STUDIES ON CERTAIN ECONOMIC TRAITS IN DESI DUCKS

By

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THESIS

Submitted in Partial fulfilment
of the requirement for the degree

MASTER OF VETERINARY SCIENCE

Faculty of Veterinary and Animal Sciences
Kerala Agricultural University

Department of Poultry Science
COLLEGE OF VETERINARY & ANIMAL SCIENCES
MANNUTHY - TRICHUR

1977

DECLARATION

I hereby declare that this thesis entitled STUDIES ON CERTAIN ECONOMIC TRAITS IN DESI DUCKS is a bona fide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship, or other similar title, of any other University or Society.

RENCHI P. GEORGE.

Nannuthy,

14-5-1977.

CERTIFICATE

Certified that this thesis, entitled STUDIES ON CERTAIN ECONOMIC TRAITS IN DESI DUCKS is a record of research work done independently by Shri Renchi. P. George under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship, or associateship to him.

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ACKNOWLEDGEMENTS

I wish to express my deep sense of gratitude to Dr. A. K. K. Unni, Professor and Head of Department of Poultry Science for his valuable guidance, encouragement and co-operation as major adviser.

I am specially indebted to Dr. A.Ramakrishnan, Professor of Poultry Science (on deputation) and Dr. C. K. Venugopalan, Senior Scientist, All India Co-ordinated Project for eggs for their inspiring guidance and constructive suggestions.

I am specially indebted to Dr. P. G. Nair, Dean, College of Veterinary and Animal Sciences, Mannuthy, for granting permission to undertake this study.

I wish to express my sincere thanks to Dr. G. Nirmalan, Professor of Physiology and Dr. (Mrs) Maggie D. Menacherry, Associate Professor, Nutrition for their encouragement during the course of this manuscript.

Sincere thanks are due to Dr. P. K. Abdulla, Professor of Bacteriology, Dr. (Mrs) K. I. Mariamma, Asst. Professor in Pathology and Dr. V. Jayaprakasan, Instructor in Bacteriology for their kind help in bacteriological and pathological studies related to this work.

I wish to record my thanks to Dr. P. U. Surendran, Professor of Statistics for the guidance rendered for analysing the data presented in this manuscript.

My sincere thanks are due to Dr. A. Jalaludeen, and Dr. R. S. Nair, Department of Poultry Science and Dr. G. R. Nair for their timely help through out the course of this work.

I express my heart-felt thanks to Mr. K. R. Mohanan for getting this manuscript neatly typed in time and also to Mr. G. Gopinathan Nair for preparing graphs and photographs.

I place on record my gratitude to the Kerala Agricultural University for granting leave to enable me to persue this work.

I appreciate the understanding and encouragement of my parents, wife and children during the entire period of study.

RENCHI P. GEORGE.

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INTRODUCTION

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The population of ducks in India according to 1972 census is reported to be 9 millions which constitutes 6.5 per cent of the total poultry population in the country. Though duck population is scattered, they are mostly concentrated in the States of West Bengal, Assam, Tamil Nadu, Andhra Pradesh, Kerala, Orissa and Jammu and Kashmir. The habitat of the ducks clearly indicates their capacity to thrive better in coastal areas and areas with lagoons and back waters.

Inspite of this enormous number, development programmes aimed at popularising duck farming and studies related to assessment of production potentialities, methods of management, feeding and other aspects of duck husbandry have received very little attention. This is mainly due to two factors, namely, the duck population is mostly in the hands of unorganised sector and the consumer demand for duck egg/meat in many States is limited by the religious taboos and lack of awareness on the nutritive worth of duck eggs/meat.

Kerala with a coastal stretch of 580 Km has 361941 ducks (1972 census) which account for 4 per cent of the duck population of India. They are mostly concentrated

in the Districts of Alleppey, Kottayam, Ernakulam and Trichur of this State. Kerala is fortunate in that generally there are no religious sentiments and taboos in the use of duck eggs/meat and therefore has good scope for development of Duck Industry.

Duck farming, for many farmers is a means of livelihood in this State. They are essentially maintained for eggs though spent ducks and surplus males are utilised for table. The production potentialities of the local ducks are rather poor. However, authentic records are not available. Information gathered from the duck farmers indicates that the local ducks lay around 80 to 130 eggs per year and therefore, there is scope for improving their egg production potential.

