COMPARATIVE STUDIES ON THE PER CENT ORGAN WEIGHTS IN COMMERCIAL BROILER AND LAYER CHICKEN

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Abstract

The weight of internal organs relative to the body weight were studied in broiler and layer chicken of the same age group. The average weights of heart, liver, pancreas and spleen were 8.84±0.30, 35.05±7.15, 4.35±0.74 and 2.26±1.34 grams respectively and these formed 0.42 ±0.04, 1.65±0.22, 0.21±0.04 and 0.105±0.054 per cent of body weight in broiler birds. In layer birds the average weights of heart, liver, pancreas and spleen were 1.52±0.05, 8.09±1.05, 1.24±0.13 and 0.451±0.080 grams respectively and these formed 0.60 ±0.06, 8.09±1.05, 0.49±0.04 and 0.177±0.030 per cent of body weight . There was a significant difference in per cent organ weights among broilers and layers indicating that the mean per cent organ weight of layer chicken is more than that of broiler chicken of the same age group.

Keywords : *Per cent organ weight, Broiler chicken, Layer chicken*

Poultry is one of the fastest growing as well as the ailing industry in India today. While the production of agricultural crops has been rising at a rate of 1.5to 2 percent, the production of eggs and broilers has been rising at a rate of 8 to 10 percent per annum. Driving this expansion is a combination of factors - growth in per capita income, a growing population and innovative management practices.

The fast growth rates and high feed conversion ratios in commercial broiler chicken industry was made possible by advances in genetic selection, management, and nutrition. These attributes promoted an increased workload on the cardiovascular system predisposing birds to metabolic disorders such as right ventricular failure, ascites syndrome, cardiac arrhythmias, cardiopulmonary disorders, and sudden death (Julian, 2005). Acute heart failure (sudden death syndrome-SDS) and chronic heart failure (hypoxemia, ascites) are the leading non-infectious causes of mortality and morbidity in modern broiler flocks. Broilers are highly susceptible to heart failure when compared with other classes of poultry (Korte *et al.,* 1999). Observations made from electrocardiographic data and post mortem findings of otherwise normal flocks revealed that a relatively large number of fast-growing

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broilers shows evidence of subclinical heart disease and may be at risk for acute or chronic heart failure (Olkowski *et al.,* 1997, Olkowski and Classen, 1998). This is likely associated with the genetic selection of broilers for growth and feed conversion efficiency, while neglecting basic anatomical and physiological aspects of internal organs especially vital organs (Scheele, 1997). With this background, studies on the percent organ weights in commercial broiler chicken and comparing it with layer chicken of the same age group will provide some added information for researchers working on internal organs of broiler birds, the vital organs in particular.

Materials and methods

The materials for the present study, the internal organs of commercial broiler and layer chicken were collected from the birds slaughtered at the Meat Technology Unit, Kerala Veterinary and Animal Sciences University, Mannuthy. Samples were collected from a total of 12 birds comprising of six commercial broiler birds and six layer birds belonging to the same age group (45 days post hatch). Prior to slaughter, live body weights of each birds were recorded to the nearest 0.1 g using a digital weighing balance.

Immediately after slaughter and evisceration, heart, liver, spleen and pancreas were collected. Weight of each organ were recorded to the nearest 0.001g using a monopan balance. The percent weight of internal organs relative to the body weight were calculated using Microsoft Excel spread sheet software 2013. The independent sample t test was performed to compare the mean percent weight of internal organs in commercial broiler chicken and layer chicken and the analysis were carried out using Statistical Product and Service Solutions (SPSS) software version 20.

Results and Discussion

Body weight

The mean live bodyweight respectively in 45 days old broiler and layer birds were 2100±192.3 g and 254±2.9 g. A similar study conducted in 1980s (Plavnik and Hurwitz, 1982) reported that the average body weight of broiler chicken of six weeks of age was around 1.5 kilograms and the broilers of that time had the relative organ weight close to that of layer birds of same age group.

