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NUTRITIVE EVALUATION OF CASHEW APPLE WASTE IN BROILERS

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ABSTRACT
A study was conducted for 35 days to investigate the effect of dietary cashew apple waste (CAW) on performance of broilers. One hundred and sixty day old Vencobb 400 broiler chicks were divided into four groups using completely randomized design. Each group had four replicates of ten birds per replicate. Four experimental diets were formulated as follows. Control group (T1) with no CAW (0 percent), T2, T3 and T4 treatments had CAW at 5, 10 and 20 percent respectively. Performance indices measured were feed intake, weight gain, feed conversion ratio (FCR), European Broiler Index (EBI) and European Production Efficiency Factor (EPEF). Feed intake was affected with increasing level of CAW in diets. The cumulative feed intake in T3 and T4 was statistically ($P<0.01$) lower than T1 and T2 birds. The weight gain observed in 5th week was statistically lower in groups T3 and T4 when compared to other groups. The cumulative feed conversion ratio of T3 and T4 birds were poorer when compared to other groups. Highest values for the EBI and EPEF were obtained in control group. It was concluded that cashew apple waste could be included in the broiler ration up to 5 percent level in all phases of broiler ration without compromising performance.

KEYWORDS: Cashew apple waste, Broiler production, European broiler index, European production efficiency factor, Feed conversion ratio.

INTRODUCTION
Agro-industrial by products can play significant role in reducing feed cost in poultry enterprises. By-products from fruit processing industries which are otherwise wasted can be included in poultry diets (Swain *et al*, 2014). Cashew apple (*Anacardium occidentale*) is an important by product of cashew nut industry and most commonly available seasonal fruit in south India. In certain areas like Goa, the fruit is used for the extraction of juice and residue is rejected as cashew apple waste. The chemical composition of CAW varies according to processing methods, location and not only in accordance to plant species but also varies between genotype in all over India. The cost of CAW is relatively low compared to that of other ingredients because it considered as waste product and it reduces the feed cost by decreasing the overall cost of production. Hence this study was conducted to determine the effect of feeding broiler chicken with different levels of CAW in their diet.

MATERIALS & METHODS
One hundred and sixty, day old Vencobb-400 commercial strain chicks were procured from native integrator. The broiler chicks were weighed; wing banded and randomly distributed to four groups viz T1, T2, T3 and T4 with four replicates of ten chicks in each group. Ration given to different groups is presented in Table.1.

TABLE 1: Experimental groups

Groups	Ration
T1	Standard broiler ration (control) as per BIS standard (2007)
T2	Ration containing 5 % CAW replaced with maize
T3	Ration containing 10 % CAW replaced with maize
T4	Ration containing 20 % CAW replaced with maize

The experimental ration was prepared as per BIS, 2007. The rations were made iso-caloric and iso-nitrogenous when CAW was included at 0, 5, 10 and 20 per cent in T1, T2, T3 and T4 diets respectively. Sun dried cashew apple waste (CAW) *(Anacardium occidentale)* was collected from M/s. Plantation Corporation of Kerala, Mannarkad Estate, Palakkad, Kerala. The birds were housed under deep litter system with wood shaving as litter material. The standard broiler production management practices *viz* brooding, feeding and watering was provided *ad libitum* to all the groups throughout the experimental period. One square feet floor space to each bird was provided. The electric hovers was used as brooder to maintain required temperature in all the pens till 10th day; after that sufficient light was provided to all the birds during night hours. The feeding trial was for 35 days. The feed samples were analysed as per AOAC (2012). Weekly feed intake and body weight gain were measured.

Production performance was calculated in terms of feed conversion ratio, European Broiler Index (EBI) and European Production Efficiency Factor (EPEF).

