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OBSERVATIONS ON MORTALITY IN CAGED LAYING CHICKENS

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ABSTRAK

Observations on mortality in laying chicken

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Pengajian ini dibuat untuk mengenalpasti sebab-sebab kematian di dalam ladang ternakan ayam penelur. Terdapat 1,241 kematian dalam jangka masa lima belas hari. Ini adalah 0.5% daripada populasi yang mengandungi 240,192 ayam-ayam penelur. Lima sebab-sebab kematian yang paling ketara ialah masalah reproduksi (33.7%), kanibalisma (20.5%), hati berlemak dan hati yang pecah (12.9%), lesi yang melibatkan ginjal (8.1%) dan neoplasia (7%0). Pengajian ini juga menunjukkan hubungan yang linear di antara prolap kloaka dan duktus ovari dengan umur ayam; prolap di dapati berlaku pada kadar yang lebih pada ayam-ayam penelur yang lebih muda. Selain dari itu terdapat juga satu hubungan yang linear di antara kanibalisma dengan umur. Hati berlemak dan hati yang pecah biasanya didapati dalam ayam-ayam yang berumur lebih daripada 30 minggu. Lesi yang melibatkan ginjal didapati berlaku pada semua kumpulan ayam-ayam penelur tersebut.

Abstract

Observations on mortality in caged laying chickens

by Ng Siew Thiam

supervised by Dr. Chooi Kum Fai

This study was carried out to determine the incidence and causes of mortalities in a commercial layer farm. There were 1,241 mortalities in a population of 240,192 birds over a fifteen day period, giving a "background" mortality of 0.5%. The five major causes of mortality were reproductive disorder (33.7%), cannibalism (20.5%), fatty liver and hepatic rupture (12.9%), kidney lesions (8.1%) and neoplasia (7%). There was a linear relationship between incidence of prolapsed cloaca and oviduct, and age. A higher incidence of clocal prolapse was observed in younger birds. There was also a linear relationship between incidence of cannibalism and age. A higher incidence of cannibalism was observed in older birds. The incidence of fatty liver and hepatic rupture was more common in birds over thirty weeks of age. Kidney lesion was found to occur randomly among the various age groups.

INTRODUCTION

In 1985, there were 12.06 million commercial layer birds kept in more than 2,500 layer farms throughout Malaysia [Oh, 1986]. One of the problems encountered in these farms during disease or production investigation is the presence of "background" diseases which causes continuous low level mortality. Some indication of the causes of these diseases can be obtained from autopsy examination of commercial birds at diagnostic laboratories but the value of these data is limited [Jordon 1965, Jackson et al., 1972]. The birds examined in such cases are usually a bias sample as a particular disease is always occuring in the flock at the time of examination.

Mortality in broiler chickens has been studied in Malaysia by Tan [1986]. However, no similar studies on caged layers have been carried out locally. In view of this, a study on mortality in caged laying chickens was carried out with the following objectives:

1. To determine the incidence of "background" mortality.
2. To determine the causes of mortality, its frequency and relationship to age.

LITERATURE REVIEW

There have been many surveys on "background" mortality in layers. Randall et al. [1977], Jones et al. [1978] and North [1978] reported monthly mortalities of 2.5%, 1-1.3% and 0.5-2% respectively. Records from University Pertanian Malaysia poultry commercial unit from 1980 to 1984 shows an average monthly mortality of 1.6%. McArdle [1972], Nesheim et al. [1979] and Flock [1986] reported mortality of 5-10%, less than 10% and 4.2% per year respectively. North [1978] attributed monthly mortality of over 1% to poor management.

The causes of mortality in different flocks varies. Reproductive disorders which include prolapsed cloaca and oviduct, egg peritonitis, impacted oviduct, salpingitis, ruptured oviduct, cystic ovary and internal lay were the most commonly diagnosed. Jones et al. [1978] reported that 24.5% of all mortalities were due to reproductive disorders. Grimes [1975] reported that prolapse and cannibalism of the vent accounted for 17.1-17.4% of all causes of mortality.

Randall et al. [1977] reported 15.1% of all mortalities were due to reproductive disorders and egg peritonitis was the most common of all reproductive disorders and the frequency increases as the birds get

older. Bergmann et al. [1984] reported egg peritonitis as the second most important causes for condemnation of slaughtered hens.

In studies by Jones et al. [1978] and Randall et al. [1977], cannibalism accounted for 24% and 11% respectively of all mortalities. Cannibalism was found to be more common in lighter breeds of chicken [Hungerford, 1969, Gordon and Jordon, 1982]. The incidence of cannibalism was highest immediately after caging and at the start of lay [Randall et al., 1977]. Hughes and Duncan [1972] suggested that cannibalism arises as a result of the interaction of individual birds and the environment.

