ECONOMIC VIABILITY OF ORGANIC BROILER FEEDING IN SRI LANKA

P.G.S.D.Gunasena*, N.M.N. Nambapana[1] and S.S.P. Silva[2]

[1] Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Passara Road, Badulla, Sri Lanka.

[2] Veterinary Research Institute, P.O. Box 28, Gannoruwa, Peradeniya, Sri Lanka.

ABSTRACT: *Broiler is highly propagated livestock subsector in Sri Lanka. Aim of the present study was to evaluate the economic performance of organic broiler feeding in Sri Lanka. Ninety of Cobb 500 strain chicks were randomly divided into 3 equal treatment groups and each treatment had 10 replicates with three chicks for each replicate. Treatment A was Conventional diet. Treatment B and C were semi organic diets. Feeding was done for 45 days. Treatment A showed higher average body weight, feed intake, body weight gain, feed to gain ratio, live weight and carcass weight than semi organic dietary treatment groups. However, Dressing percentages (76%) of all treatment groups were equal. Highest liver weight was recorded by treatment A while the highest gizzard weight recorded by treatment B. Conventional broiler feeding was profitable than organic broiler feeding and which confirmed by critical factor analysis and return on investment analysis. Under the prevailing conditions, organic broiler feeding was not economically viable in Sri Lanka.*

Key words: *Broiler, Economic, Feeding, Organic, Viability*

INTRODUCTION

Broiler is highly propagated livestock subsector in Sri Lanka (Samarasingha, 2007). Chicken meat export was recorded as 1812.025 Metric Ton (MT) in the year 2011; a remarkable increase of 173.81% previous year volume of 661.71 MT (DAPH, 2011). Export is one of the major breakthroughs to expandsion of the broiler production. The per capita chicken meat availability had recorded as 4.86 kg/person/year and it has been increased up to 4.99 kg /person /year (DAPH, 2011). The anticipated per capita availability of chicken meat will be 10 kg/ person/year at year 2016 (MLRCD, 2011). In Sri Lanka, mostly consume meat type was chicken meat recorded as 259.11 g/person/month in 2010 (DAPH, 2011). Therefore, huge expansion of local broiler industry is on course.

To promote the exportation of value added poultry products is essential to improve the quality standard of the poultry products in conformity with the global standard (DAPH, 2011). Organic feed is intended to ensure the quality of production rather than maximizing the production (Pedersen *et al.,* 2003). In recent years, there has been a rapid increased in organic animal production in many European countries (Nizam, 2011, Fatico *et al.,* 2009). This development is response to increase consumer demand for that has perceived to be fresh, wholesome and flavorsome, free of hormones, antibiotics and harmful chemicals, and produced in a way that is suitable environmentally and without the use of gene modified (GM) crops (Blair, 2008, Buchanan,2007). United States of America (USA), Canada, is having rapidly growing Organic Food market reporting around 20% annual growth rate (Ranaweera, 2008). In addition, European Union rate of growth on Organic Food market is averaging 7.8% per year (Ranaweera, 2008). Organic broiler concept is not fully developed in Sri Lanka despite higher potential for export market and especially higher demand from hotel industries to cater

* Corresponding author: susan87uwu@gmail.com

rapidly developing tourism industry. Anticipated tourist arrival in year 2016 is 2.5 million (SLTBP, 2011). Therefore, promote and enhance organic broiler production in Sri Lanka has a great significance.

Organic feed is generally more expensive than conventional feed often resulting in egg and meat being twice as costly as the conventional products (Blair, 2008). One of the major issues of the poultry sector in Sri Lanka is fluctuation of feed cost and high cost of feed and chicks which is over 70% in of cost of production (DAPH, 2011). Therefore, the cost of organic feed is a key factor influencing the financial performance of organic broiler enterprise (Castellini *et al.,* 2006). Therefore, the objective of the present study was to evaluate the organic broiler feeding could be commercially viable in Sri Lanka.

METHODOLOGY

Feed Formulation

Basal diet (A) was prepared by adding conventional feed ingredients and two semi-organic (B and C) diets were prepared by using some conventional feed ingredients and organic trace minerals (Bioplex), brewer's yeast and germinated rice by using Linear programming software package. Treatment B and C was known as semi organic because some ingredients which used for feed formulation were not organic. Organic feeds were formulated based on some guidelines of Codex Alimentareous Commission (1999), International Federation of Organic Agriculture Movement (IFOAM, 2005) and accordance with some conditions of United Kingdom Register of Food Standers (UKROFS, 2000) and European Union (European Commission, 2005) regulations (Table 1). Feed mixing was done manually in the Feed Mill at Veterinary Research Institute, Sri Lanka. Feed samples were analyzed for proximate composition by following the AOAC procedure (2005).

Management of Experimental Birds

The experiment was conducted with 90 day old Cobb 700 broiler chicks for a period of 45 days. Chicks were weighted and randomly divided in to 3 equal treatment groups (A, B and C) each having 30 chicks. Each treatment was included in to 10 equal replications of 3 chicks for each. The birds were housed in metabolism cages of 36"×20". Dry mash feed was supplied on adlibitum basis and first 3 days fed with control diet (Basal diet) in the same pen together. At the fourth day birds were weighed and put into the labeled metal cages accordance with treatment and replicates. Treatment diets were introduced to the animals at 4^{th} day. Starter diet was given up to 22^{nd} day and Finisher diet up to 45^{th} day relevant to the different treatments. Fresh clean drinking water was made at all the time and adequate sanitary measures were taken during entire experimental period.

