Biochemical and hormonal analysis of different poultry in Kerala

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Abstract

Poultry are domesticated birds kept by humans for their eggs, meat or feathers. These birds are most typically members of the superorder Galloanserae (fowl), especially the order Galliformes (which includes chickens, quails and turkeys). The domestication of poultry took place several thousand years ago. Poultry products are some of the most economical meat protein sources available to consumers. A study was conducted on Biochemical and Hormonal Analysis of Different Poultry in Kerala during July 2017 to February 2018. The biochemical parameters like protein, cholesterol, glucose & triglycerides and their levels were compared among four varieties of poultry like Common domestic fowl, Broiler, White leghorn (*Gallus gallusdomesticus*), Quail (*Coturnixcoturnix*). The hormonal parameters being testosterone, luteinizing hormone(LH), follicle-stimulating hormone(FSH), estrogen, progesterone, thyroid-stimulating hormone(TSH), prolactin & cortisol. Four varieties of poultry were collected from a commercial poultry farm, Pattarkulam, Manjeri (Malappuram). Blood (4ml) were collected from four varieties of poultry using 5ml syringe in a clot activator cuvet. Biochemical and hormonal analysis was done with the help of trainees at Doctor's Speciality Diagnostic Centre, Kondotty (Malappuram) and DB Lulu OP Clinic German Diagnostic Pvt. Ltd, Calicut. Nutritional important of chickens were studied. High amount of protein and glucose; low cholesterol and triglyceride content is found in domestic fowl compared to other three varieties. The hormonal variation in chickens were discussed. An awareness has been made on side effects of eating broiler chickens and healthy dietary habits.

Keyword: Poultry.

Introduction

Human life has always entailed exposure to chemicals. The substances we eat, drink and breathe are composed of chemicals. In recent decades, there has been widespread concern that synthetic chemical substances increasing in number and concentrations and natural substances may adversely affect human health. In response to the concern, such agencies as the Environmental Protection Agency, the Consumer product safety Commission, the Occupational Safety and Health Administration, the Food and Drug Administration and the Department of Agriculture began to monitor the use of chemicals. Toxicity is the degree to which a chemical substance or a particular mixture of substance can damage an organism. "The dose makes the poison" is an adage intended to indicate a basic principal of toxicology. "All things are poison and nothing is without poison; the dosage alone makes it, so a thing is not a poison" (Paracelsus – Father of toxicology). The principle relies on the finding that all chemicals- even food, water and oxygen- can be toxic if too much is being eaten, drunk or absorbed. The toxicity of any particular chemical depends on many factors, including the extent to which it enters an individual's body.

Poultry are domesticated birds kept by human for their eggs, meat or feathers. This birds are most typically members of the superorder Galloanserae (fowl), especially the order Galliformes (which includes chickens, quails and turkeys). The domestication of poultry took place several thousand years ago. The chicken (Gallus Gallusdomesticus)is a type of domesticated fowl, a subspecies of the red jungle fowl (Gallus gallus). Humans keep chickens primarily as a source of food for their meat and eggs and more rarely, as pets. Chickens farmed for meat are called broiler chickens. The White Leghorn Chicken is the most popular breed of white egg laying chickens. P Leghorn chickens will lay an astounding 280 large white eggs per years. Quail (Coturnixcoturnix) is a collective name for several genera of mid-sized birds generally placed in the order Galliformes. Poultry products are some of the most economical meat protein sources available to consumers. Nutritional value of poultry meat is important. People assume that chicken is lower in cholesterol (130mg) than beef, it doesn't mean it's necessarily healthier.

Chicken store fat in different parts of their bodies. Chicken store fat primarily under the skin, and chicken thighs are higher in fat and cholesterol than breast meat.

Hormones enter the food supply in a variety of ways. Modern farming practices often involve supplementary animal feed with growth hormones to promote faster weight gain. All of these hormones have varying effects on human body. Poultry industry in Tamilnadu, has expanded tremendously during the last few years. . In this scenario of hormonal toxification of poultry for economic gain, it was necessary to analyze the hormonal toxicity of the chicken that we consume. So, through this project we can analyze the different toxicants injected to the chicken & to know about its adverse effects on human health. Also biochemical and hormonal analysis in different poultry was conducted.

Methodology

The present study is aimed to detect biochemical and hormonal parameters in different poultry. The biochemical parameters like protein, glucose, cholesterol & triglycerides and their levels were compared among four varieties of chickens like Common domestic fowl, broiler, white leghorn (Gallus gallusdomesticus), quail (Coturnixcoturnix). The hormonal parameters being testosterone, luteinizing hormone (LH), Follicle-stimulating hormone (FSH), cortisol, estrogen, progesterone, thyroid-stimulating hormone (TSH) and prolactin.

Four varieties of chickens were collected from a commercial poultry farm, Pattarkulam, Manjeri (Malappuram). This farm was selected since all fowl varieties of chicken required were available there. Groups of four varieties of chicken namely Common domestic fowl, Broiler, White leghorn (Gallus gallusdomesticus), quail (Coturnixcoturnix) were procured from this farm for further studies. 4ml of chicken blood were collected from a single individual of each of the four groups of freshly cut chicken using 5ml syringe. The blood from syringe is collected in a clot activator cuvet. And the blood in clot activator is kept in room temperature for clotting the blood. Keep it for 24 hours. And analyze the serum for further studies. The sample collection was done at a regular interval of 24 hours. Estimation of biochemical and hormonal parameters were done. It was done with the help of trainees at Doctor's Speciality Diagnostic Centre, Kondotty (Malappuram) and DB Lulu OP Clinic German Diagnostic Pvt. Ltd, Calicut.