Out of 2,615 specimens examined, Randall et al. [1977] discovered that kidney lesion were the most common diagnosis accounting for 20% of total mortality. The lesions of nephrosis, nephritis and visceral gout were observed in birds of all ages In earlier studies, kidney lesions accounted for 15% [Goss, 1940], 4% [Loliger, 1971] and 0.65-1.3% [Grimes, 1975] of total mortality. Jones et al. [1978] reported that kidney lesions were the third most important cause of mortality.

Fatty liver and hepatic rupture, also known as fatty liver haemorrhagic syndrome was first reported in America in 1954. The disease occur mainly in the

heavier brown egg layers [Coutts, 1981]. Dimitrov et al. [1980] studied the disease in two flocks of laying hens over a period of three years and reported that mortality due to this condition ranges from 0.4-2% per year in one flock and 0.3-2.4% per year in another flock. Grimes [1975] attributed the variation in occurence of the disease to differences in the feeding program and reproductive maturity of the birds; he recorded an increase in the disease frequency 10-12 weeks after 50% egg production was attained. Similarly, Randall et al. [1977] reported that the incidence of fatty liver and hepatic rupture increases towards end of lay.

Neoplasm which include lymphoid tumour and tumour of other cell origin are common diagnoses in layers. Randall et al. [1977] and Jones et al. [1978] reported that neoplasms accounted for 15% and 10.5% respectively of all mortality. Grimes [1975] reported that 26.4% of all mortality and culls were due to tumours.

MATERIALS AND METHODS

The study was carried out in a commercial layer farm in Negri Sembilan. At the start of the study, there was a laying population of 240,192 birds of various ages. All birds in the farm were housed in conventional battery cages with two birds to a cage. Cages were arranged into three tiers. Birds kept in the farm were of two brown strains; Hisex Brown and Golden Comet. The two strain were mixed during the pullet stage. Four brands of commercial feed were used. All birds were fed manually and ad libitum. Cup waterers were used with birds in two adjacent cages sharing one cup. All birds were vaccinated and the vaccination program was shown in Appendix I.

The study was carried out for a period of 15 days. Prior to the start, the population under study was divided into groups according to age, with a difference of four weeks between groups.

During the study, dead birds were collected in the morning and necropsy examinations were performed immediately. Diagnosis was based on gross lesions. The most significant lesion[s] were recorded. Samples for histopathological examination were collected whenever necessary. Tissues for histopathology were fixed in 10% buffered formalin. Birds that died in the afternoon

were collected the following morning. Necropsy was not done on culled birds. The data obtained was analysed with STATGRAPHICS computer program produced by Statistical Graphics Corp.

RESULTS

A. Overall mortality

Figures for overall mortality are shown in table 1. Percentage mortality ranges from 0.3-0.8% in the 13 groups. A total of 1,241 mortalities were recorded, thus giving an overall mortality of 0.5% for the 15 days period.

Table 1

Mortalities in different age groups

Age[weeks]	Population	Mortality	Percentage
19-22	28,743	82	0.3
23-26	22,135	177	0.8
27-30	22,438	111	0.5
31-34	21,841	112	0.5
35-38	18,053	93	0.5
39-42	20,933	93	0.4
43-46	22,552	81	0.4
47-50	17,721	65	0.4
51-54	14,416	110	0.8
55-58	12,352	45	0.4
59-62	15,143	79	0.5
63-66	11,192	90	0.8
67-70	12,673	103	0.8
Total	240,192	1,241	0.5

B. Causes of mortality

The various causes of mortality are listed in table 2. Reproductive disorders were the most common cause of mortality accounting for 33.7% of all mortalities. This was followed by cannibalism [20.5%], fatty liver and hepatic rupture [12.9%], kidney lesions [8.1%] and neoplasia [7%]. The above five groups of lesions accounted for 82.3% of all motality in the farm.

Table 2

Causes of mortality

Lesion group	No.	%	Total	%
Reprod. disorders			418	33.7
prolapsed cloaca and oviduct	272	21.9		
egg peritonitis	87	7.0		
impacted oviduct	44	3.5		
oophoritis	12	1.0		
salphingitis	2	0.2		
internal lay	1	0.1		
Cannibalism	255	20.5		
Fatty liver	160	12.9		
Kidney lesions			101	8.2
nephrosis/tis	57	4.6		
visceral gout	44	3.6		
Neoplasia			87	7.1
lymphoid tumour	44	3.6		
other tumour	43	3.5		
Respiratory diseases			33	3.3
pneumonia	6	0.5		
pulm. congestion	27	2.1		
Cardiovascular	3	0.2		
Septicaemia	4	0.3		
Emaciation	28	2.3		
No diagnosis	33	2.6		
Others	119	9.6		
Total	1,241	100.0		