Slaughtering process

Two birds of 45 day old in each replicate were randomly selected, fasted over night, live weight was measured and slaughtered by severing a jugular vein. After scalding in warm water for about few minutes, defeathering was done. Each and every bird was manually eviscerated.

Data collection

To evaluate the treatment effect, feed intake and body weight were recorded and from which body weight gain and feed to gain ratio were calculated in week basis. After slaughtering process, weights of the carcass, heart, liver, gizzard, pancreas and length of the small intestine were recorded. Mortality rate was calculated by recording the number of dead animals weekly. Economical performance was evaluated by determining total feed cost, total chick cost, management cost, total production cost, total sale price and net profit which relevant to each dietary treatment. It was assumed that apart from the feed cost rest of the cost components were similar in all the treatment groups. In addition, Critical Factor Analysis and Return on Investment (ROI) analysis were done to further clarify the economic performances of three treatments.

Table 1. Content of Different Dietary Treatments

Ingredients		Starter			Finisher	
	Diet A	Diet B	Diet C	Diet A	Diet B	Diet C
Maize	57.22	70.44	60.1	62.04	76.57	61.84
Organic Soyabean meal (expeller)		9.62	9.78		12.24	9.68
Soyabean meal (dehulled)	36.52			30.69		
Plant protein		14.46	14.40		9.12	10.25
Coconut oil			0.7			3
Palm Oil	2.33			3.5		
DCP	1.7	1.21	1.25	1.49	1.17	1.2
NaHCO3		0.1			0.05	0.11
Shell powder	1.26	0.78	0.73	1.18	0.32	0.51
Salt	0.35			0.35		
Herbal methionone		0.29	0.29		0.28	0.31
Herbal choline		0.1	0.1		0.1	0.1
Choline Chloride	0.1			0.1		
D-L methionine	0.23			0.23		
L- lysine	0.12			0.19		
L- Threonine	0.02			0.08		
Mineral premixes	0.1	0.1		0.1	0.1	
Vitamin premixes	0.05	00.5		0.05	00.5	
Bioplex			0.05			0.1
Dried brewery yeast			2.5			2
Germinated rice flour			10			10
Coconut Poonac		2.7				

Statistical Analysis

Complete Randomized Design (CRD) was applied as an experimental design. Differences among three treatments were analyzed by using one way ANOVA (Analysis of Variance) and means separated by performing Least Significant Deference (LSD). Data were statistically analyzed by using Minitab 16 software package.

RESULT AND DISCUSSION

Proximate composition of the dietary treatment is shown in Table 2 and values are quite similar except treatment diet C. Metabolized energy of starter and finisher was 2950 Kcal/kg and 3075 Kcal/kg respectively. Metabolized energy and proximate composition values were approximately similar to the Buchanan *et al.,* (2007) and Castellini *et al.,* (2002) values. Average body weight of the different treatments is presented in Table 3. Statistically significant (P < 0.05) differences in average body weights among the treatments were observed at all the ages.

Table 2. Proximate Composition of Dietary Treatments

Parameter	Starter			Finisher		
	Diet A	Diet B	Diet C	Diet A	Diet B	Diet C
Moisture	13.1%	12.9	14.3	10.4	11.9	11.0
Crude protein	20.4	21.9	21.5	18.7	18.0	18.4
Crude fat	4.8	4.0	3.6	6.4	4.0	6.3
Crude fiber	3.4	3.1	2.6	3.0	4.4	2.3
Ash	6.3	6.5	5.0	5.2	4.2	3.8

Source: Laboratory records of Veterinary Research Institute

Birds on treatment B and C was showed lower (P< 0.05) average body weight than treatment A. There was not statistically significant difference in between treatment B and C during first 4 weeks.

Table 3. Average body weights at different ages in different treatments

Age (Days)	Dietary Treatments			SED	Level of Sig:
	A	B	C		
1 Day	46.6 ± 1.430	45.9 ± 0.876	46.1 ± 1.449	0.572	N.S
4 Day	86.0 ± 5.907	86.5 ± 4.143	85.7 ± 5.334	2.317	N.S
10 Day	241.8 ± 13.74 [a]	222.0 ± 10.01 [b]	224.2 ± 13.8 [b]	5.65	*
17 Day	520.27 ± 29.39 [a]	499.87 ± 23.43 [b]	447.13 ± 26.19 [b]	11.83	*
24 Day	941.93 ± 36.77 [a]	735.60 ± 58.76 [b]	708.00 ± 70.62 [b]	25.5	*
31 Day	1444.3 ± 94.9 [a]	1080.7 ± 76.7 [b]	1029.6 ± 119.6 [b]	44.1	*
38 Day	2010.6 ± 84.2 [a]	1672 ± 125.1 [b]	1482 ± 175.2 [c]	59.7	*
45 Day	2507.7 ± 159.4 [a]	2151.8 ± 158.1 [b]	1827.0 ± 282.5 [c]	93.2	*

A= Conventional diet; B= Semi organic diet option 01; C= Semi organic diet option 02; ± = Standard deviation; SEM= Standard Error of Mean difference; Figure having different superscript in the same row differ significantly (P < 0.05); * = 5 % level of significance; NS= non significant. Note: Dietary treatments were started at 4 th day onwards