By using the values obtained, graphical representation was done. Statistical tools were also used in this study to analyze coefficient of variation. ANOVA test is used. Analysis of variance (ANOVA) is a collection of statistical models used to analyze the differences among group means and their associated procedures. ANOVAs are useful for comparing (testing) three or more groups or variables for statistical significance. So ANOVA is suited for this study.

Result and Discussion

In the present study an attempt has been made to detect Biochemical and Hormonal Analysis of Different Poultry in Kerala. The study was conducted during July 2017 to February 2018.Four varieties of chickens were collected from a commercial poultry farm, Pattarkulam, Manjeri, (Malappuram). The biochemical parameters like protein, cholesterol, Glucose & triglycerides and their levels were compared among four varieties of chickens like Common domestic fowl, broiler, white leghorn (Gallus gallusdomesticus), quail (Coturnixcoturnix). The hormonal parameters being testosterone, luteinizing hormone (LH), Follicle-stimulating hormone (FSH), cortisol, estrogen, progesterone, thyroid-stimulating hormone (TSH) and prolactin.

1-Biochemical Analysis:

The biochemical parameters like protein, cholesterol, glucose & triglycerides and their levels were compared among four varieties of chickens like Common domestic fowl, broiler, white leghorn & quail. Analysis of various biochemical parameters are shown in table no: 1.

Table no: 1- Biochemical Parameters of Different Poultry:

VARIETIES	BLOOD GLUCOSE	PROTEIN	CHOLESTEROL	TRIGLYCERIDES
BROILER	64 mg/dl	3.2 g/dl	107 mg/dl	66 mg/dl
DOMESTIC FOWL	80 mg/dl	5.1 g/dl	129 mg/dl	55 mg/dl
WHITE LEGHORN	58 mg/dl	4.0 g/dl	154 mg/dl	68 mg/dl
QUAIL	77 mg/dl	4.2 g/dl	240 mg/dl	268 mg/dl

1.1-Protein:

Proteins forms the major portion of dissolved substances in plasma. They form the basic structural components of the body and act as a secondary source of energy. Protein is a vital nutrient for poultry and all other classes of animals. In virtue of its amino acid constituents, protein plays a significant role in growth, egg production, immunity, adaptation to the environment and in many other biological functions. From table no: 1, among four varieties of poultry, high protein content is found to be in domestic fowl compared to other varieties. Quail also have high protein content. But broiler have very low amount of protein. Amount of protein is almost equal in white leghorn and quail. So while selecting chickens for meat it is better to opt domestic fowl since it contain high amount of protein.

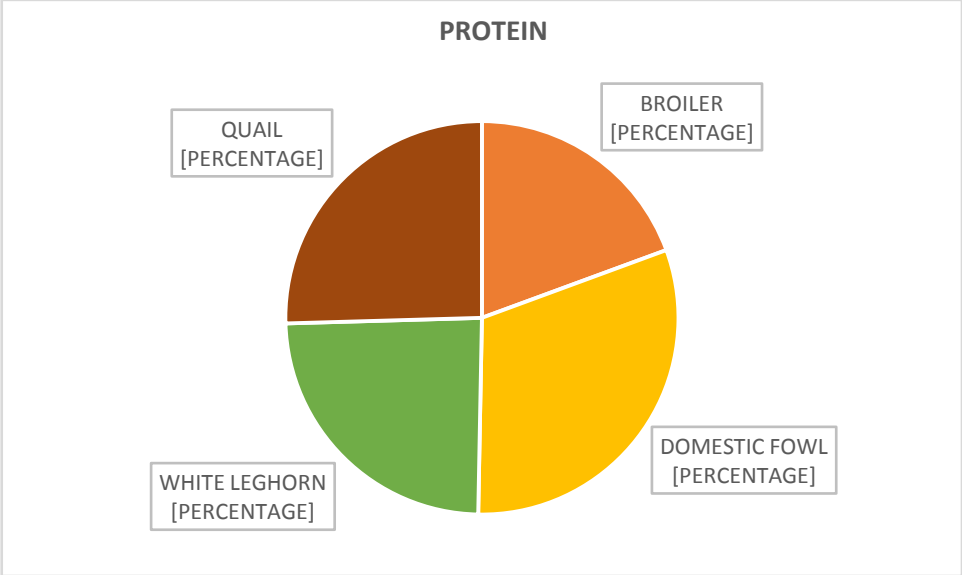

Figure 1: Amount of Protein in Four Varieties of Poultry.

1.2-Cholesterol:

Cholesterol is the main lipid found in the blood, bile & brain tissues. It is also one of the most important steroids of the body & is precursor of many steroid hormones. Cholesterol is a waxy, fat-like substance that circulates in the blood and is found in all cell membranes and nerve fibers of animals. It is found only in foods of animal origin- white meat, fish, eggs and every other meat and dairy product. Poultry contain cholesterol, as well as saturated fat, which can have a negative impact on our cholesterol level. Table no: 1 shows the amount of cholesterol in four varieties of chickens. From the table, highest amount of cholesterol level is found to be in quail compared to other varieties. So it is better to avoid quail meat to reduce the cholesterol level in our body. White leghorn also have high amount of cholesterol. Domestic fowl and broiler have comparatively low amount of cholesterol. So it is better to choose broiler or domestic fowl as a source of meat.