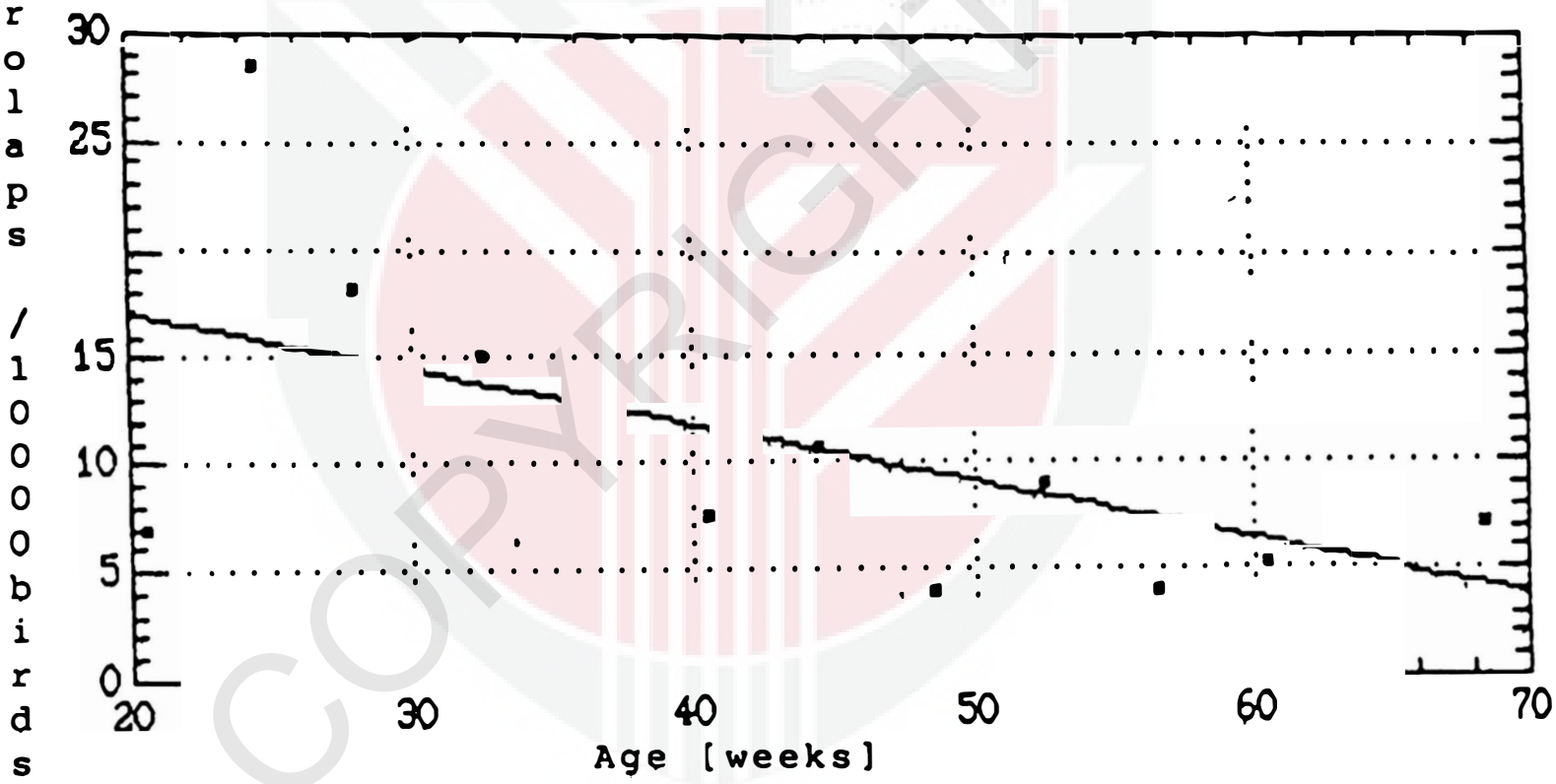
C. Relationship between disease and age

i) Disorder of reproductive system

Prolapsed cloaca and oviduct was the most common of all the reproductive disorders accounting for 65.1% of mortalities in this group. Incidence of this disease decreases from 28.5 per 10,000 in 23-26 weeks age group to 7.1 per 10,000 in 67-70 weeks age group [Figure 1].

Figure 1

Regression of prolapsed cloaca and oviduct on age



The regression equation for the graph is

$$Y = 22.4 - 0.27X$$

Correlation coefficient [r] = -0.61

where y = number of mortality due to prolapse cloaca and oviduct per 10,000 birds