The results were agreement with the Bunyamin *et al.,* (2011) who described that the average bogy weight of conventional bird was higher than the organic control group. Bunyamin *et al.,* (2011) stated that average body weight of conventional group was higher (2307.4g) than organic control group (14435.3g). Furthermore, Bunyamin *et al.,* (2011) emphasized that the mean body weight of the organic broiler based on pastures was recorded as 1702 g of average body weight at the 6th week. National Research Council (1994) was mentioned that the expected typical body weight at the different ages as at the 4,5,6 weeks expected 1085g, 1576g, and 2088g respectively. According to the results of the experiment (Table 3) conventional group (A) and semi organic diet B were compatible with those expected values but semi organic diet option C far behind than expected values. Therefore, at the extreme organic conditions, it was difficult to maintain expected performance without extra cost for prolong the slaughtering period until they reached to the accepted market weight.
Average feed intake of the birds fed on different diet is shown in Table 4. Feed intakes of birds were not significantly different (p<0.05) at the first week. It was evident that average feed intake higher in treatment A and lower in treatment C and statistically differed except for day 4-10. There was an evidence that treatment B and C had not expressed statistically significant difference p<0.05) up to day 21-31. At the last two weeks statistically significant difference (p<0.05) was existed in between treatment B and C.

Table 4. Feed intake (g) at different ages of experimental birds in different treatments

Age (Days)	Dietary Treatments			SED	Level of
	A	B	C		Sig:
4-10 Day	206.53 ± 18.97	199.67 ± 18.01	208.97 ± 12.89	7.53	N.S
10-17 Day	439.37 ± 19.76 ^{a}	418.00 ±26.82 ^{ab}	397.43 ± 34.16 ^{b}	12.32	*
17-24 Day	608.60 ± 101.64 ^{a}	567.47 ± 75.70 ^{ab}	515.13 ± 59.06 ^{b}	36.1	*
24-31 Day	815.10 ± 84.10 ^{a}	679.93 ± 87.30 ^{b}	635.77 ± 81.48 ^{b}	37.7	*
31-38 Day	968.6 ± 65.4 ^{a}	875.0 ± 65.3 ^{b}	776.3 ± 106.6 ^{c}	36.4	*
38-45 Day	1277.9 ±84.7 ^{a}	1258.4 ± 98.7 ^{a}	1042.3 ± 173.0 ^{b}	55.9	*

A= Conventional diet; B= Semi organic diet option 01; C= Semi organic diet option 02; ± = Standard deviation; SEM= Standard Error of Mean difference; Figure having different superscript in the same row differ significantly (P < 0.05); * = 5 % level of significance; NS= non significant. Note: Dietary treatments were started at 4 th day onwards

Feed intake of the semi organic diet option C was considerably reduced because of the leg outstretched of growing birds, which difficult to access to the feed and therefore reduced the growth rate of the animals and use of yeast slurry instead of Dried Brewer's Yeast as a feed ingredients of semi organic diet option C was significantly reduce the feed intake due to the low palatability. Previous research of Blair (2008) indicated that the feed intake of starter period was lower with yeast slurry at the grower stage of animals. Paryad and Mahmoudi (2008) indicated that more than 1.5% yeast inclusion level was reduced the growth rate, feed intake, and feed conversion ratio. In the treatment C, mineral premix was completely replaced by Bioplex and according to the Nollet *et al.,* (2008) there was not significant performance difference between 100% Bioplex included broilers diet and 100% mineral premix included broilers diet.

Cumulative feed consumption also expressed a similar pattern as feed intake is shown in Table 5. Highest cumulative feed intake was recorded by treatment A and lowest in treatment C which statistically different (p<0.05) at all the ages. There was not statistically significant difference (p<005) in between treatment B and C at starter period and statistically significant difference (p<005) was expressed at latter part of the finisher period. The highest feed consumption was shown at treatment A and the lowest in treatment C. The results were compatible with findings of Bunyamin *et al.,* (2011) who reported that the highest cumulative feed intake of the conventional group (1131.3g at starter period, 3825g at finisher period) and organic control group consumed 942.9g and 3496.8 g during the starter and finisher periods respectively.

However, Bulmyumin *et al.,* (2011) was prolong the experimental period up to 10 weeks only in the organic control group recorded 1935.5g total feed intake and organic pasture group double the feed consumption at last 4 weeks (3211.6). Fanttica *et al.,* (2009) was reported that the feed intake of faster growing indoor organic birds was 7402g at the 63rd day and Cobanoglu *et al.,* (2012) was reported that the cumulative feed intake of organic broilers as 8041g for 81 days. Those values were higher than present study because they extended the experimental periods.