Weight of heart

The average weight of heart was 8.84±0.30 g and 1.52±0.05 g respectively in broiler and layer chicken. The mean percent heart weight of the broiler chicken and layer chicken were 0.42 ±0.04 and 0.60 ±0.06 respectively and there was a significant difference indicating that the mean percent heart weight of layer chicken is more than that of broiler chicken (Table 1 & 2). Plavnik and Hurwitz (1982) reported that the mean percent heart weight in broiler males and females of six weeks of age was 0.67± 0.02 and 0.81 ± 0.05 respectively. The results shows that the broiler birds of 1980s were having the percent heart weights almost equal to that in layer birds of the same age group.

Weight of liver

The average weight of liver was 35.05±7.15 g and 8.09±1.05 g respectively in broiler and layer chicken (Table 1). The mean percent liver weight of the broiler chicken and layer chicken were 1.65±0.22 and 8.09±1.05 respectively. There was a significant difference in the mean percent liver weight of commercial broiler and layer chicken and it was more in layer birds (Table 2). This agrees with the findings of Ishi *et al.,* (2000, 2001), who observed that liver of broiler was weighing between 45 to 60 g and Iqbal *et al.* (2014) reported that the mean weight of liver without gall bladder of broiler chicken of six week of age was 47.98 g. Martienz *et al.,*(2015) in a study conducted in 16 week old layer pullets reported that the liver weight was 1.46 g per kg of body weight. The result of the present study shows that the percent contribution of liver to the body weight is much less in broiler birds when compared with the layer birds.

Weight of pancreas

As per the present study the average weight of pancreas found was 4.35±0.74 g and

Table 1. Weight of internal organs and percent organ weight recorded in broiler and layer birds

Organ	Boiler chicken		Layer chicken	
	Organ weight in grams (Mean±SD)	Percent organ weight (Mean±SD)	Organ weight in grams (Mean±SD)	Percent organ weight (Mean±SD)
Heart	8.84±0.30	0.42±0.04	1.52±0.05	0.60±0.014
Liver	35.05±7.15	1.65±0.22	8.09±1.05	3.17±0.38
Pancreas	4.35±0.74	0.21±0.04	1.24±0.13	0.49±0.04
Spleen	2.26±1.34	0.105±0.054	0.451±0.080	0.17±0.030

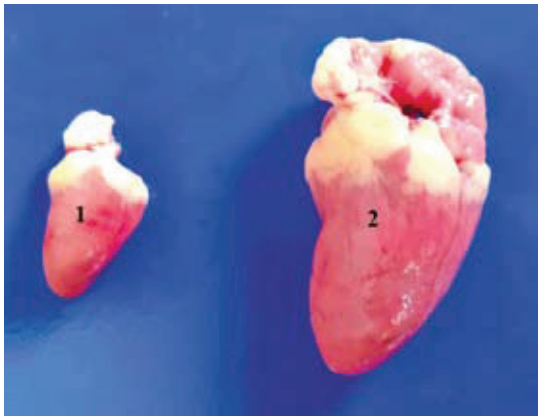
Table 2. Comparison of percent organ weight of commercial broiler and layer chicken

Organ	Percent organ weight in		't' value	p- value
	Broilers (Mean ± SD)	Layers (Mean ± SD)		
Heart	0.42 ±0.04	0.60 ±0.06	9.327	p< 0.001
Liver	1.65±0.22	8.09±1.05	9.327	p< 0.001
Pancreas	0.21±0.04	0.49±0.04	-3.806	p < 0.05
Spleen	0.105±0.054	0.177±0.030	-2.761	p < 0.001

1.24±0.13 g respectively in broiler and layer chicken and the percent pancreas weight in broiler was found to be 0.21±0.04 and in layers it was 0.49±0.04. This indicates that the percent pancreas weight in layers is much greater than the broiler (Table 1 &2). Plavnik and Hurwitz (1982) reported that 0.32 ±0.03 and 0.35 ±0.02 was the percent pancreas weights in 6 week old broiler males and females of that time and the reported body weigh were 1576 ±44 g and 1392 ±42 g respectively in male and female birds. The mean live bodyweight of broiler birds under study was 2100±192.3 g. So we can assume that with the advancement in feed conversion ratio and growth rate of broilers, from 1980s when it reached 2010s the muscle mass increased a lot but the relative organ size reduced much.