X = age of birds in weeks

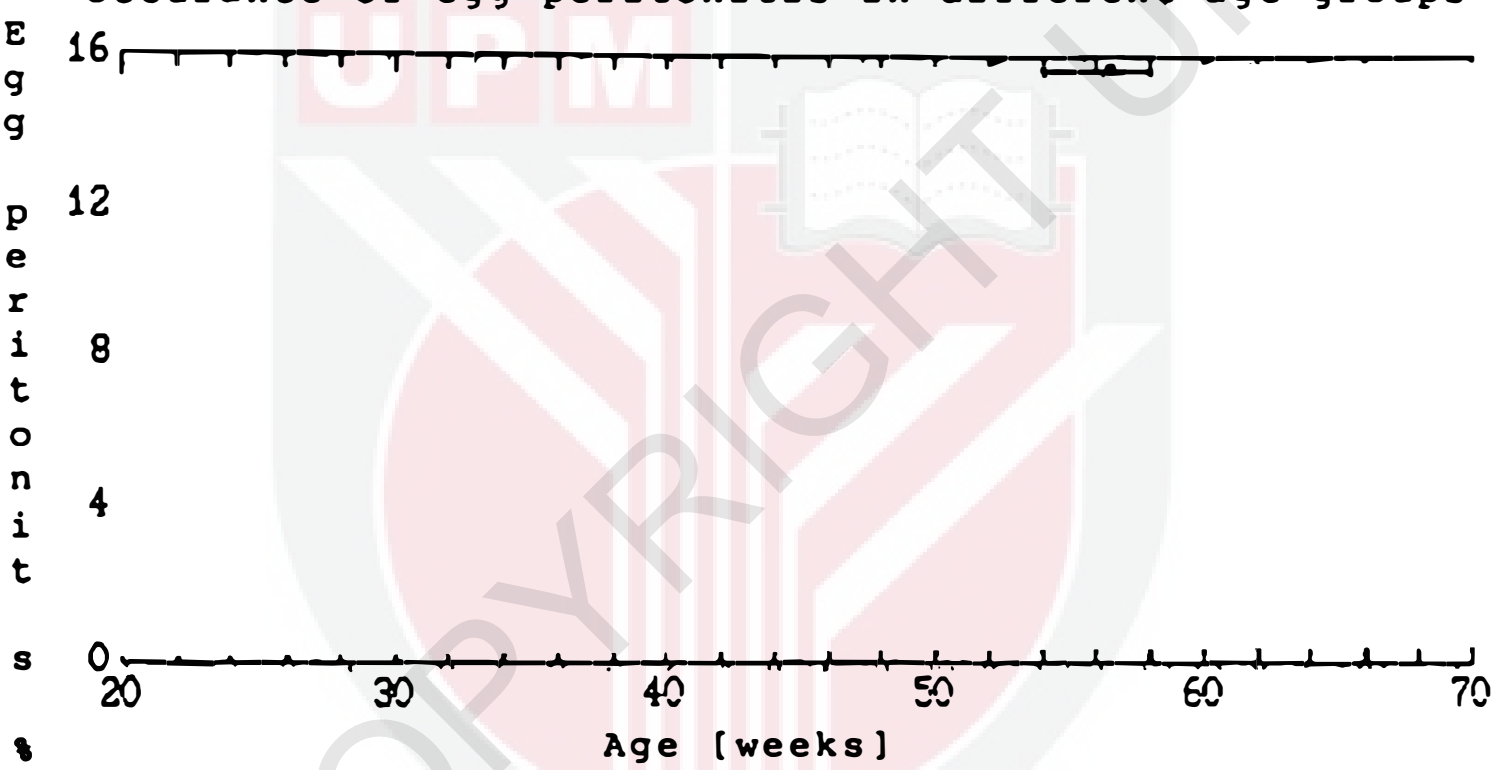
19 weeks< X <70 weeks

and the regression coefficient[-0.27] equals the weekly

decrease in incidence of prolapse cloaca and oviduct.

Egg peritonitis was found to be common in all age groups [Figure 2] except those at 19-22 weeks. the highest incidence was recorded in birds that were 55-58 weeks old.