Table 5. Cumulative feed consumption (g/bird) of the birds in different ages

Age (Days)	Dietary Treatments			SED	Level of
	A	B	C		Sig:
4-10 Day	206.53 ± 18.97	199.67 ± 18.01	208.97 ± 12.89	7.53	N.S
4-17 Day	645.90 ± 18.42 ^{a}	617.67 ± 17.57 ^{b}	606.40 ± 30.08 ^{b}	10.19	*
4-24 Day	1254.5 ± 113.0 ^{a}	1185.1 ± 75.7 ^{b}	1124.5 ± 52.7 ^{b}	37.7	*
4-31 Day	2069.6 ± 175.2 ^{a}	1865.1 ± 154.8 ^{b}	1757.3 ±116.3 ^{b}	67.4	*
4-38 Day	2633.1 ±189.7 ^{a}	2197.5 ± 250.7 ^{b}	1979.7 ± 117.8 ^{c}	86.7	*
4-45 Day	3910.9 ± 115.0 ^{a}	3455.9 ± 213.0 ^{b}	3022.0 ± 223.8 ^{c}	85.6	*

A= Conventional diet; B= Semi organic diet option 01; C= Semi organic diet option 02; ± = Standard deviation; SEM= Standard Error of Mean difference; Figure having different superscript in the same row differ significantly (P < 0.05); *= 5 % level of significance; NS= non significant. Note: Dietary treatments were started at 4 th day onwards

Effect of different dietary treatments on live weight gain is presented in Table 6. Highest average body weight gain was recorded in treatment A and which significantly higher (p<0.05) at 4-10 days to 24-31 days than diet B and C. Lowest average body weight gain was recorded by treatment C which had significant difference (p<0.05) while compared with treatment A .Treatment B was shown high average body weight gain relative to the treatment C but not significantly differed (p<0.05) up to day 24-31. At the day 31-38 highest average body weight gain was recorded by treatment B but not significantly different with treatment A. At the last week, average body weight gains of all treatments were reached to the same level and there was no significant difference (p<0.05) exist among the treatments.

Table 6. Live weight gain of birds in different treatments

Age (Days)	Dietary Treatments			SED	Level of
	A	B	C		Sig:
4 Day	86.00 ± 5.907	86.50 ± 4.143	85.70 ± 5.334	2.317	N.S
4-10 Day	154.53 ± 16.09 ^{a}	135.50 ± 7.81 ^{b}	138.50 ± 13.24 ^{b}	5.75	*
10-17 Day	281.73 ± 21.66 ^{a}	227.87 ± 16.88 ^{b}	222.93 ± 25.41 ^{b}	9.66	*
17-24 Day	416.73 ± 23.59 ^{a}	285.73 ± 55.28 ^{b}	260.87 ± 62.55 ^{b}	22.40	*
24-31 Day	494.73 ± 92.67 ^{a}	345.07 ± 53.02 ^{b}	321.60 ± 82.43 ^{b}	34.8	*
31-38 Day	567.93 ± 33.25 ^{a}	591.53 ± 75.08 ^{a}	453.20 ± 107.14 ^{b}	34.9	*
38-45 Day	483.10 ± 104.0	479.6 ± 45.9	425.9 ± 257.6	72.7	N.S

A= Conventional diet; B= Semi organic diet option 01; C= Semi organic diet option 02; ± = Standard deviation; SEM= Standard Error of Mean difference; Figure having different superscript in the same row differ significantly (P < 0.05); *= 5 % level of significance; NS= non significant. Note: Dietary treatments were started at 4 th day onwards

The result was contradicted with findings of Pedersen *et al.,* (2003) who indicated that the average body weight gains at day 01-24, day 25-35, and day 34-50 as 297, 200, and 115 respectively. At the same ages the results of semi organic diet option B and C (Table 6) were than previous research findings. Fanttica *et al.,* (2005) reported that overall weight gain of the fast growing indoor organic birds was 2,506 at the day 53, and those values approximately compatible with semi organic diet C because it was shown higher cumulative live weight gain. The results of the cumulative weight gain was contradicted with the findings of Fanttica *et al.,* (2009) who reported body weight gain of indoor rearing organic broiler as 3389g at the 63 day.

The effect of the different dietary treatments on the feed to gain ratio is presented in Table 7. It was evident that the feed to gain ratio was statistically significant ($p<0.05$) and better feed to gain ratio was recorded by treatment A during the initial 4 weeks. There was an enough evidence that different between treatment A and B was statistically significant ($p<0.05$) and difference in between B and C was non-significant. At the last 2 weeks feed to gain ratio of the different treatments were reached to equal level and statistically non-significant. Feed to gain ratios of treatment B and C were considerably decreased (0.5000, 0.3145) when increasing (0.0286) the corresponding value of treatment A while moving from day 24-30 to 31-38.

Table 7. Feed to gain ratios of the birds in different treatment groups

Age (Days)	Dietary Treatments			SED	Level of Sig:
	A	B	C		
4-10 Day	1.3446 ± 0.134 ^{b}	1.4786 ± 0.168 ^{a}	1.5150 ± 0.087 ^{a}	0.06	*
10-17 Day	1.5663 ± 0.119 ^{b}	1.8396 ± 0.130 ^{a}	1.7921 ± 0.139 ^{a}	0.058	*
17-24 Day	1.4597 ± 0.235 ^{b}	2.0244 ± 0.287 ^{a}	2.0522 ± 0.407 ^{a}	0.1423	*
24-31 Day	1.6816 ± 0.219 ^{b}	2.0035 ± 0.360 ^{ab}	2.0933 ± 0.550 ^{a}	0.1789	*
31-38 Day	1.7102 ± 0.142	1.5035 ± 0.250	1.7888 ± 0.459	0.1407	N.S
38-45 Day	2.791 ± 0.795	2.658 ± 0.455	3.242 ± 2.0490	0.580	N.S

A= Conventional diet; B= Semi organic diet option 01; C= Semi organic diet option 02; ± = Standard deviation; SEM= Standard Error of Mean difference; Figure having different superscript in the same row differ significantly ($P < 0.05$); *= 5 % level of significance; NS= non significant. Note: Dietary treatments were started at 4 thday onwards

At the last week, treatment effect is non-significant and showed considerably higher feed to gain ratio than all other weeks and highest feed to gain ratio was recorded by treatment C. The results were agreement with previous findings of Bulmyumin *et al.,* (2011) that higher feed to gain ratio was observed in organic control and organic pasture group that 2.21 and 2.11 respectively compared with conventional group as 1.66 at the age 0-6 weeks.