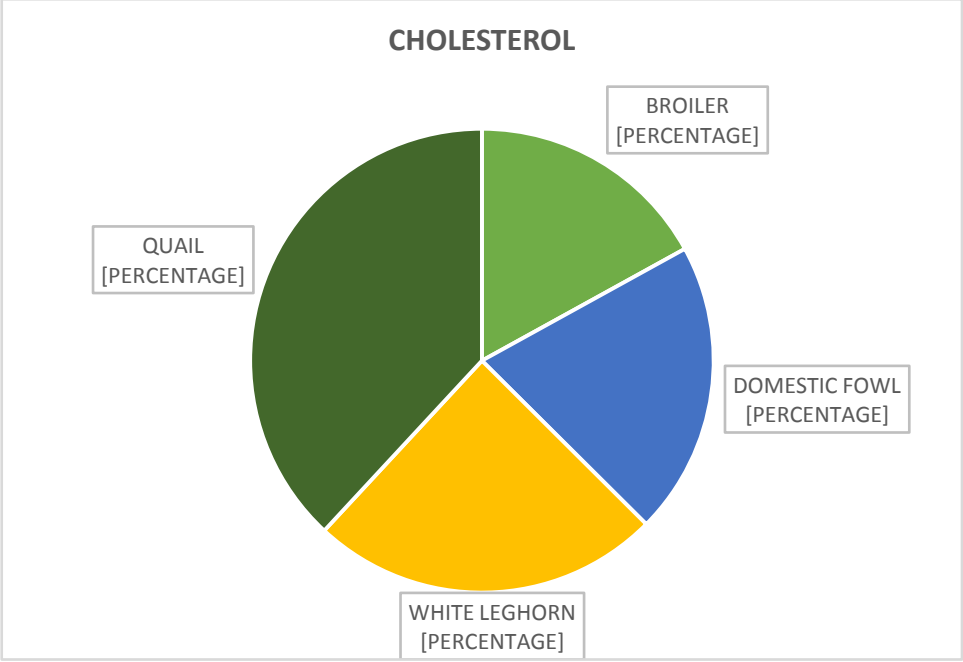

Figure 2: Amount of Cholesterol in Four Varieties of Poultry.

1.3-Glucose:

Glucose is the major carbohydrate present in the blood and serve as a primary source of energy. Dietary carbohydrates are important source of energy for poultry. Cereal grains such as corn, wheat and barley contribute most of the carbohydrates to poultry diets. From figure-3 it is clear that high amount of glucose level is found to be in domestic fowl (29%). Quail contains 27% of blood glucose, 23% in broiler & 21% in white leghorn. While consuming, high amount of energy will get from domestic fowl and also from quail. So it is better to choose domestic fowl as a source of energy from animal meat.

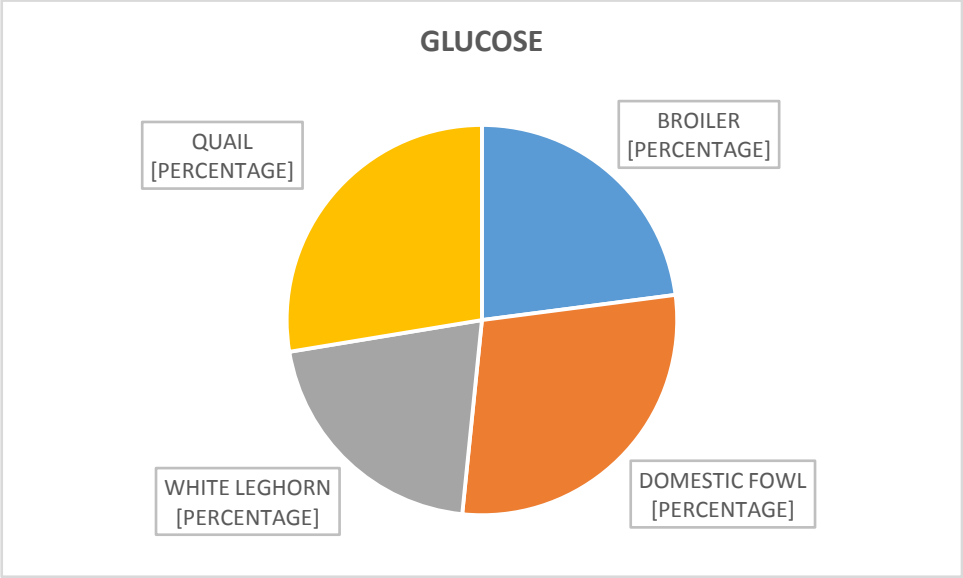

Figure 3: Amount of Glucose in Four Varieties of Poultry.

1.4-Triglycerides:

Triglycerides are esters of fatty acids and are hydrolyzed to glycerol and free fatty acids. Triglycerides are fat stored by body. Poultry such as chicken and turkey are naturally lower in fat than red meat. Remove the skin to eliminate the layer of fat that rests between the skin and meat. So to reduce the amount of fat in our body always remove skin from poultry. From table no: 1, it is clear that highest amount of triglycerides have to be seen in quail compared

to other varieties. So it is better to avoid quail meat in order to reduce the risk of high triglyceride level. The value from 200 to 499 considered as high level of triglycerides. Since quail contains 268 mg/dl of triglycerides when consuming its meat, it is obviously increase the level of triglycerides in our body. In other varieties amount is below 150 mg/dl, so it is considered as normal.