Further, the other problems confronted by duck farmers are the poor hatchability and viability of ducklings that are hatched and reared using broody hens. This not only involves higher investments, but also entails difficulties in building replacement flocks.

Lack of sufficient basic scientific information on these aspects is the major bottleneck in drawing viable development programmes for improving duck farming in this State. Information on the genetic worth of the local germ plasm for growth and production, as well as on fertility,

hatchability and other economic traits are essentially required to place duck farming on scientific footing.

Therefore, this study was planned to gather information on artificial incubation of desi duck eggs and growth characteristics of ducklings under scientific systems of feeding and management. The relatively limited knowledge on desi ducks available to-day warrants such detailed studies on domestic desi ducks with a view to improve their egg and meat production potentialities.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Published scientific information on the various aspects of duck management is very scanty. Therefore, in this review, an attempt has been made to collect consolidate and review whatever relevant information is available on duck husbandry.

Mean weight of duck eggs as reported in Indian literature varies from 62 to 72 g (Bose and Mahadevan, 1956). Romanoff (1967) has reported mean weight of eggs of different breeds of ducks as Pekin 85 g, Mallard 80 g, Muscovy 70 g and Runner 60 g.

The shape of an egg is determined by the ratio of its length to width. According to Bose and Mahadevan (1956) these ratios for hen and duck eggs are 1.37 and 1.39 respectively. In duck eggs, therefore, the length is proportionally more than width in comparison with hen egg.

The shape index of eggs from Pekin, Muscovy, Runner and Mallard ducks have been reported to be 72.73, 72.38, 73.77 and 71.19 respectively (Romanoff and Romanoff, 1949). They also reported that the shape index of medium type chicken egg is 73.68. Sergeeva (1975) reported that egg shape index averaged 73.5, 74.5, 62.0, 65.5, 75.0 and 76.0 for fowl, turkey, duck, goose, guinea fowl and patridge.

Kumar and Shingari (1960) reported that larger eggs

always produced larger chicks. They also reported a very low statistically non-significant relationship between size of egg and hatchability. However, they observed that in medium sized eggs hatchability was highly associated (0.567) with chick weight at hatch. It was also reported by the authors that there is no statistically significant relationship between the shape index and sex of chicks although percentage of male chicks were greater in elongate eggs and percentage of female chicks were more in oval eggs. Leslie (1961) and Gleichauf (1962) found no relationship between shape of egg and sex of chicks. Scanning the literature did not give any information on the relationship between shape index and sex of ducklings hatched.

MacLaury et al. (1973) reported that there is a very highly significant linear regression of hatchability on shape index in fertile quail eggs. They further observed that over the range of shape indices the values of the surface area: Volume ratio (SVR) were close to the regression of hatchability on shape index (0.998). They opined that the SVR, possibly as an indicator of rate of heat transfer, is closely related to hatchability in quail eggs. Sergeeva (1975) reported that the correlation between hatchability of egg and shape index was 0.09 to 0.29 for fowl eggs, 0.14 to 0.20 for turkey eggs and 0.15 to 0.26 for duck eggs.

Incubation period of duck eggs is 28 days with the exception of Muscovy breed which requires 35 days (Romanoff, 1967).

Chatterjee (1956) reported that the optimum results in hatchability with duck eggs were obtained with 70 to 75 per cent relative humidity. He further stated that when the relative humidity was above 75 per cent or below 65 per cent the hatchability results were very poor. McArdle (1966) suggested that duck eggs should be incubated in forced draught incubators at 37.5°C for best results. He also recommended that the relative humidity should be about 70 per cent (Wet bulb reading of 32.7°C) for the first few days and then reduced to 60 or 65 per cent until chipping, when the relative humidity should be again enhanced to 70 per cent. He also recommended spraying of warm water over the duck eggs during the last four days of incubation as a means to provide higher humidity. Siddiqui et al. (1975) recommended the following dry bulb and wet bulb readings as optimum for duck eggs: 1st to 3rd day, 3rd to 16th day, 16th to 25th day, and 25th to 28th day, dry bulb reading to be 37.6°C, 37.5°C, 37.2°C and 36.8°C and the corresponding wet bulb reading to be 31.1°C, 27.7°C, 28.9°C, 26 to 28.3°C and 30 to 32.2°C respectively. They also recommended that the eggs should be turned upto the 25th day of incubation.