Feed Conversion Ratio (FCR)

Weekly feed conversion ratio was calculated by dividing the weekly feed consumption by weekly weight gain.

$$\text{FCR} = \frac{\text{Total feed consumed (g)}}{\text{Gain in weight (g)}}$$

European Broiler Index (EBI)

$$\text{EBI} = \frac{\text{Daily weight gain (g)} \times \text{Survival (\%)}}{10 \times \text{Feed Conversion Ratio}}$$

European Production Efficiency Factor (EPEF)

$$\text{EPEF} = \frac{\text{Live weight (Kg)} \times \text{Liveability (\%)}}{\text{Age at depleted (days)} \times \text{Feed Conversion Efficiency}}$$

Between groups comparisons of collected data were done using one way analysis of variance followed by Duncan Multiple Range test (DMRT) (Snedecor and Cochran, 1994). Statistical analysis of data was done using SPSS software version 21.0.

RESULTS & DISCUSSION

The chemical composition of the cashew apple waste is presented in Table 2. The crude protein (19.64%) and crude fiber (14.64%) content of CAW used in the present study were higher when compared to chemical composition reported by other Indian studies (Swain and Barbuddhe, 2008).

TABLE 2: Chemical composition of Cashew Apple Waste (CAW) (% DM basis)

Attributes	Percent (%)
Organic matter	92.65
Crude protein	19.60
Ether extract	2.56
Crude fiber	14.64
Total ash	7.35
Acid insoluble ash	6.67
Nitrogen free extract	55.85
Calcium	0.29
Phosphorus	0.43
True Metabolizable Energy (TME)	3676.68 (kcal/kg)

The difference observed may be due to the difference in processing method and the variety of the plant cultivated. The growth performance was assessed by recording the weekly feed intake, weekly weight gain, cumulative body weight gain, EBI and EPEF of experimental birds. The data pertaining to weekly feed intake is presented in Table-3. The cumulative feed intakes (g) of birds were 2915.00, 2897.61, 2754.19 and 2776.98 in groups T1, T2, T3 and T4 respectively.

TABLE 3: Weekly feed intake (g) of broilers birds

Age	Groups				SEM	p-Value
(Weeks)	T1 (g)	T2 (g)	T3 (g)	T4 (g)		
I**	149.75±0.06^{b}	150.15±0.08^{c}	150.55±0.17^{d}	149.30±0.13^{a}	0.07	< 0.01
II**	385.50±2.60^{b}	380.82±0.27^{b}	370.50±3.93^{a}	379.75±0.63	1.24	< 0.01
III**	551.25±4.47^{b}	549.72±0.94^{b}	539.25±1.37^{a}	533.50±4.43^{a}	1.70	0.01
IV**	802.50±2.34^{c}	800.50±1.26^{c}	738.50±1.24^{a}	760.75±9.5^{b}	3.32	< 0.01
V**	1026.0±6.83^{b}	1016.52±4.7^{b}	951.52±6.86^{a}	953.0±11.03^{a}	4.67	< 0.01
CUM.F.I.**	2915.00± 6.43^{b}	2897.90 ± 5.53^{b}	2750.32 ± 8.66^{a}	2776.30± 19.62 ^{a}	8.17	< 0.01

** Significant at 0.01 level; ns- non significant.
Means bearing different superscripts in a row differ significantly

TABLE 4: Mean weekly body weight (g) of broiler birds

Age	Groups				SEM	p-Value
(Weeks)	T1 (g)	T2 (g)	T3 (g)	T4 (g)		
Initial body weight	45.97 ± 0.50	45.77 ± 0.55	46.10 ± 0.63	45.22 ± 0.47	0.27	0.683
I**	188.25±0.40^{c}	186.85 ± 1.43^{c}	151.00 ± 2.02^{b}	142.75 ± 1.8^{a}	1.83	< 0.01
II**	413.07 ±3.38^{c}	413.90 ±4.40^{c}	366.40 ± 5.49^{b}	339.12 ± 6.11^{a}	3.52	0.01
III**	776.62 ±7.28^{d}	735.92±10.49^{c}	668.32 ± 11.99^{b}	605.57± 11.41^{a}	7.32	< 0.01
IV**	1234.87±12.23^{c}	1221.10±13.81^{c}	1017.20± 21.19^{b}	945.65 ±21.09^{a}	13.37	< 0.01
V**	1743.22±14.84^{c}	1725.20 ± 6.29^{c}	1479.22±29.79^{b}	1334.60±30.05^{a}	18.32	< 0.01