The results of the feed to gain ratios of both semi-organic treatment groups were contradicted with the previous research of Fanattica *et al.,* (2009) who found that overall feed to gain ratio of fast growing indoor organic broilers were recorded as 2.9 at 63 day. But the present value of the results (Table 7) much higher even in 45 days experimental period. The results of the feed to gain ratio was agreement with the findings of Pedersen *et al.,* (2003) who reported average feed to gain ratio at different organic farms in Denmark that 2.1, 2.8, and 3.3 at the starting growing and finishing periods respectively. Most of those values were compatible with present experimental results (Table 7) which recorded 2.024 and 2.05 in semi organic diet option 01 and 02 respectively. At the last week (day38-45) feed to gain ratio was recorded as 2.658 and 3.242 in the semi organic diet option B and C (Table 7). Castellini *et al.,* (2002) was reported that the average feeding efficiency as 2.75 and 3.29 at the day 53 and day 81 respectively and those values were approximately comparable with present study. Average feed to gain ratio of the present study was approximately compatible with Cobanoglu *et al.,* (2012) who reported that the feed to gain ratio of organic and conventional groups as 1.93 and 2.93 respectively.

Effect of different dietary treatments on carcass yield is presented in Table 8. It was evident that dressing percentages for treatment A, B and C have not differ significantly (p<0.05). Higher live weight and carcass weight was shown by treatment A and lower in treatment C which showed statistically significant difference (p<0.05) among the three dietary treatment groups.

Bulmyumin *et al.,* (2011) stated that the slaughtering weight of conventional group was 2,588g and carcass weight 1,948g and organic control group recorded 2,381g slaughtering weight and 1,758g of carcass weight. Those values were approximately compatibles with present experimental results in Table 8. In contrast, the mean carcass weight of organic pasture group was higher than conventional group (Bulmyumin *et al.,* 2011). Slaughtering weight of the organic broilers were lowered in present study compared with the Castellini *et al.,* (2002) who recorded 2861g slaughtering weight at 56 day. Fanttica *et al.,* (2005) findings was also agreement with the results of the carcass characteristics, those organic indoor rearing birds yield 2630g of carcass with 76.3% dressing percentage. Castellini *et al.,* (2002) was reported that the carcass weight and dressing percentage as 2011g and 70.3% respectively and carcass weights were higher and dressing percentages were lowered than present study (Table 8).

Table 8. Carcass weights of broilers in different treatment groups

Parameters	Dietary Treatments A	B	C	SED	Level of Sig:
Live weight (g)	2476.6 ± 108.2 ^{a}	2262.2 ± 157.8 ^{b}	2041.9 ± 353.3 ^{c}	98.53	*
Carcass weight (g)	1899.8 ± 107.4 ^{a}	1736.2 ± 173.7 ^{b}	1552.8 ± 269.3 ^{c}	86.0	*
Dressing %	76.789 ± 4.394	76.782 ± 5.835	76.587 ± 8.970	2.99	N.S

A= Conventional diet; B= Semi organic diet option 01; C= Semi organic diet option 02; ± = Standard deviation; SEM= Standard Error of Mean difference; Figure having different superscript in the same row differ significantly (P < 0.05); *= 5 % level of significance; NS= non significant. Note: Dietary treatments were started at 4 thday onwards.

Castellini *et al.,* (2002) also stated that the carcass weights were higher in conventional production system than organic system and dressing percentages were similar in both systems. Those results were agreement with present study (Table 8). In contrast, slaughtering weights and carcass weights of the organic group was higher than conventional group (Cobanoglu *et al.,* 2012.). Cobanoglu *et al.,* (2012) was reported that the carcass weights of organic and conventional groups as 2045g and 1735g respectively and slaughtering weights organic and conventional groups as 2778g and 2250g respectively.

Effect of different dietary treatments on the different organs which associated with carcass and some parts of digestive system is presented in Table 9. Heart weight, percentage of heart and liver weight in relation to the carcass weight and length of small intestine was not expressed statistically significant difference (p<0.05) among different dietary treatments. Highest heart weight, (non- significant at p<0.05) liver weight shown in treatment A and lowest weights in treatment C which had statistically significant difference (p<0.05). Higher gizzard weight percentage to carcass weight was shown by treatment B which had not expressed statistically significant difference (p<0.05) with any other dietary treatments. The highest pancreas weight was recorded in treatment A and the lowest in treatment C which had statistically significant difference (p<0.05) in between treatment A and treatment C. Statistically significant difference (p<0.05) had not exist among the length of small intestine in different dietary treatment groups. Adil *et al.,* (2010) was recorded the gizzard , heart and liver weight by feeding diet which similar to the conventional diet of present study and values were compatible with present study.