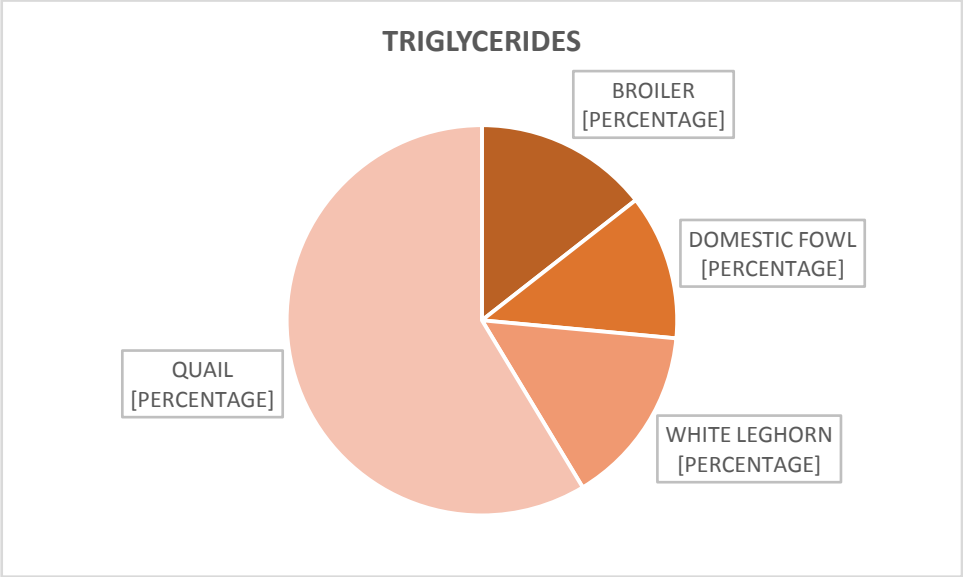

Figure 4: Amount of Triglycerides in Four Varieties of Poultry.

2-Hormonal Analysis:

2.1. Testosterone

Table no: 2- amount of Testosterone in four varieties of poultry.

HORMONES	VARIETIES	DAY 1	DAY 2	DAY 3
TESTOSTERONE	BROILER	55.93 ng/dl	55.12 ng/dl	58.14 ng/dl
	DOMESTIC FOWL	23.13 ng/dl	24.92 ng/dl	22.62 ng/dl
	WHITE LEGHORN	41.22 ng/dl	42.61 ng/dl	45.32 ng/dl
	QUAIL	36.64 ng/dl	34.61 ng/dl	38.62 ng/dl

Amount of testosterone is varying among four varieties (figure 5). In domestic fowl, white leghorn and quail the hormonal content does not show significant variation. The significant variation is seen in the case of broiler. It may be due to the extra intake of hormones in broiler either orally or through injection. So it is better to choose the meat of domestic fowl which have very low testosterone compared to other varieties.

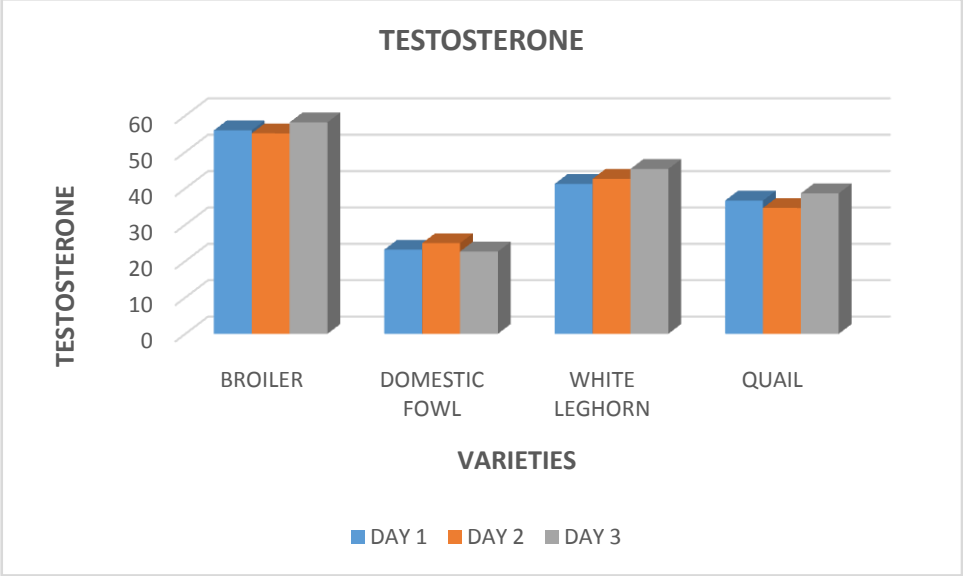

Figure 5: amount of Testosterone in four varieties of poultry.

2.2-Luteinizing Hormone (LH):

Table no: 3- amount of LH in four varieties of poultry.

HORMONE	VARIETIES	DAY 1	DAY 2	DAY 3
LH (LUTEINIZING HORMONE)	BROILER	0.28 MIU/ml	0.37 MIU/ml	0.52 MIU/ml
	DOMESTIC FOWL	0.19 MIU/ml	0.27 MIU/ml	0.15 MIU/ml
	WHITE LEGHORN	0.19 MIU/ml	0.19 MIU/ml	0.14 MIU/ml
	QUAIL	4.12 MIU/ml	5.19 MIU/ml	6.43 MIU/ml

Like mammals, LH also induces ovulation in birds. Table no: 3 shows the amount of LH hormone in domestic fowl, white leghorn, broiler and quail. From figure 6, it is clear that amount of LH is very low in domestic fowl, white leghorn and broiler.