** Significant at 0.01 level; ns- non significant.
Means bearing different superscripts in a row differ significantly

The cumulative feed intake in T3 and T4 was statistically (P<0.01) lower than T1 and T2 birds. At the end of 5th week, birds in control group T1 (1743 g) and T2 (1726 g) recorded highest body weight followed by T3 (1484 g) and T4 (1322 g). The weight gain observed in 5th week were statistically (P<0.01) higher in T1 and T2 when compared to groups T3 and T4 birds. The growth inhibition was not observed at lower level (5%) of CAW inclusion whereas significant growth inhibition could be observed at 10 and 20 per cent level. Higher level of non-starch polysaccharides (NSP's) and other growth inhibitors may be the reason for growth inhibition observed in poultry birds fed with higher levels (10 & 20%) of CAW.

The production efficiency of broiler birds are expressed in terms of feed conversion ratio (FCR), European broiler index (EBI) and European production efficiency factor (EPEF) and is represented in Tables 5, 6 & 7, respectively. The cumulative FCR values in T1, T2, T3 and T4 were 1.72, 1.74, 1.95 and 2.23 respectively. The FCR values for T1 and T2 were statistically (P<0.01) better than T3 which was again poorer in group T4 birds.

TABLE 5: Feed conversion ratio (FCR) of broiler birds

Age (Weeks)	Groups T1	T2	T3	T4	SEM	p-Value
I**	1.05 ± 0.01 a	1.06 ± 0.01 a	1.82 ± 0.03 b	1.98 ± 0.04c	0.04	< 0.01
II**	1.72 ± 0.03 a	1.69 ± 0.03 a	1.73 ± 0.03 a	1.98 ± 0.05 b	0.02	< 0.01
III**	1.57 ± 0.03 a	1.76 ± 0.06b	1.83 ± 0.04 b	2.07 ± 0.06 c	0.03	0.01
IV**	1.75 ± 0.04 a	1.76 ± 0.03a	2.22 ± 0.08 b	2.41 ± 0.11 b	0.59	< 0.01
V**	2.04 ± 0.05 a	2.07 ± 0.04 a	2.21 ± 0.12 a	2.58 ± 0.09 b	0.05	< 0.01
CUM.FCR**	1.72 ± 0.01 a	1.74 ± 0.01 a	1.98 ± 0.04 b	2.24 ± 0.06 c	0.02	< 0.01

** Significant at 0.01 level; ns- non significant.
Means bearing different superscripts in a row differ significantly

TABLE 6: European Broiler Index (EBI) of broiler birds

Age (Weeks)	Groups T1	T2	T3	T4	SEM	p-Value
I**	193.88± 4.05c	190.18±4.11 c	70.91±4.05 b	56.22±2.22 a	5.39	<0.01
II**	189.99± 6.06b	198.88±7.29 b	180.81±6.26 b	148.24±7.26 a	3.67	<0.01
III**	335.42±13.61c	278.69±14.61 b	249.86±12.29 b	195.62±10.64 a	7.49	<0.01
IV**	396.12±19.63 b	395.59±18.27 b	249.60±17.48 a	225.64±18.62 a	11.11	<0.01
V**	365.41±18.22 b	364.09±15.87 b	336.19±20.21 b	231.76±16.32 a	9.82	<0.01
Final EBI **	282.59±5.26 c	273.84±5.72 c	211.92±8.62 b	166.02±7.42 a	5.09	< 0.01