Figure 2

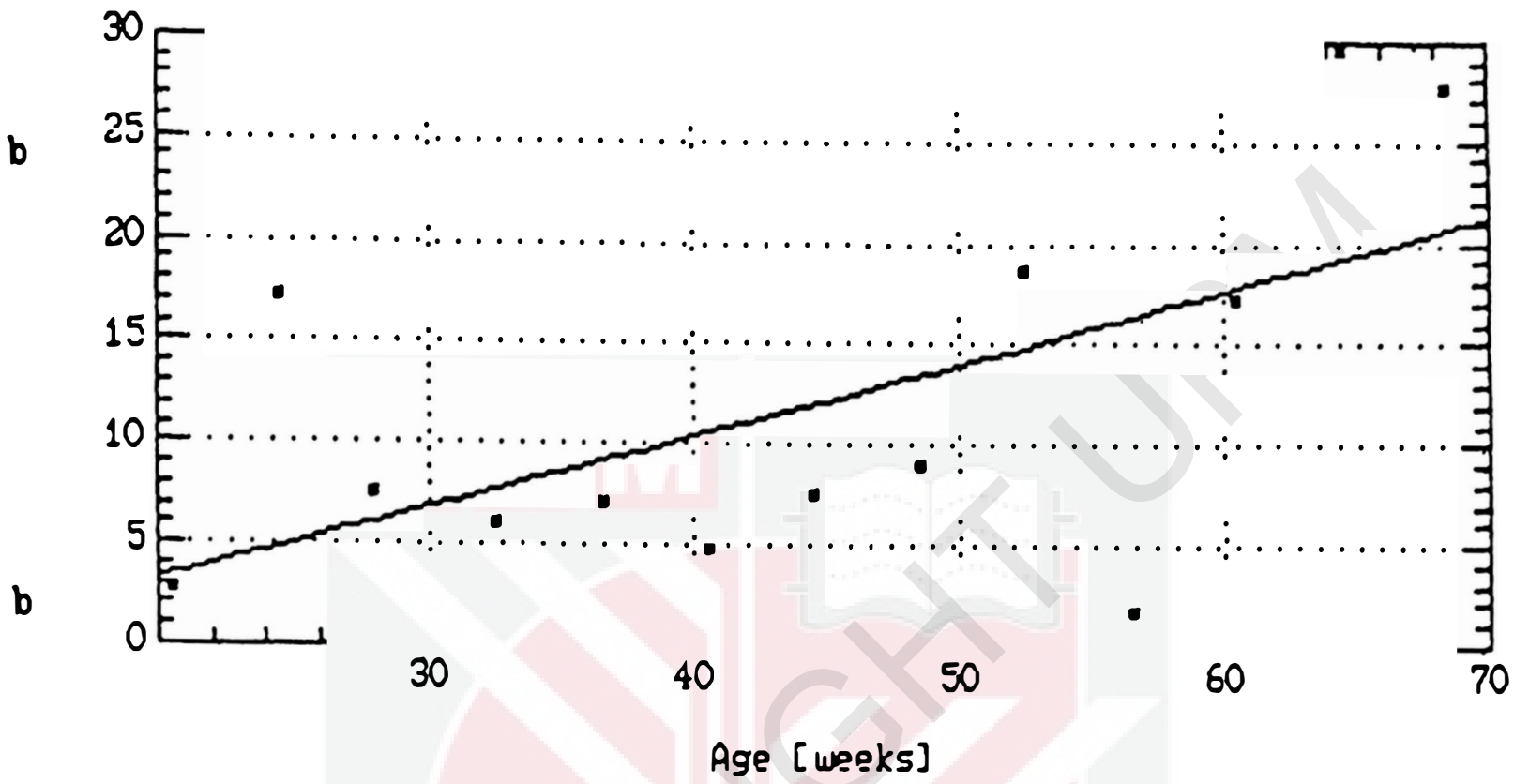


ii) Cannibalism

Cannibalism of the back resulting in bleeding and cellulitis was the second most common diagnosis accounting for 20.5% of all causes of mortality [Table 2]. The incidence of cannibalism [number of birds affected per 10,000 birds] was plotted against age as shown in Figure 3. The incidence was 2.8 per 10,000 birds in the 19-22 weeks age group and increases to 27.6 per 10,000 birds in the 67-70 weeks age group.