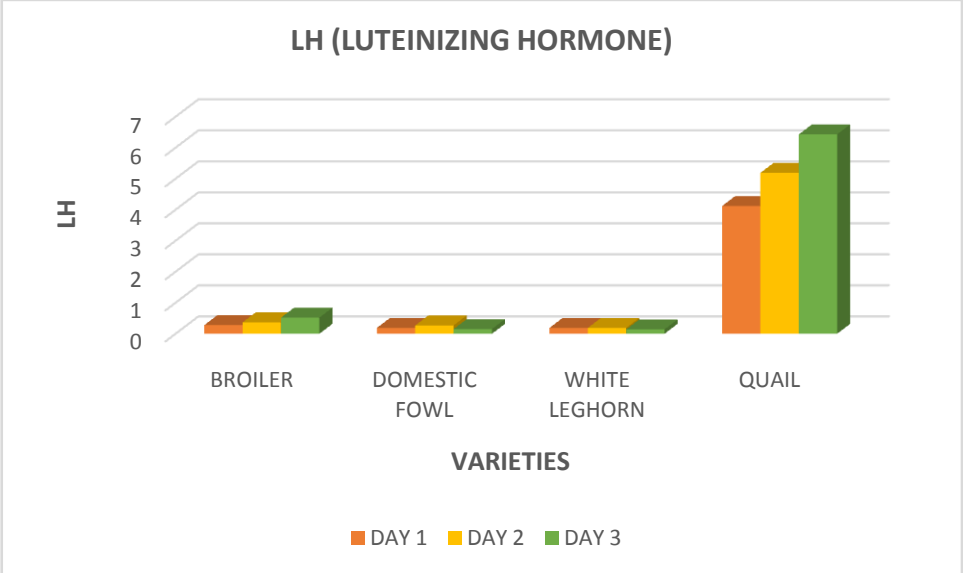

Figure 6: Amount of LH in Four Varieties of Poultry.

2.3-Follicle Stimulating Hormone (FSH):

Table no: 4- amount of FSH in four varieties of poultry.

HORMONE	VARIETIES	DAY 1	DAY 2	DAY 3
FSH (FOLLICLE STIMULATING HORMONE)	BROILER	0.16 MIU/ml	0.24 MIU/ml	0.38 MIU/ml
	DOMESTIC FOWL	0.63 MIU/ml	0.72 MIU/ml	0.81 MIU/ml
	WHITE LEGHORN	0.86 MIU/ml	0.86 MIU/ml	0.62 MIU/ml
	QUAIL	0.91 MIU/ml	1.31 MIU/ml	1.11 MIU/ml

In chickens, FSH is mainly for egg laying. Some chickens are raised for meat (broiler), while others are primarily for eggs (white leghorn), and some are used for meat as well as eggs (domestic fowl & quail). From table no: 4, the amount of FSH is found to be higher in quail. From figure 7, very low amount of FSH is seen in broiler. Broiler is raised specifically for meat production and it have no role in egg production, so the amount of FSH is very low in broiler compared to other varieties. Common domestic fowl shows gradual increase in the level of FSH.

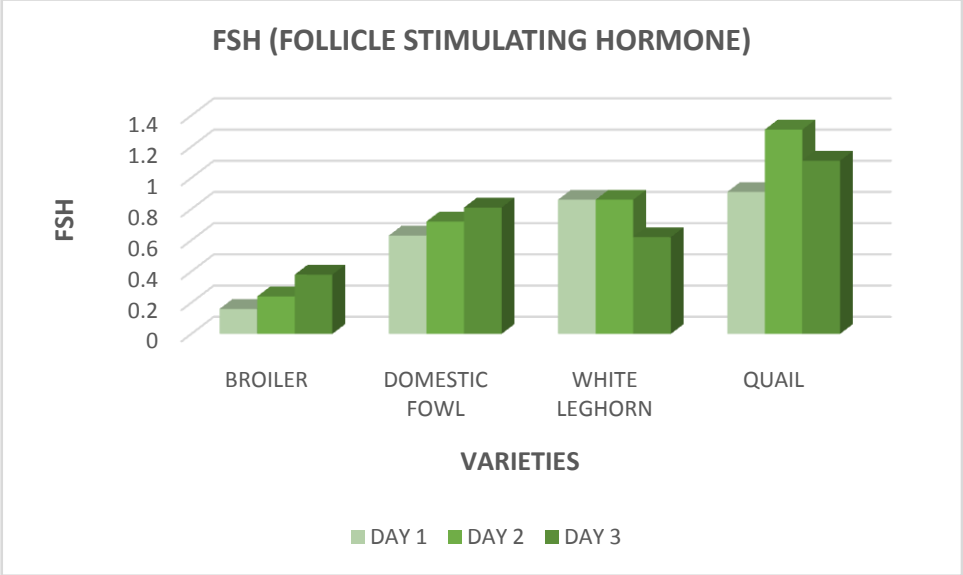

Figure 7: Amount of FSH in Four Varieties of Poultry.

2.4-Estrogen:

Table no: 5- amount of Estrogen in four varieties of poultry.