** Significant at 0.01 level; ns- non significant.
Means bearing different superscripts in a row differ significantly

TABLE 7: European Production Efficiency Factor (EPEF) of broiler birds

Age (Weeks)	Groups T1	T2	T3	T4	SEM	p-Value
I**	256.19 ± 4.52 c	251.59 ± 4.62 c	124.60 ± 5.12 b	104.50 ± 3.32 a	5.94	<0.01
II**	173.29 ± 4.07 c	179.09 ± 5.14 c	153.92 ± 4.93 b	126.91 ± 5.21 a	2.90	<0.01
III**	241.67 ± 7.52 c	208.35 ± 8.48 c	182.40 ± 7.59 b	146.30 ± 6.68 a	4.66	<0.01
IV**	258.33 ± 8.63 b	255.69 ± 7.97 b	177.63 ± 9.89 a	152.30 ± 9.61 a	5.83	<0.01
V**	247.44 ± 7.78 c	246.15 ± 7.08 c	209.89 ± 9.84 b	155.52 ± 8.19 a	5.09	<0.01
Final EPEF **	290.55 ± 5.25 c	284.17 ± 5.77 c	221.71 ± 8.83 b	174.60 ± 7.63 a	5.14	< 0.01

** Significant at 0.01 level; ns- non significant.
Means bearing different superscripts in a row differ significantly

The performance of broiler birds were evaluated in terms of European broiler index which includes daily weight gain and survival percentage and higher values indicated that the birds body weight gain is uniform and flock is in good health. The EBI values at end of 5th week in T1, T2, T3 and T4 were 365.41, 364.09, 336.19 and 231.76 respectively. The EBI values were significantly (P<0.01) lowered in group T4 birds when compared to groups T1, T2 and T3. The EBI values of the present study were comparable with the values obtained by Luckstadt and Mellor (2012) and Murugan *et al.* (2014). Present values were higher when compared to Tolmir *et al.* (2014).

The calculation of European production efficiency factor is to find out the health condition of the birds, because it includes livability of the birds and efficiency of feeding management or feeding system followed in the farm. The higher values indicate the good management of the farm. The EPEF values at the end of 5th week were 247.44, 246.15, 209.89 and 155.52 in T1, T2, T3 and T4 group birds respectively. The EPEF values in T3 and T4 were statistically (P<0.01) lowered when compared to groups T1 and T2 birds. Comparable EPEF values were observed by Tolmir *et al.* (2014). But the present values were lower when compared to Murugan *et al.* (2014). The data on EBI and EPEF will give better picture of management factors in farm and will enable to derive a similar Indian index in future.

CONCLUSIONS

CAW is good source of energy and protein can be included in broiler poultry diets at 5 percent level. At higher levels (10 and 20 percent) of inclusion it resulted in significant growth inhibition. Growth inhibitors and higher level of non-starch polysaccharides present in CAW may be the probable reason for poor performance.

REFRENCES

AOAC (2012) Official Methods of Analysis, (19th Ed.). Association of official Analytical Chemist. Washington D.C.

Indian standard for Poultry Feeds (2007) Bureau of Indian Standards (IS: 1374), 5th revision, New Delhi.

Luckstadt, C. and Mellor, B. (2012) Recent advances in the role of organic acids in poultry nutrition. *J. Appl. Anim. Res.* **44**(1): 359-369.

Murugan, S.S., Balusami, C., Shamly, T.M., Singh, V.K., Remya Krishnan, S.G., Singh, R.K. and Varghese, M.R. (2014) the influence of high altitude on economic efficiency of broiler Farming in Kerala, India**.** *Indian J. Nat. Sci.* **4** (25): 1734 -1740.

Snedecor, G.W. and Cochran, W.G. (1994) Statistical Methods, (8th Ed.). Iowa State University, Ames, I.A. 314 p.

Swain, B.K. and Barbuddhe, S.B. (2008) Technical Bulletin. Use of agro-industrial by-products to economise feed cost in poultry production. ICAR, Research Complex for Goa, India. 4-6 p.

Swain, B.K., Naik, P.K. and Singh, N.P. (2014) Unconventional feed resources for efficient poultry production. ICAR, Research Complex for Goa, India. 19-28p.

Tolmir, N., Milosevi, N., Ceroni, C., Skrbi, Z. and Maslovari, M. (2014) The effect of feeding programmes on broiler performance and production efficiency. Proceedings of the *Int. symposium on Anim. Sci.* 2014: 224-230.