*Aloe barbadensis*) extract, cheese whey, lactic acids, probiotics and other natural growth promoters are also gaining importance when added to the drinking water of poultry and livestock (Desmazeaud, 1996).

Acid cheese whey on the other hand, is estimated to contain 42-44% solid milk, These solids includes over 90% milk sugar, a portion of the mineral matter and fat, as well as very high percentage of water-soluble vitamins of the original milk. Typically, cheese whey is composed of 93.4% water, 35% fat, 85% protein, 4.8% milk sugar and 0.6% ash (Fox, 2004; Schingoethe, 1975).

Commercial feeds for growing and laying quails are very limited in the market, in fact most, quail raisers in the locality where the researcher obtained his stock are just using commercial feeds for broilers and layer chickens.

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Hence, to make use of the abundance of the identified feed sources in the community, this study was conducted to ascertain effect of feeding varying levels of locally formulated *T. gigantea*-based diets and supplementing *aloe vera* extract and *cheese whey* on the growth and egg production in quails.

MATERIALS AND METHODS

The Experimental Diets

Experimental diet was formulated by mixing the *Trichanthera* leaf meal with other feed ingredients (Table 1) following the treatment levels and nutrient requirements of quails. Preparations for the experimental diets were made every two weeks while adjusting the CP, Ca, ME and other mineral contents based on growth stages.

Table 1 - Composition of the formulated grower and layer mash for quail

Ingredients	Brooding & Growing Period			Laying Period		
	To	T_1	T_2	T_0	T_2	T_3
Yellow corn	34.02	29.25	25.49	37.14	32.27	28.50
Rice bran	17.00	14.63	12.75	18.76	15.46	14.50
Fish meal	8.80	6.30	5.86	6.75	5.67	4.10
Soybean meal	26.00	22.68	19.54	20.23	18.00	16.30
Copra meal	9.20	7.23	6.66	6.74	5.60	4.90
T. gigantea	0.0	15.00	25.00	0.0	15.00	25.00
Dicaphos	0.60	0.20	0.15	1.18	0.80	0.50
Limestone	0.80	0.40	0.20	4.88	3.50	2.50
Lysine	1.30	1.30	1.30	1.00	1.00	1.00
DL Methionine	0.50	0.50	0.50	0.45	0.45	0.45
Oil	1.50	1.50	1.50	1.50	1.50	1.50
Vit. Premix	1.50	0.86	0.80	0.50	0.50	0.50
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated Composition						
CP %	24.00	24.00	24.00	20.00	20.00	20.00
Ca %	0.87	0.92	1.39	2.53	2.62	2.75
Available P %	0.33	0.24	0.25	0.38	0.33	0.29
Lysine %	1.30	1.30	1.30	1.15	1.15	1.15
Methionine %	0.50	0.50	0.50	0.45	0.45	0.45
ME (kcal/kg)	3032	2961	2816	2993	2835	2798

Preparation and Application of *Aloe Vera* extract

Leaves were collected from the Aloe vera plant (*Aloe barbadensis*), weighed, washed to remove dirt's, sliced/chopped into pieces, and crushed using an electric blender or by hands. The gel from the solid materials was separated by straining with the use of cheese cloth or fine screen, then kept in container and preserved in a refrigerator to further use and analysis.

Preparation of the acid cheese whey

Acid cheese whey used in this study was secured as by-product in white cheese project of the university. The cheese whey was, strained, refrigerated and used as additive in the drinking water for the quails.

Experimental Birds, Design and Treatments

A total of 300 quail birds were randomly divided into 15 treatment combinations with four replications and arranged using randomized complete block design (RCBD). Five females and 1 male both growing and laying periods were subjected to the treatment levels of T. *gigantea* leaf meal, AV, and cheese whey. The feeding and supplementation took place from 7-45 days old of the birds at growing period and 1st to 3rd months of the laying period of the quails.