HORMONE	VARIETIES	DAY 1	DAY 2	DAY 3
ESTROGEN	BROILER	158.67 Pg/ml	160.62 Pg/ml	156.14 Pg/ml
	DOMESTIC FOWL	58.96 Pg/ml	58.91 Pg/ml	56.62 Pg/ml
	WHITE LEGHORN	126.82 Pg/ml	126.72 Pg/ml	125.81 Pg/ml
	QUAIL	110 Pg/ml	107.81 Pg/ml	103.92 Pg/ml

From table no: 5 broiler contains highest level of estrogen compared to other varieties (160.62 pg/ml). The high level of estrogen in broiler may be due to the injection of estrogen. So it is better to avoid broiler and prefer the meat of domestic fowl. As steroid hormones like estrogen,

progesterone etc are injected to the fowl, they fasten growth in human who consume them, leading to obesity and related diseases.

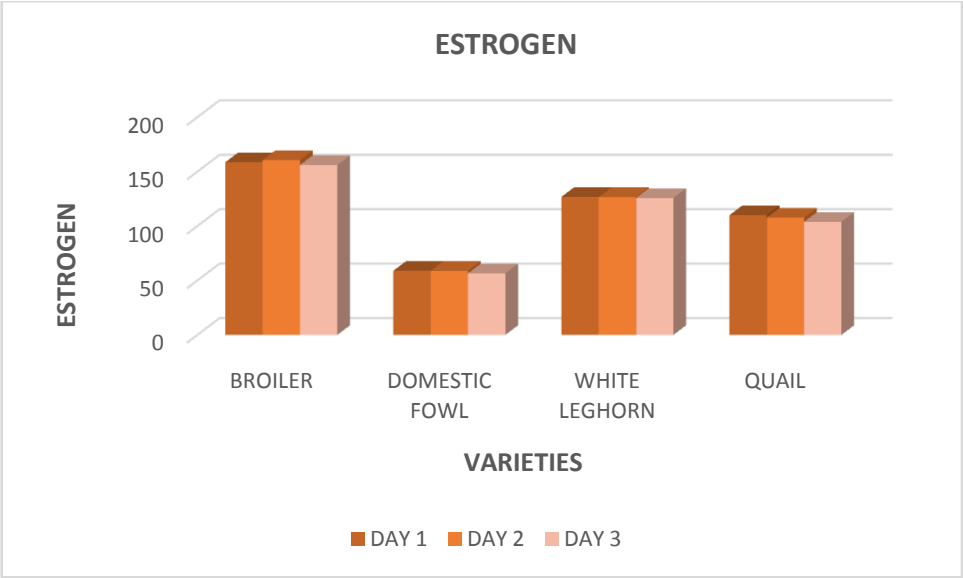

Figure 8: Amount of Estrogen in Four Varieties of Poultry.

2.5-Progesterone:

Table no: 6- Amount of Progesterone in Four Varieties of Poultry.

HORMONE	VARIETIES	DAY 1	DAY 2	DAY 3
PROGESTERONE	BROILER	0.10 ng/ml	0.10 ng/ml	0.10 ng/ml
	DOMESTIC FOWL	0.10 ng/ml	0.20 ng/ml	0.10 ng/ml
	WHITE LEGHORN	0.60 ng/ml	0.70 ng/ml	0.60 ng/ml
	QUAIL	0.4 ng/ml	0.4 ng/ml	0.5 ng/ml

Progesterone have a crucial role in egg production in poultry. From table no: 6, it is clear that high amount of progesterone is found in white leghorn (0.6 & 0.7 ng/ml). It is because; white leghorn will lay 280 large white eggs per year. So the amount of progesterone is high in white leghorn compared others. Broiler is raised specifically for meat production, so the amount of progesterone is very low in broiler. From figure 9, we can conclude that, egg laying chickens like white leghorn and quail have high amount of progesterone than domestic fowl and broiler.

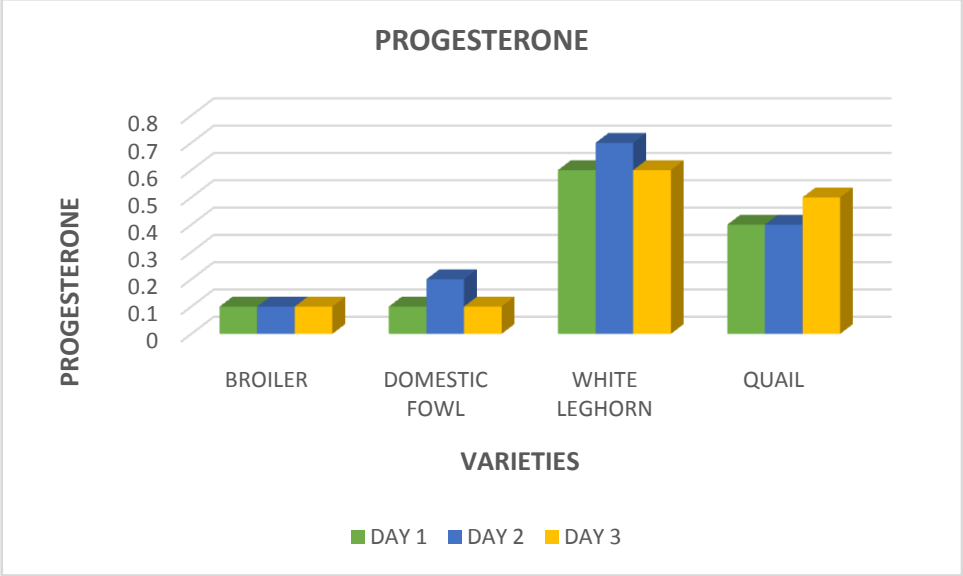

Figure 9: Amount of Progesterone in Four Varieties of Poultry.