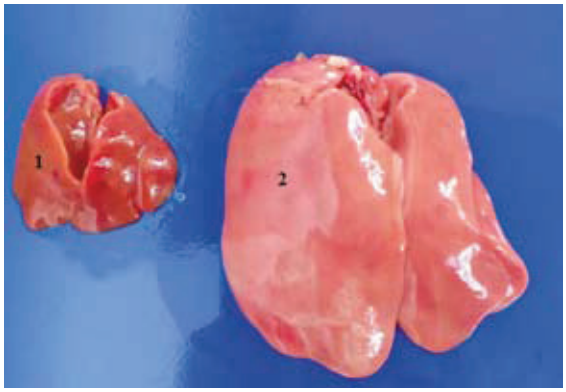
Weight of spleen

The percent weight of spleen in broiler was 0.105±0.054 and that of layer was 0.177±0.030, indicating that the layer birds have a high percent spleen value than the broiler birds (Table 1 &2). But Plavnik and Hurwitz (1982) observed that 0.18 ± 0.02 and 0.16 ± 0.06 was the percent spleen weights of male and female birds of 6 weeks of age which were close to the values in layer chicks of present study. Rodríguez *et al.,* (2006) and Gonzalez Alvarado *et al.,* (2007) did not observe any changes in the relative weight of spleen in laying pullets and broiler birds, respectively, fed different fibre sources.



1. Heart of layer
2. Heart of broiler

Figure 1 Comparison between heart of broiler and layer



1. liver of layer
2. Liver of broiler

Figure 2 Comparison between liver of broiler and layer chicken

1. Pancreas of layer
2. Pancreas of broiler

Figure 3 Comparison between pancreas of broiler and layer

1. Spleen of layer
2. Spleen of broiler

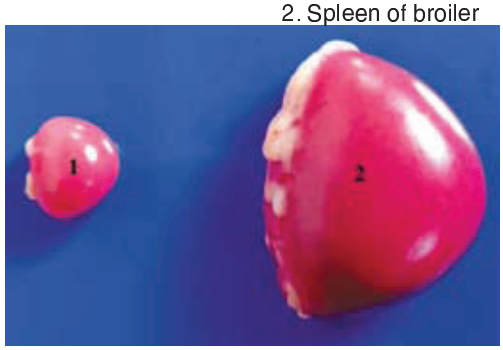


Figure 4 Comparison between spleen of broiler and layer chicken

According to Korte *et al*. (1999), in comparison with other classes of chickens, broilers are highly susceptible to heart failure. Cheriyan (2007) reported that as a result of advances in genetic selection, management and nutrition, the modern day commercial broiler chicken have fast growth rates, high feed conversion ratios and metabolic rates, thereby putting an increased workload in the cardiovascular system which resulted in metabolic, cardiovascular disorders and sudden death and an increased rate of mortality in broiler chicken. But the genetic and nutritional advancement in growth performance did not much concentrate on weight of internal organs in par with body weight. Olkowski (2007) observed that the modern strains of fast growing meat type poultry are highly susceptible to acute heart failure as well as chronic heart failure when compared with the layer breeds of chicken and prevalence rate is much higher in broiler birds (27%) than in layers (1%).

The observations made by these scientists clearly suggest that increasing demands of large body mass of commercial broiler birds are not compensated by their cardiovascular system. In the present study also it is found that the heart weight relative to the body mass is much less in broiler birds when compared with the layer birds of the same age group. The peak mortality due to sudden death syndrome occurs during 12 to 28 days of age and results in heavy economic

loss to the broiler industry. So in future, the researchers must focus on evolving strains of broiler birds with moderate heart size to compensate for demands of its increased body mass. The faster growth rates of the modern broiler lines demands a better management of metabolic activities and disorders for which the internal vital organs such as liver and heart and supporting organs such as pancreas has to be well equipped. The scientists who could evolve strains of birds which can grow up to 2.5 to 3 kilograms within a short span of 35 to 40 days can definitely think of strains with vital organs also growing at such faster rates to compensate with the increasing metabolic requirements. This will mitigate the huge economic loss of broiler industry due to the sudden death syndrome and other non infectious causes of mortality. Since the vital organs such as liver and heart are edible parts, a change in the mass of these organs will not affect the dressing percentage of birds too.

The results of the present study will provide an added information for researchers working on broiler industry to focus more on gross size and weight as well as compensatory functioning of vital internal organs to cope with the increasing demands of fast growth and higher metabolic demands of modern broiler lines.

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