Factor T (Amount of *T. gigantea* leaf meal)

T_0 = 0% *T. gigantea* leaf meal
T_1 = 15% *T. gigantea* leaf meal
T_2 = 25% *T. gigantea* leaf meal

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Factor 1- 5 (Amount of *Aloe Vera* and acid cheese whey)

1 = No *Aloe Vera* and no acid cheese whey
2 = 15 ml. *Aloe Vera* extract
3 = 25 ml. *Aloe Vera* extract
4 = 15 ml. acid cheese whey
5 = 25 ml. acid cheese whey

General Management Practices

Quails were raised in a plastic screen - floored cage. Feeding the birds with the *Trichanthera*-based diets was regularly undertaken and access to drinking water with supplementation was strictly followed, cleaning and renewal of water in each treatment. Lighting, ventilation, proper health program and sanitation practices were strictly considered for the birds to be protected and comfortable.

Data Collection and Analysis

Growth and laying performance data were collected every week, while economic analysis of the project was taken after 3 months of lay. All observations in each parameter were subjected to Analysis of Variance (ANOVA) and treatment means were compared based on Tukey's Honestly Significant difference Test (HSD).

RESULTS AND DISCUSSION

Final and Gain Weights

As presented in Table 2, the final/gain weights of the quails were significantly affected by the experimental diets. The result showed the final weights of quails fed with 25% *TGLM* irrespective of supplementation have significantly lowered final and gain weights than those birds with 15% *TGLM*. The result implies that regardless of supplementation, the 15% *TGLM* in the diet is the minimum inclusion rate since it also showed higher final and gain weights over the birds without *TGLM* while decreasing its weight when *T. gigantea* was increased to 25%. The result conformed with the findings of Bitancor (2008) who revealed that quails fed with 10-20% *TGLM* had higher final and gain weights than those with 0% and with 30-40% *TGLM* in their diets.

For the AVE and ACW in drinking water of quails the supplementation did not significantly influence the final and gain weights of the quails. However, numerical data indicated a little and gradual increase in the weights of those birds supplemented with 15-25 ml of both AVE and ACW as compared to the birds without supplementation. This result is supported by the study of Alcantara et al. (2004) and Bejar (2005) on *AVE* supplementation which showed significant increase of final weights of broiler as inclusion rate was increased from 5-20 ml. per gallon of water. While the effects of ACW in this study could be associated with the nutritional attributes of *cheese whey* as revealed by Ahmed (2001). It is also noted in the interaction of the two factors, although not significant, that quails supplemented with both AVE and ACW showed a gradual increase of final and gain weights in all levels of *TGLM* in the diets. The treatment combination of 15% *TGLM* in the diet and 25 ml ACW in the drinking water showed the highest weights of the birds.

Feed Consumption

Feed consumption of the quail varied significantly among treatments Table 2. The result indicated that the quail fed diet without *T. gigantea* had significantly lower feed consumption than the birds with 25% *T. gigantea* leaf meal in their diets. However, birds without *T. gigantea* and those with 15% *T. gigantea* are not significantly different from each other, which mean that birds fed 15% levels of *T. gigantea* also have comparably lowered feed consumption. It can be observed that an increase of *T. gigantea* in their diets from 15% to 25% also have an increased feed intake as compared to those without *T. gigantea* in their diets. There was an increase of feed consumption in the treatments that received 25% level of *T. gigantea* leaf meal but resulted to lower gain weights, which was probably attributed to a certain decrease in nutrient digestibility due to high fiber content of the feeds with higher level of *T. gigantea*. This study conformed with the findings of Jaya et al., 2007 which revealed highest feed consumption of pigs fed 10% *T. gigantea* leaf meal in the ration, and the study of Schingoethe (1975) claiming that, if birds are being fed a low energy diet, they will tend to eat more of that diet than if they were fed a higher energy diet.