2.6-Thyroid-Stimulating Hormone (TSH):

Table no: 7- Amount of TSH in Four Varieties of Poultry.

HORMONE	VARIETIES	DAY 1	DAY 2	DAY 3
TSH (THYROID STIMULATING HORMONE)	BROILER	0.014 µIU/ml	0.012 µIU/ml	0.015 µIU/ml
	DOMESTIC FOWL	0.01 µIU/ml	0.016 µIU/ml	0.012 µIU/ml
	WHITE LEGHORN	0.01 µIU/ml	0.01 µIU/ml	0.012 µIU/ml
	QUAIL	0.018 µIU/ml	0.018 µIU/ml	0.016 µIU/ml

The thyroid glands in birds are paired organs oval in shape and dark red in colour. It becomes functional and secretes T_4 by 10-11 days of incubation. Both T_3 and T_4 have equal potencies for preventing goiter, stimulating body weight, comb growth, influencing oxygen consumption and heart rate. Table no: 7, shows the amount of TSH in four varieties of chickens. The amount is comparatively higher in quail (0.018 µIU/ml). Other varieties show almost equal amount of TSH level (Figure 10).

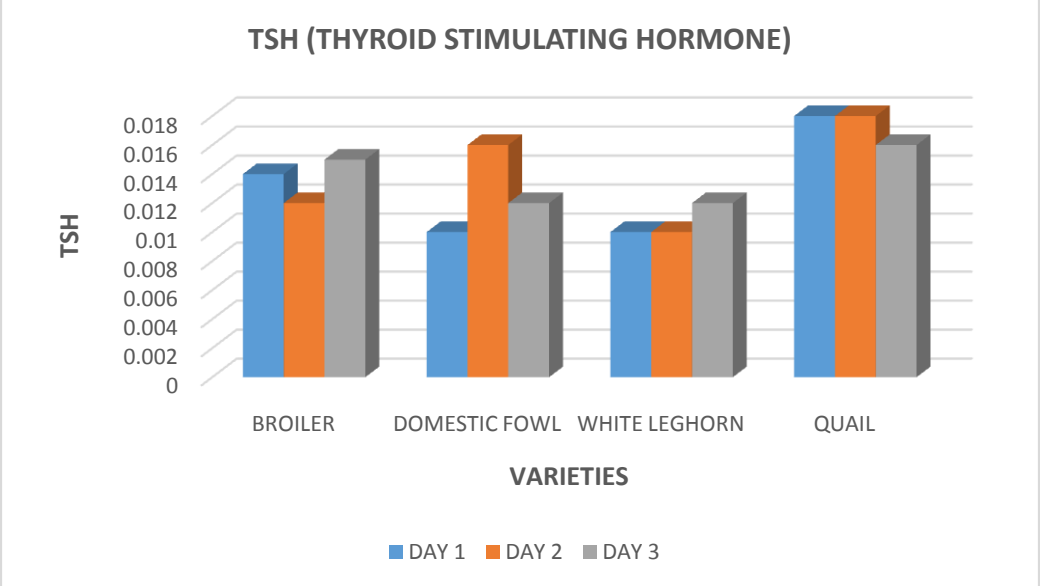

Figure 10: amount of TSH in four varieties of poultry.

2.7-Prolactin:

Table no: 8- amount of Prolactin in four varieties of poultry.

HORMONE	VARIETIES	DAY 1	DAY 2	DAY 3
PROLACTIN	BROILER	0.32 ng/ml	0.31 ng/ml	0.35 ng/ml
	DOMESTIC FOWL	9.11 ng/ml	8.92 ng/ml	7.12 ng/ml
	WHITE LEGHORN	1.96 ng/ml	2.11 ng/ml	1.12 ng/ml
	QUAIL	1.14 ng/ml	1.11 ng/ml	2.33 ng/ml

In birds, prolactin is related to either reproduction or to osmoregulation and possibly in the regulation of metabolism and growth in some birds. From table no: 8, the amount of prolactin is very high in domestic fowl (9.11 ng/ml). Very low amount is found to be in broiler (0.35 ng/ml). Compare to domestic fowl, White leghorn & quail have low amount of prolactin (figure 11).

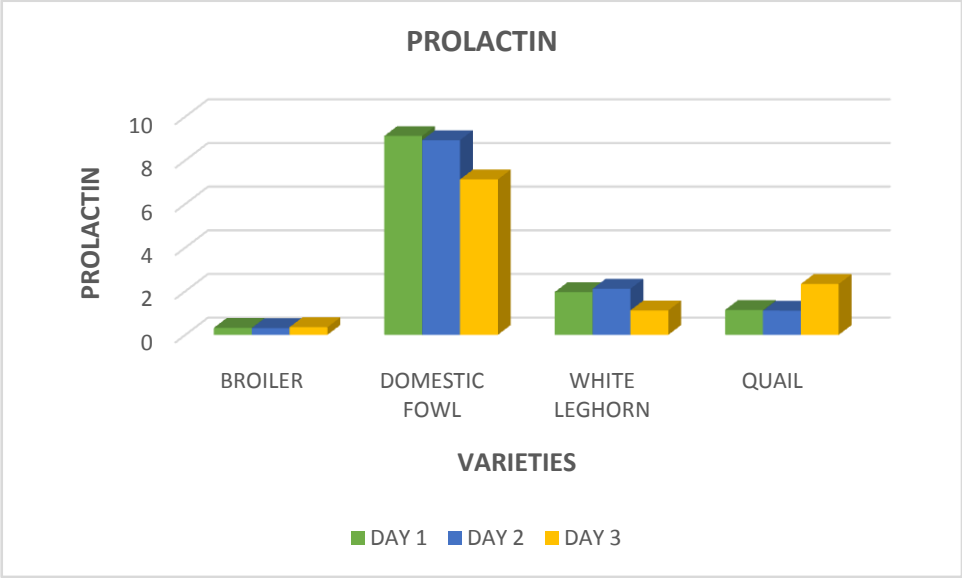

Figure 11: Amount of Prolactin in Four Varieties of Poultry.