Figure 3

Regression of cannibalism on age



The regression equation for the line is

$$Y = 0.36X - 3.93$$

Correlation coefficient [r] = 0.62

Where Y = no. of mortality per 10,000 birds

X = age of birds in week

19 weeks< X <70 weeks

iii) Fatty Liver and Hepatic Rupture

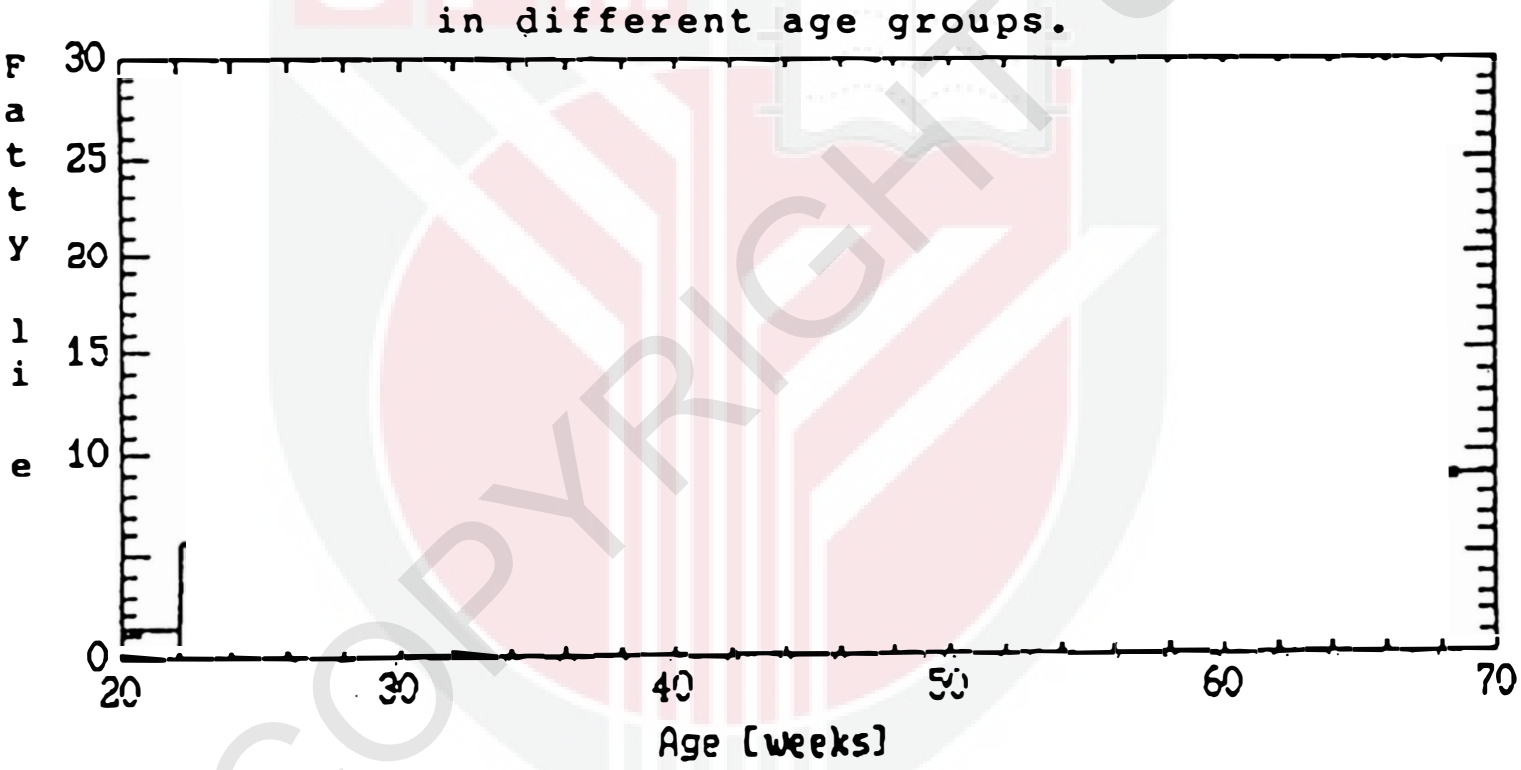
Those birds that died of this condition were excessively obese. The liver was yellow, greasy and soft. Rupture of the liver capsule when occured resulted in haemorrhage into the abdominal cavity and large blood clots were present upon opening the abdominal cavity of these birds. 12.9% of all mortality recorded

was due to this condition [Table 2].

The percentage mortality due to fatty liver and hepatic rupture in different age groups was shown in Figure 4. The incidence increases rapidly after the birds reach thirty weeks of age, peak at 39-42 weeks after which it fluctuate between 10-23%.

Figure 4

Occurance of fatty liver and hepatic rupture in different age groups.