Feed Conversion Ratio

As indicated in Table 2, the feed conversion ratio of the quail in this study showed that treatment means are significantly differed based on Tukey's HSD Test. As indicated, birds fed with 15% *T. gigantea* leaf meal had

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significantly higher feed conversion ratio than those birds with 25% *T. gigantea* in the diet. This result implies that, the lower the FCR value, the more efficient the birds are, in converting their feed consumed into live body weight gain or egg produced. Thus, the birds without *T. gigantea* and those with 15% *T. gigantea* are more efficient than those with 25%. This study corroborates with the results obtained in the study of Jaya et al. (2007).

Water Consumption

Result showed that the mean water consumption of birds without *T. gigantea* significantly lowered than the birds with 15% and 25% *T. gigantea* in their diets. The data on water consumption (Table 2) of the birds seemed to show a definite trend, it correlated with the feed consumption because birds having consumed more feeds and higher FCR values are also the birds with higher water consumption. The water and feed consumption correlation in this study corroborate in the study on growing chicken by Sharma (1990). However, it showed inverse effects in terms of final and gain in weights. The data also reflects the absence of significant effects of *aloe vera* and acid cheese whey supplementation regardless of *T. gigantea* leaf meal in the diet.

Table 2 - Effect on growth performance of the quail for 1 month period.

Factors	Initial Weight	Final weight	Gain in weight	Feed consumption	Feed Conversion Ratio	Water consumption
Factor T						
T_0 (0% T. gigantea)	21.85	102.80^{b}	80.95^{b}	365.55^{b}	4.53^{b}	36.45^{c}
T_1 (15% T. gigantea)	21.60	108.70^{a}	86.95^{a}	401.25^{ab}	4.63^{b}	42.85^{b}
T_2 (25% T. gigantea)	21.70	99.20^{b}	77.50^{b}	409.45^{a}	5.31^{a}	45.51^{a}
Factor 1-5						
1 (0 ml Aloe vera & cheese whey)	21.17	100.75	79.58	389.33	4.92^{a}	41.75
2 (15 ml Aloe vera)	22.58	103.08	80.50	394.75	4.93^{a}	41.98
3 (25 ml Aloe vera)	22.25	103.33	80.67	389.25	4.85^{ab}	41.30
4 (15 ml cheese whey)	21.08	103.50	82.42	396.50	4.83^{ab}	41.88
5 (25 ml cheese whey)	21.33	107.17	85.83	390.58	4.58^{b}	41.10

Means followed by different letters. ^{abc} in the column is significantly different ($P<0.05$). Factor T (Levels of *T. gigantea* leaf meal). Factor 1-5 (Levels of *Aloe vera* and *cheese whey)*.

Point of Lay

The mean point of lay of birds without *T. gigantea* leaf meal in the diet was significantly lower than those quails with 15-25% *T. gigantea* leaf meal in their diets. The two levels of *T. gigantea* feeds for quail did not vary significantly among treatments (15% and 25%). The point of lay of birds in this study revealed that birds fed without *T. gigantea* leaf meal in their diets laid eggs earlier than those with *T. gigantea* leaf meal. The result implies that the sexual maturity of the birds was adversely affected by the experimental diets (Dozier and Bramwell, 2002). The result on the point of lay of the birds with 0% *T. gigantea* leaf meal can be compared with the study of Bitancor (2008); Dozier and Bramwell, (2002) which revealed 6-7 weeks or 42-56 days normal point of lay for the quail. The point of lay of quails were not affected by the levels of *aloe vera* extract and acid cheese whey supplementation. However, significant interaction was noted due to the longer point of lay of birds fed with 25% *T. gigantea* leaf meal and with 15 mL acid cheese whey as compared to the quails fed without *T. gigantea* and without supplementation.

Egg Production

The egg production of quails was significantly affected by the levels of *T. gigantea* leaf meal during the first and second month of egg production. Data showed that birds with 15% *T. gigantea* had significantly higher egg production percentage than the birds with 25% *T. gigantea* leaf meal in the diet. Quails fed with 15% *T. gigantea* and those without *T. gigantea* did not vary significantly on egg production. The result also revealed no significant difference on egg production among birds on the third month of lay.