Weights of the some organs and percentage weight relative to the carcass weights were recorded. Gizzard weight was quite higher in semi organic diet B and considerably small in semi organic diet option C. It may be consequences of low feed intake of birds in semi organic diet option C. Pancreas weight was also lower in semi organic diet C might be due to the mal functioning of digestive process. Length of the small intestine was also smaller in semi organic diet C. It may be due to the suppression of immunity since lack of adequate well balance vitamins in the diet. In contrast, Geo *et al.,* (2008) stated that supplementation of 2.5g/kg of yeast was improved the immune function.

Table 9. Weights and length of some organs in different treatment group

Parameters	Dietary Treatments			SED	Level of Sig:
	A	B	C		
Organ weights (g)					
Heart	8.7 ± 1.457	7.4 ± 0.843	7.7 ± 1.513	0.584	N.S
Liver	47.6 ± 4.440 [a]	44.2 ± 3.545 [ab]	40.550 ± 6.84 [b]	2.296	*
Gizzard	31.600 ± 4.095 [a]	34.300 ± 4.097[ab]	28.350 ± 4.928 [b]	1.964	*
Organ weights (% of carcass weight)					
Heart	0.4557 ± 0.075	0.4305 ± 0.063	0.5119 ± 0.133	0.1395	N.S
Liver	2.4885 ± 0.251	2.5617 ± 0.206	2.6562 ± 0.432	0.0427	N.S
Gizzard	1.6543 ± 0.221 [a]	1.9877 ± 0.196[ab]	1.8393 ± 0.321 [a]	0.1129	*
Associated organs					
Pancreas (g)	4.70 ± 0.4830 [a]	4.50 ± 0.4714 [a]	3.90 ± 0.7746 [b]	0.265	*
Small intestine(cm)	173.50 ± 8.71	171.10 ± 10.2	162.23 ± 15.57	5.31	N.S

A= Conventional diet; B= Semi organic diet option 01; C= Semi organic diet option 02; ± = Standard deviation; SEM= Standard Error of Mean difference; Figure having different superscript in the same row differ significantly ($P < 0.05$); *= 5 % level of significance; NS= non significant. Note: Dietary treatments were started at 4 thday onwards

None of the single bird was dying during the experimental period in treatment A and B. In treatment C, mortality percentage was 3.33%, recorded at the finisher period. The results of mortality percentages were agreement with Bunyamin *et al.,* (2011) that recorded 3% in organic control group and 1% of organic pasture based group. The result was contradicted with the findings of Lampkin (1997) who reported 10% mortality level current organic forming in United Kingdom (UK) and European Union (EU) region. Mortality rate of the of the present study was contradicted with the Cobanoglu et al., 2012 findings who reported that the mortality rates of the organic and conventional group as 1.00% and 2.83% respectively.

The production cost of broiler in different dietary treatments is shown in Table 10. The feed cost was highest in treatment C and the lower in treatment B. Most of the other expenditures were equal among the treatments because uniform conditions were maintained during experimental period. Higher total net profit and the net profit per kg of carcass weights were recorded in treatment A and approximately two times higher than treatment C. Cobanoglu *et al.,* 2012 stated that organic broiler production was profitable relative to conventional boiler production because market price of the organic broilers were twice than conventional broilers. The increment of feed prices resulted from the proposed EU organic livestock regulation could be resulted in a significant loss (Lampkin, 1997). As Table 10 present that the net profit of semi organic diet option C was drastically reduced because of the higher feed cost.

Organic regulations were banned most of the cheap synthetic raw materials. Therefore, additional cost is added to total production cost. In consequently, profit margin would be reduced. The results of the cost evaluation in Table 10 were derived by selling 1kg of broiler meat on LKR 350.00. Major factor which affected to the profitability of organic broiler production was feed cost (Castellini *et al.,* 2006). In present study, Critical factor was the feed cost element which critically affected to the revenue/profit of the each treatment groups whereas other cost elements were remaining constant as equal cost has incurred separately for each treatment.

Table 10. Cost of production and net profit of different dietary treatments

Parameter	Dietary Treatments		
	A	B	C
Total feed cost (LKR.)	3,127.07	2,789.00	4,066.88
Total chick cost (LKR)	2,100.00	2,100.00	2,100.00
Electricity cost (LKR)	1,950.00	1,950.00	1,950.00
Slaughtering cost (LKR)	600.00	600.00	600.00
Other management cost (LKR) [1]	1,750.00	1,750.00	1,750.00
Total production cost (LKR)	9527.09	9,189.00	10,466.88
Total production cost (LKR)/ kg carcass weight	167.16	176.50	224.68
Total sale price (LKR)	19,947.90	1,8230.10	16,304.40
Total net profit (LKR)	10,420.00	9,041.10	5,837.51
Net profit (LKR) /kg carcass weight	182.84	173.66	125.31

A= Conventional diet; B= Semi organic diet option 01; C= Semi organic diet option 02;

Critical factor analysis (Table 11) indicated that the conventional feed was highly productive than both semi organic diets. Return on Investment (ROI) analysis is a performance measure used to evaluate the efficiency of an investment or to compare the efficiency of the number of different investments (Dowan, 2012). ROI analysis of present study (Table 12) indicated that the conventional broiler feeding was given higher return than both semi organic diet options.