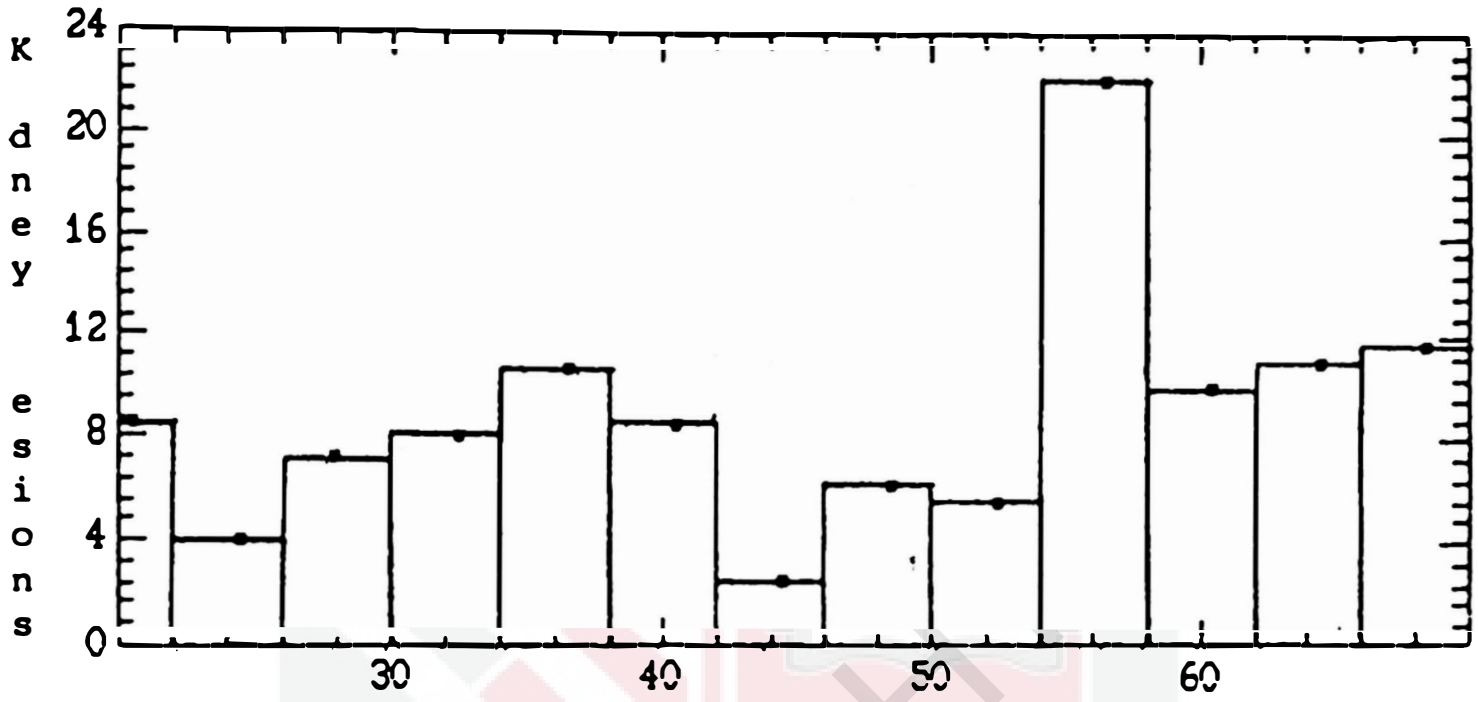


iv) Kidney lesions, neoplasia and other diagnoses

Kidney lesions include atrophy of one or more renal divisions resulting in compensatory hypertrophy of other regions of kidney, distension of tubules with urates, impaction of greatly thickened mis-shapen ureters with uroliths and deposition of urates over the visceral surfaces. These lesions occured randomly in all the age groups [Table 2], with a very high incidence in the 55-58 weeks age group [Figure 5].

Figure 5

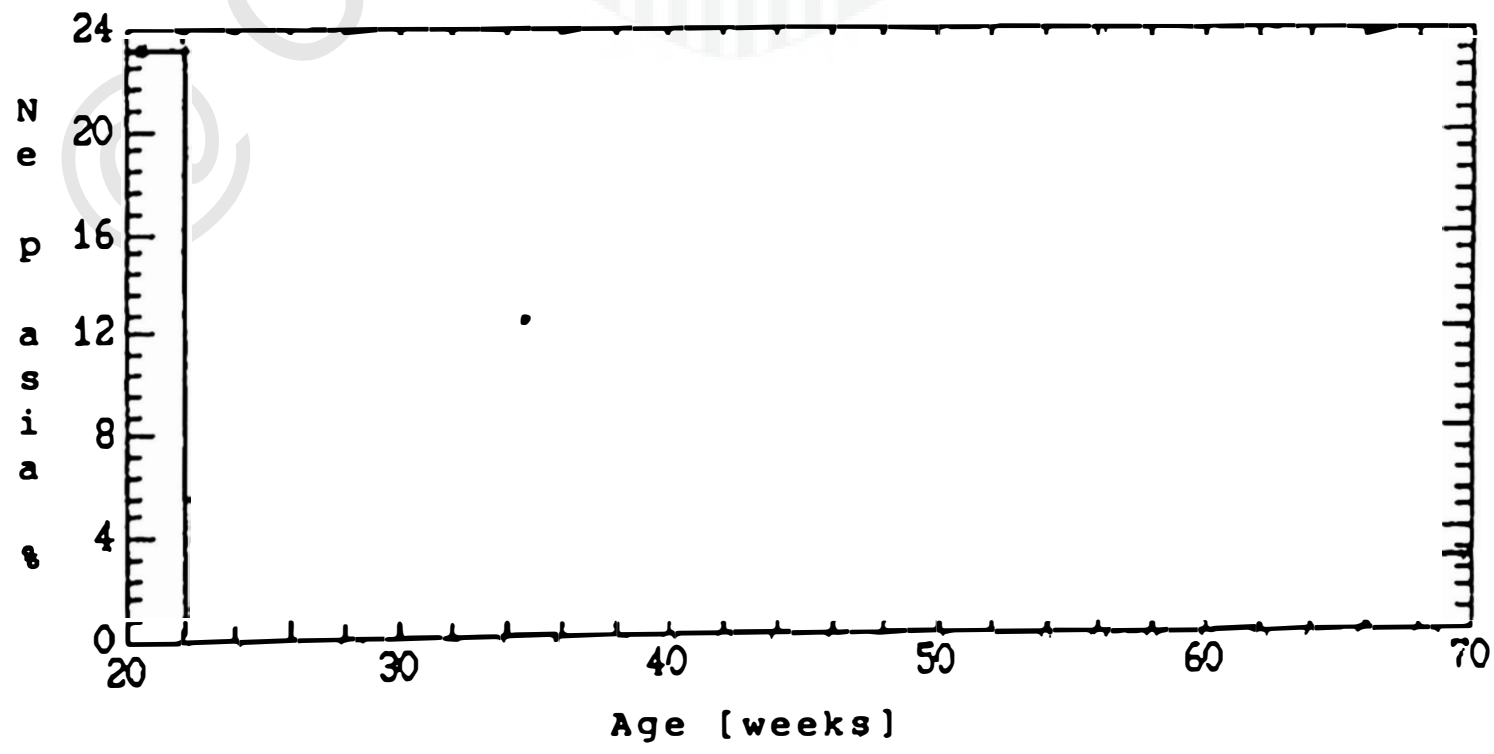
Occurance of kidney lesions in different age groups



Neoplasia accounted for 7.0% of all mortality [Table 2]. The incidence of neoplasia in the various age groups is shown in the chart below [Figure 6].