There was no significant effects of *Aloe extract* and acid cheese whey supplementation on the egg production of quails throughout the 3-month laying periods. Likewise, interaction effects were not observed between levels of *T. gigantea* in the diets and levels of the two supplements in drinking water of quails. The percentage of egg production ranges from 33.92% to 46.34% in the first month of 40.34-54.17% in the second month lay, and 53.17-62.50% in the third month. However, numerical data showed that birds with *T. gigantea* in their diets (25% *T. gigantea*) showed lower percentage of egg production as compared to treatments without *T. gigantea* and with 15% *T. gigantea* in their diets at first and second months of lay.

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Table 3 - The laying performance of quail fed T. gigantea leaf meal for 3 months period.

Factors	Point of Lay	Egg Weight	Egg Production (1st month)	Egg Production (2nd month)	Egg Production (3rd month)
Factor T					
T_0 (0% T. gigantea)	56.60[b]	9.27[b]	43.65[a]	51.30[a]	57.40
T_1 (15% T. gigantea)	59.95[a]	9.41[ab]	44.16[a]	50.05[a]	59.25
T_2 (25% T. gigantea)	60.90[a]	9.58[a]	36.82[b]	43.66[b]	55.89
Factor 1-5					
1 (0 ml Aloe vera & cheese whey)	58.08	9.38	42.11	49.50	56.36
2 (15 ml Aloe vera)	59.83	9.46	42.57	47.53	57.53
3 (25 ml Aloe vera)	59.08	9.40	41.33	47.61	55.86
4 (15 ml cheese whey)	59.33	9.40	40.45	48.53	58.31
5 (25 ml cheese whey)	59.42	9.45	41.25	48.52	59.51

Means followed by different letters. abc in the column is significantly different (P<0.05). Factor T (Levels of *T. gigantea* leaf meal). Factor 1-5 (Levels of *Aloe vera* and *cheese whey).*

Financial Profitability

Among the dietary treatments evaluated, birds fed 15% *T. gigantea* leaf meal showed the highest net income and return on investment (Table 4). It can be observed that birds fed without *T. gigantea* and with 15% *T. gigantea* are the ones that showed positive earnings. However, the 0% *T. gigantea* fed birds with 15 ml. *aloe vera* and the birds fed 15% *T. gigantea* with 15-25 ml *cheese whey* are the most profitable considering its return on investment reached beyond 10%. Birds fed 25% *T. gigantea* regardless of supplementation appeared to have negative and the lowest earnings among treatments. The result can be associated with the effects of the treatments on the growth and point of lay of the birds, which resulted to lower gain in weights and delayed sexual maturity of the birds, and thus lower egg production.

The viability of the project is more justified by the result of the project worth measures which indicated worthwhile NPV, IRR and BCR values for the birds with 15% *T. gigantea* leaf meal and with 25 ml *cheese whey* supplementation as well as those birds without *T. gigantea* leaf meal and without supplementation. It appeared that birds with 15% *T. gigantea* leaf meal and without *T. gigantea* are the two projects said to be economically profitable since both obtained a desirable and positive worth measures. While birds fed 25% *T. gigantea* and 25 ml *aloe vera* supplement is no longer economical due to its negative NPV, lower IRR than the interest rate of 22% and a BCR value of less than one.

Table 5 also shows the consequence of the three levels of *T. gigantea* leaf meal fed quails if continued for a periods of 5 years with an assumption of 10% increase of total costs annually, while maintaining its total benefits within five years. It is expected that birds fed 15% *T. gigantea* with the supplementation of 25 ml cheese whey can be profitable within 5 years period without change of benefits while increasing total costs by 10% every year.