Table 1. Calculation of Net Profit to the Critical Factor

Project	A	B	C
Net Profit	10,420.00	9,041.10	5,837.52
Critical Factor (Feed Cost)	3,127.07	2,789.00	4,066.88
Thus,			
Net Profit/Feed Cost	**3.33**	**3.24**	**1.43**
Rank	1	2	3

A= Conventional diet; B= Semi organic diet option 01; C= Semi organic diet option 02

Lampkin (1997) stated that when net margin of conventional broilers were 0.04£ EU and organic broiler production recorded -15£ in UK. The overall profitability of organic table bird production is highly dependent on scale in order to spread fixed costs. The extension of the finishing period from 70 to 81 days, which would be required to meet the current EU proposals, reduces the number of batches which can be finished each year in an individual house from 5 to 4, resulting in a 20% increase in housing costs (Lampkin, 1997). Castellini *et al.,* (2006) findings also proved that production performances of organic broiler production much lower than conventional broiler production and whereby lower the profitability of organic broiler production than conventional production. Cobanoglu *et al.,* (2012) suggested that twice the selling price of organic broiler product than conventional broilers to maintain the profit margin.

Table 2. Calculation of Return on Investment

Project	A	B	C
Investment	12,000.00	12,000.00	12,000.00
Net Profit (a)	10,420.00	9,041.10	5,837.52
Interest income from temporary investment of exceeds funds			
Initial invested funds	12,000.00	12,000.00	12,000.00
Expenses incurred at the beginning of the Research	(9,527.09)	(9,189.00)	(10,466.88)
Excess funds	**2,472.91**	**3,061.00**	**1,533.12**
Period of Research (days)	45	45	45
Interest rate (Savings account)	4.5%	4.5%	4.5%
Thus,			
Interest income (b)	13.71	16.98	8.51
Total Net Profit (a+b)	10,433.71	9,058.08	5,846.03
Thus,			
ROI (Total Net Profit/ Investment)*100%	**86.94%**	**75.48%**	**48.72%**
Rank	1	2	3

A= Conventional diet; B= Semi organic diet option 01; C= Semi organic diet option 02, It is assumed that the excess funds are invested in a savings account at a prevailing interest rate during the research period and all expenses are incurred exactly at the beginning of the research.

CONCLUSION

Organic broiler feeding was not economically viable under local conditions in term of profitability when compared to commercial poultry feeding system in Sri Lanka. For sustain the business it is essential to increase the premium price of organic broiler meat. Organic broiler production with fast growing strains will be profitable. Further research is needed to identify the cheap feed ingredients which capable to use in organic ration formulation. Alternative antibiotics, natural amino acids sources, more vitamin sources, and natural growth promoters, would have to identify. Traditional herbal medicines, spices, and non conventional feedstuff in Sri Lanka would have to direct on the further investigation.

ACKNOWLEDGEMENT

The authors wish to acknowledge Animal Nutrition Division, Veterinary Research Institute for their financial assistance to carry out the above study and allow us to use their laboratory resources, research farm and staff.

REFERENCES

Adil, S., Banday, T., Bhat, G. A., Mir, M. S., and Rehman, M. (2010). Effect of dietary supplementation of organic acids on performance, intestinal histomorphology, and serum biochemistry of broiler chicken. Veterinary medicine international, Volume 2010, Article ID 479485, 7 pages doi:10.4061/2010/479485. [Online] Available: http//:www.ncbi.nlm.nih.gov [Accessed on: 14 May 2012]

Association of Analytical Chemistry, (2005). Official Method of Analysis. National Academic Press. Washington D.C. USA

Blair, R. (2008). Nutrition and Feeding of Organic poultry. CAB International, Oxfordshi OX10 8DE, uk Pp. 01-20.

Bunyamin, S., HakanInci, T. and Turgay,S.(2011). Growth Performance and Carcass Traits of Broiler Reared in Conventional and Organic Conditions. Asian Journal of Animal and Veterinary Advances, 6: 992-1000.

Buchanan, N.P. Hott, J.M. Kimbler, L.B. and Moritz, J.S. (2007). Nutrient Composition and Digestibility of Organic Broiler Diets and Pasture Forages. J Appl Poult Res 16 (1): 13-21 doi:10.1093/japr/16.1.13 [online] Available: http://japr.oxfordjournals.org/ [Accessed on: 14 May 2012]

Castellini, C., Bastianoni, S., Granai, C., Dal Bosco, A., and Brunetti, M. (2006). Sustainability of poultry production using the energy approach: Comparison of conventional and organic rearing systems. Agriculture, ecosystems & environment, 114(2), 343-350. [online] Available: http://orgprints.org/9317/1/emergy_pollo.pdf [Accssesd on :14 May 2012]

Castellini, C., Mugnai, C., and Dal Bosco, A. (2002). Effect of organic production system on broiler carcass and meat quality. Meat science, Elsevier Science Ltd.60(3), 219-225 [online] Available: www.sciencedirect.com/science/article/pii/S0309174001001243 ?[Accessed on: 02 April2012].

Cobanoglu, F, Kucukyilmaz, K, Cinar, M, Bozkurt, M, Catli, AU, and Bintas, E. (2012). Comparing the profitability of organic and conventional broiler production. Revista Brasileira de Ciência Avícola, 16(1), 89-95.