Funk (1953) observed that the percentage of hatch

could be increased by 5 per cent or more by turning eggs at 45^{o} angle (total of 90^{o}) as compared to turning them only through 30^{o}.

Amer (1962) suggested several causes for the malpositions of chicken embryos. He reported that rise in ambient temperature increases the frequency, whereas decreased egg size reduced the occurrence.

Florence (1969) reported that the duck embryo development at 50 to 54 hours of incubation corresponds to 33 to 36 hour development of chick embryo. Agarwal et al. (1973) reported that egg weight had no significant correlation with time of embryonic mortality during the incubation period.

Kovinko and Zhumabekov (1975) observed that pre-incubation washing of duck eggs for 10 to 12 minutes in a solution containing one per cent chloramine or 0.5 per cent perhydrol at a temperature of 35^{o}C to 40^{o}C increased hatchability over 10 per cent. Moudgal et al. (1976) reported that the eggs of White Pekin ducks stored in polythene bags showed significantly better ($P < 0.01$) hatchability over those washed with savlon, fumigated and control.

Upp (1928) observed that the chick weight at hatch was 68 per cent of the egg weight before incubation. Ghaney et al. (1966) working with Japanese quail reported a chick weight of 65 per cent for males and 67 per cent for females with correlation of 0.72 to 0.77 between egg weight and

hatch weight. Romanoff (1967) reported the hatch weight of ducklings of different breeds of ducks, such as Pekin, Mallard, Muscovy and Runner as 55.3, 52.0, 45.5 and 39.0 g respectively for the corresponding egg weights of 85, 80, 70 and 60 g. Oplt et al. (1975) reported that the weight of Pekin ducklings at hatch as a percentage of egg weight of the 81 to 82, 83 to 84, 85 to 86, 87 to 88, 89 to 90, 91 to 92, 93 to 94, 95 to 96, 97 to 98, 99 to 100 g groups were 62.8, 62.1, 63.7, 61.1, 63.8, 62.0, 64.5, 64.0, 62.9 and 63.3 respectively. They further observed that for eggs weighing 82, 89 to 92 and above 95 g averaged 993, 1089, 1094 g respectively at 4 weeks of age and 2465, 2583 and 2598 g at 7 weeks. Veltsman et al. (1975) reported that the hatch weight of broilers averaged 61.2 g and that of Pekin duck was 50 g.

The early growth rate and quick attainment of the greater portion of the mature weight as characteristics of ducks and geese were reported by Milby and Herderson (1937). Godfrey et al. (1953) and Pope and Schaible (1957) reported that the effect of egg size on early growth in broiler chicken decreased rapidly after the first few weeks of age and had no appreciable effect on weight at slaughter age. It was cautioned, however, that the above relationship might not hold true for all breeds and strains of chicken. Byhover and Bulah (1968) reported that the body weights of chicks and ducklings were correlated with the weights of the eggs

from which they were hatched. They further observed that at two months of age, ducklings from small eggs had lower body weights than those from large eggs. The correlation between weight at hatching and at two months of age was 0.14 to 0.25.

Agarwal et al. (1973) reported that egg weight was significantly correlated with chick weight at hatching (0.982). They also reported a highly positive correlation of 0.994 and linear regression coefficient of 0.32 showing thereby a high degree of association between the two traits. They further observed that the phenotypic correlation between egg weight and hatchability was negative (-0.156) and statistically non-significant. Tosovsky et al. (1974) reported that in meat type hybrid birds, egg weight was significantly correlated with hatch weight. Georgieve (1974) reported that egg weight was significantly correlated with the day old body weight in chicken: 0.52 to 0.60 for males and 0.58 to 0.79 for females.

Holroyd (1974) observed that correlation between body weight at one day old stage and all subsequent ages was low and statistically non-significant in majority of cases in chicken, but correlations at two weeks of age was larger for females than for males. Thus, they concluded that the body weight at two weeks to be a better guide to the body weight ranking at the time of marketing broiler. While Potemkowska et al. (1974) reported that correlations

between body weight at one day of age and that at 8 or 10 weeks were generally low, indicating that weight at hatching is not a suitable criterion on which to base selection for 8 or 10 week body weight. Oplt et al. (1975) reported that the correlation between egg weight and hatch weight of ducklings was 0.79. Marks (1976) reported that in Japanese quail correlation between egg weight and hatch weight was higher (0.7 to 0.8).