Table 4 - Cost and return analysis for 4-months egg production of the quails

Treatments	Total Operating Costs[1]	Egg Produced[2]	Sales of Eggs[3]	Net Income[4]	Return on Investment[5]
$T_{0\text{-}1}$ (0% *T. g* & 0 ml AV & ACW)	84.00	48.22	96.44	12.44	14.81
$T_{0\text{-}2}$ (0% *T. g* & 15 ml Aloe vera)	84.00	47.89	95.78	11.78	14.02
$T_{0\text{-}3}$ (0% *T. g* & 25 ml Aloe vera)	84.09	44.78	89.56	5.47	6.50
$T_{0\text{-}4}$ (0% *T. g* & 15 ml Cheese whey)	84.01	45.22	90.44	6.43	7.65
$T_{0\text{-}5}$ (0% *T. g* & 25 ml Cheese whey)	84.04	44.78	89.56	5.52	6.57
$T_{1\text{-}1}$ (15% *T. g* & 0 ml AV & ACW)	82.58	44.34	88.68	6.10	7.39
$T_{1\text{-}2}$ (15% *T. g* & 15 ml Aloe vera)	82.79	45.38	90.76	7.97	9.63
$T_{1\text{-}3}$ (15% *T. g* & 25 ml Aloe vera)	82.70	43.00	86.18	6.16	7.55
$T_{1\text{-}4}$ (15% *T. g* & 15 ml Cheese whey)	83.13	47.38	94.76	11.63	13.99
$T_{1\text{-}5}$ (15% *T. g* & 25 ml Cheese whey)	82.72	48.38	96.76	14.04	16.97
$T_{2\text{-}1}$ (25% *T. g* & 0 ml AV & ACW)	81.60	43.88	87.76	3.48	4.21
$T_{2\text{-}2}$ (25% *T. g* & 15 ml Aloe vera)	81.75	38.33	76.66	-5.09	6.23
$T_{2\text{-}3}$ (25% *T. g* & 25 ml Aloe vera)	81.40	41.47	82.94	1.54	1.89
$T_{2\text{-}4}$ (25% *T. g* & 15 ml Cheese whey)	81.52	40.60	81.20	-0.32	-0.39
$T_{2\text{-}5}$ (25% *T. g* & 25 ml Cheese whey)	81.51	38.80	77.60	-3.91	-4.80

[1]Include cost of quail chicks, feeds, labor, water and electric bill. [2]Egg produced of the quail for 3 months. [3]. Derived from multiplying the number of eggs produced by 2.00 pesos each. [4]Gross income (total sales) minus total operating cost. [5]Net income expressed as a percentage of total operating costs.

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Table 4 - Five years egg production analysis of quail fed with levels of *t. gigantea* and supplementation.

Treatment Combinations	Year 1		Year 2		Year 3		Year 4		Year 5		Total
	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost	
T0-1 (0% T.g & 0 ml A.V/ACW)	60057.17	40,689.34	60057.17	44,758.27	60057.17	49,234.10	60057.17	54,157.51	60057.17	59573.26	
Net Benefit	19,367.83		15,298.90		10,823.07		5,899.66		483.91		51,873.36
T1-5 (15% T. g & 25 ml ACW)	62156.28	40,114.21	62156.28	44125.63	62156.28	48538.19	62156.28	53392.01	62156.28	58731.21	
Net Benefit	22,042.07		18030.65		13618.09		8764.27		3425.07		65,880.13
T2-3 (25% T. g & 25 ml A.V)	56296.74	39,581.63	56296.74	43,539.79	56296.74	47,893.77	56296.74	52,683.15	56296.74	57,951.46	
Net Benefit	16,715.12		12756.96		8402.98		3613.60		-1654.71		39,833.94

CONCLUSION

The above findings indicate that growth and egg production performance of quail is affected with different percentage levels of *Trichanthera gigantea* leaf meal (TGLM) in terms of final and gain weights, feed consumption, feed conversion, water consumption, point of lay, percent egg production, return of investment and project viability. The 15% TGLM and 25 ml. ACW is the treatment combinations considered the optimum level that can provide an increase in the growth and egg production of quails.

DECLARATIONS

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Author's contribution

F.R. Bejar was the sole author of the study and the only one performed the experiments.

Competing interest

The author declared that no competing interests exist.

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