Codex Alimentarius Commission,(1999). Guilines for the production, processing Labeling and Marketing of Organically Produced Foods. Joint FAO/WHO Food Standard Programme [online] Available: http://www.codexalimentarius.net [Accssesd on :14 May 2012]

DAPH (Department of Animal Production and Health), (2011). Livestock Statistics- Key Statistics [online].Available at: http://www.daph.gov.lk/web/index.php? [Accessed on: 02 May 2012].

Down, T. (2012). Profitability Analysis of Broiler Farming Large Scale Producer Enterprises by System Dynamic in West Java Region. Lucrări Ştiinţifice - Seria Zootehnie, vol. 58, 45-48 [online] Available: www.univagro-iasi.ro/revista_zoo/ro/documente/.../Taslim_Dawan.pdf [Accessed on 2012 July- 12]

European Commission, (2005). Organic Food and Farming Research in Europe European Union Publication Office, Brussels. [Online] Available: http://www.ec.europa.eu/research/agriculture/pdf/organic_farming.pdf [Accessed on 2012 July 12]

Fanatico A.C., Owens C,M., and Emmert J.L.,2009. Organic Pouty Production in United State Broiler1. Applied Poultry Reaserch 18: 355-366 [online] Available: http://www.pibs.org/ijps/fin/336.pdf [Accessed on 06 July 2012]

Fanatico A.C., Pillai P.B., Cavitt L.V, Owens C, M., and Emmert J.L.,(2005). Evaluation of Slower GrowingBroiler Genotypes Grown with and Without Outdoor Access: Growth Performance and Carcass Yield1. Applied Poultry Research [Online] 84:1324-1327 Available at: http://www.seorganic/web/2010/pdf [Accessed on 2012- July- 12]

Gao, J. Zhang, H.J. Yu, S.H. Wu, S.G. Yoon, I. Quigley, J. Gao, Y.P. and Qi, G.H. (2008) Effects of Yeast Culture in Broiler Diets on Performance and Immunomodulatory Functions. Poultry Science 87 (7): 1377-1384 doi:10.3382/ps.2007-00418 [online] Available: http//:www.ncbi.nlm.nih.gov/pubmed/18577619 [Accessed on: 13 June 2012]

IFOAM, (2005). The IFOAM Norms for Organic Production and Processing . Bone, Germany. P.p. 31-35 [online] Available : http//:www.ifoam.bio/site/default/filespage/norms_eng_va_2009.pdf. [Accessed 08 May 2012].

Lampkin, N. (1997). Organic Poultry Production. Walsh Institute of Rural Studies. University of Wales.

MLRCD (Ministry of Livestock and Rural Community Development),(2011) January. Livestock Master plan. Ministry of Livestock and Rural Community Development, Sri Lanka. Pp.60-72

National Research Council, (1994). Nutrition Requirement of Poultry. 9th Edition. National Academy Press, Washington D.C. P.p10-25.

Nizam A. A. M., (2011). Sri Lanka is to Establish National Organic Control Authority. Asian Tribune [online]. Edited 2011-04-08 Available: http://www.asiantribune.com/newss/2011/04/08 [Accessed 08 May 2012].

Nollet, L., Huyghebaert, G., and Spring, P. (2008). Effect of different levels of dietary organic (Bioplex) trace minerals on live performance of broiler chickens by growth phases. The Journal of Applied Poultry Research, 17(1), 109-115. [online] Available: http://japr.oxfordjournals.org [Accessed 08 May 2012].

Paryad, A., and Mahmoudi, M. (2008). Effect of different levels of supplemental yeast (*Saccharomyces cerevisiae*) on performance, blood constituents and carcass characteristics of broiler chicks. Afr. J. Agric. Res, 3(12), 836-842. [online] Available: http://www.academicjournals.org/AJAR [Accessed 02 April 2012].

Pedersen M.A., Thamsbary S.M., and Fisker, A.G. (2003) New Production System: Evaluation of Organic BroilerProduction in Denmark, Poultry Science Association. [online] Res12:493-508 Available at: http://www.organicagricenter.com/reaserch/database /livepoultry.asp [Accessed on: 13 June 2012]

Ranaweera, S. (2008). Development of Organic Agriculture in Sri Lanka (Article). Asian Tribune, World Institute for Asian Studies, Vol. 11 No. 382. [online] (Updated Tue, 2008-03-25 01:29pm). Available at: http://www.asiantribune.com/?q=node/10186. [Accessed 08 May 2012].

Samarasingha, K. 2007. Feed and Feed Formulation for poultry in Sri Lanka. Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Peradeniya. Pp. 01.

SLTBP, (Sri Lanka Tourism Bureau- Media Unit) (2011). Sri Lanka Tourism achieves record breaking 750,000 arrivals in 2011. [online] (Updated 24 November 2011). Available at: http://www.sltda.gov.lk/node/679. [Accessed 08 May 2012].

United Kingdom Register of organic Food Standard, (2000). UKROF Standard for Organic Food Standards (Feed). [online] (August 2000 Edition). Available at: http://www.ifoam.org/about_ifoam/standards/norms/norm_documents_library/IBS_V3_20070817.pdf [Accessed on 02 May 2012]