2.8-Cortisol:

Table no: 9- Amount of Cortisol in Four Varieties Of Poultry.

HORMONE	VARIETIES	DAY 1	DAY 2	DAY 3
CORTISOL	BROILER	1.31 µIU/ml	1.11 µIU/ml	1.21 µIU/ml
	DOMESTIC FOWL	0.50 µIU/ml	0.41 µIU/ml	0.39 µIU/ml
	WHITE LGHORN	1.01 µIU/ml	1.11 µIU/ml	1.08 µIU/ml
	QUAIL	1.42 µIU/ml	1.41 µIU/ml	1.52 µIU/ml

In birds, with increased levels of cortisol will have slower feather growth during their molting period and an extended period of poor flight. As a result, many birds have reduced levels of cortisol when they molt so as to prevent the degradation of their new feathers. Increased levels of cortisol in chicks leads to increased begging for food and aggressiveness. Table no: 9 shows the amount of cortisol in four varieties of chickens. From the table, the value is higher in quail (1.52 µIU/ml). Very low amount of cortisol is found to be in domestic fowl (figure 12).

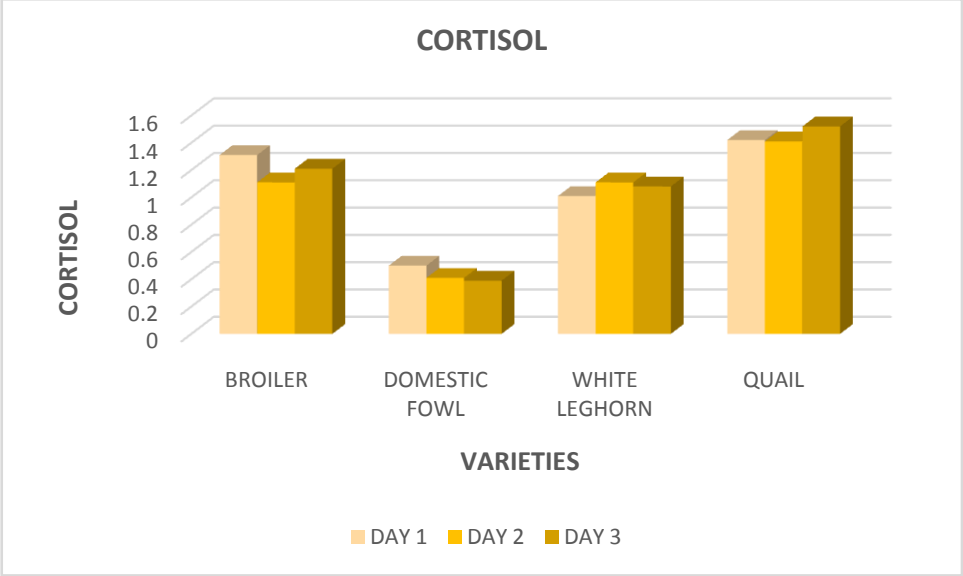

Figure 12: Amount of Cortisol in Four Varieties of Poultry.

Analysis of biochemical parameters like protein, cholesterol, glucose and triglycerides among four varieties of poultry like Common domestic fowl, Broiler, White leghorn & Quail gives the nutritional importance of food that we consume. From the analysis, it is found that domestic fowl contain high amount of protein. So to get high quantity of protein from chicken, it is better to select domestic fowl rather than broiler, which contain very low amount of protein. Quail contain highest amount of cholesterol. So it is better to avoid quail meat to reduce the cholesterol level in our body. In the case of cholesterol, choose broiler or domestic fowl as a source of meat, which contains comparatively low amount of cholesterol. Domestic fowl contain high amount of glucose. So it is better to choose domestic fowl as a source of energy from animal meat. The highest amount of triglycerides have to be seen in quail compared to other varieties. In order to reduce the risk of high triglyceride level it is better to avoid quail meat and choose domestic fowl, which contain very low amount of triglycerides.

Analysis of hormonal concentration like testosterone, LH, FSH, estrogen, progesterone, TSH, prolactin and cortisol gives the hormonal contents of different poultry. Steroid hormone like testosterone and estrogen are very high in broiler chicken compared to other varieties. It may be due to the extra intake of hormone in broiler chicken. Domestic fowl contain very low amount of testosterone and estrogen. Amount of LH & FSH is very high in quail and low in other three varieties. Progesterone level is high in white leghorn. So in white leghorn for high egg production, progesterone may be added to its feed. There is no significant variation in the amount of TSH in four varieties. Prolactin level is high in domestic fowl and others have very low amount of prolactin. Quail, white leghorn and broiler have comparatively high amount of cortisol and domestic fowl contain very low amount of cortisol.So, it is important to opt for free-range organically raised chicken to avoid any additives.

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