Figure 6

Occurance of neoplasia in different age groups



Other diagnoses [Table 3] include autolysis, traumatic injury, carcasses eaten by animals, peritonitis other than egg peritonitis, ruptured intestine, hepatic necrosis, airsacculitis and abdominal haemorrhages of unknown aetiology.

Table 3

Other diagnoses

Lesion	No. cases	%
Autolysed	48	3.9
Eaten by animals	37	3.0
Traumatic injury	18	1.5
Diffuse peritonitis	8	0.7
Ruptured intestine	3	0.2
Ruptured abd. vessels	3	0.2
Hepatic necrosis	1	0.1
Airsacculitis	1	0.1
Total	119	9.6

DISCUSSION

The estimated overall background mortality was 1% per month and the figure approximates those reported by Randall et al. [1977], North [1978], and Jones et al. [1978]. Mortality in the different age groups ranged from 0.3-0.8% for the half month period. Four groups recorded a mortality of 0.8%, and this was still considered acceptable.

Prolapsed cloaca and oviduct was the most important of the reproductive disorders causing mortality. In this study, age is one of the major factors affecting the incidence of prolapse. Grimes [1975] reported a high incidence of prolapse at the start of lay and attributed this to the immaturity of oviduct muscles and tissues. Other factors which can cause direct or indirect damage to oviduct muscles and tissues are size of egg laid, too early onset of lay, excessive body fat, reproductive tract infection and hysteria.

Egg peritonitis was defined as the presence of yolky debris in the abdominal cavity and was associated with inflammation. The incidence of 7% in this study agrees with those of Grimes [1975] and Randall et al. [1977].

The incidence of cannibalism was reported to be highest immediately after caging by Randall et al.

[1977]. However this phenomenon was not observed in this study and the condition appeared to be more common in older birds. Hughes and Duncan [1972] reported that strain of bird, the housing system, light intensity, position of birds in relation to light source had major effect on cannibalism while social hierachy, fear responses and body weight had minor effects. Gerun et al. [1978] reported that the incidence of cannibalism increases with rising dietary energy/protein ratio. However, the linear relationship observed in this study may be associated with the degree of beak growth after debeaking [Oh, personal communication].

Fatty liver and hepatic rupture was known to occur mainly in heavier brown egg layers [Coutts 1981]. Grimes [1975] and Randall et al. [1977] also reported high incidence of this condition in birds of both light and heavy strains. Grimes [1975] concluded that the incidence of fatty liver and hepatic repture varies between farms and attributed this to the different feeding programs and reproductive maturity. The high incidence of this condition after birds reaches thirty weeks of age was also observed by Grimes [1975].

The incidence of kidney lesions [8.1%] in this study was similar to those reported by Jones et al. [1978] and bulked M.A.F.F. data 1968-1970 [Hugh Jones unpublish, cited by Randall et al., 1977]. Siller

[1964] described pyelonephritis as the most common kidney lesions and was of infectious origin. However the aetiology remain obscured. Jones et al. [1978] suggested ascending infection from cloaca as source of infection. Cumming [1963] reported strains of bronchitis virus can cause kidney lesions. Jones [1974] speculated bronchitis virus attack could result in sporadic cases of renal disease in laying fowl when vaccinal protection has waned. However, Randall et al. [1977] suggested water deprivation as predisposing factor to renal disorder. In this study, the lesions occurs randomly in all age groups. The high incidence in the 55-58 weeks old needs further investigation. In this study, the occurance of tumours other than lymphoid origin was as frequent as the lymphoid tumours [Table 2]. The high incidence of tumour observed in the 19-22 weeks age group could be due to Mareks disease.

CONCLUSION

The incidence of "background" mortality in this farm falls within the accepted range. The five most common causes of mortality were reproductive disorders [33.7%], cannibalism [20.5%], fatty liver and hepatic rupture [12.9%], kidney lesions [8.1%], and neoplasia [7.0%]. There was a linear relationship between the incidence of prolapsed cloaca and oviduct and age [correlation coefficient r=-0.62], with a high incidence in the young birds which has just started to lay. A linear relationship was also observed between incidence of cannibalism and age [r=0.62] with the highest incidence in the oldest birds. The incidence of fatty liver and hepatic rupture increases rapidly after birds reach thirty weeks of age. Incidence of kidney lesions occured randomly in the flocks.

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APPENDIX

Appendix I

Vaccination program

Days	Vaccination
1	Mareks Disease
4	ND [Hitcher B1]
	IB [Massachusetts type, strain H 120]
14	Fowl Pox
	ND [Hitchner B1]
	IB [Massachusetts type, strain H 120]
21	ND [strain not known]
60	ILT [Zamberg strain]
90	IB [strain H 52]
120	EDS-76 [strain 127]
	ND [strain not known]