Bielinski et al. (1974) found that in Geese, as weight increased, food conversion was poorer in both sexes, females attaining the required weights later than males. Moudgal and Singh (1975) reported that white Pekin and Minikos ducks grew faster and had better feed conversion ratio than broiler chickens. They further opined that the ideal age for marketting was 7 weeks in the case of ducks. They also observed that at this age these two breeds of ducks attained 1.93 Kg and 1.19 Kg body weight with feed conversion ratio of 2.64 and 3.30 respectively. Luhmann and Vogt (1976) reported that ducks should not be slaughtered before 9 weeks of age as breast muscle develops relatively late.

Gibbs (1975) reported that in Pekins, weight gain increases in linear measurements were more rapid than in Mallard. Pilla and Quilics (1975) reported that sexual dimorphism for live weight was more pronounced in Muscovy than in Pekin ducks. Pekin ducks grew more quickly to

3 weeks than Muscovy, but thereafter Pekin grew more slowly on all diets. Conversion was better in Muscovys than in Pekin ducks.

Broadbent and Dean (1952) reported the average percentage dressing loss and eviscerated percentage yield of nine week old Pekin ducklings were 10.56 and 72.8 percent respectively. Wiseman et al. (1961) reported that the yield of eviscerated carcass tends to increase with increasing live weight. Synder (1961) reported that the average live weight of Muscovy male dressed at twelve weeks of age was 3.836 Kg and that of females 2.228 Kg. Dressing percentages at 12 weeks were 85.1 and 86.9 respectively. The eviscerated percentage of the live body weight was 70.9 for males and 73.6 for females. Varadarajulu and Murali Mohan Rao (1976) reported that the percentage of carcass yield of desi ducks were 60.4 and 58.8 in males and females respectively. They also reported that the total ready to cook yields (after chilling in slush ice for 3 hours) were 74.0 percent in males and 72.8 percent in females.

Synder (1961) reported that feed efficiencies for range and confined Muscovy ducks from one to ten weeks of age were 3.14 and 3.59 respectively.

Rikhter et al. (1973) after comparing two systems of rearing broiler ducks, viz, unlimited access to pond or to confinement in a fenced area with access to 3 x 100 m

pools (0.6 sq.m. of water area per bird) reported that feed consumption/Kg gain in body weight was 6.1 to 8.5 and 5.7 to 6.6 respectively. Singh et al. (1976) studied the effect of different systems of housing on growth, feed efficiency and mortality in Pekin ducks and observed that there was no significant effect of system of housing on body weight of ducks at 6 weeks of age. Average body weight obtained at six weeks of age was 1432 g. They also reported that the females weighed 64 g heavier than males at this age, although the difference was not statistically significant. They further observed that at 8 weeks of age, effect of treatment (System of housing) was highly significant and ducks reared in intensive system grew fastest and attained an average body weight of 2071 g compared to 1000 g and 1908 g in semi intensive and battery systems respectively. They also reported that the average body weight of ducks in these two systems was significantly higher than the body weight of ducks reared in batteries. They also pointed out that the feed utilization of ducks was best in the semi intensive system at all ages and also the mortality upto 10 weeks was lowest in intensive system.

The first reported study on the microbial spoilage of egg was carried out by Gayon in 1873 (Joy, 1970). Panda et al. (1968) observed that there is no apparent difference between fertile and infertile eggs as far as

microbial load is concerned. He also reported a variety of microorganisms are encountered on the egg shell surface, the majority being air, soil and water saprophytes. Reports from various countries indicated that 2.6 to 7 per cent of chicken eggs are contaminated mostly with salmonella typhimurium. Duck eggs have been reported to have an even higher contamination rate reaching 20 per cent (Frost and Reimann, 1967).

MATERIALS AND METHODS

MATERIALS AND METHODS

An experiment was conducted in the Department of Poultry Science, College of Veterinary and Animal Sciences, Kerala Agricultural University, Mannuthy to study the incubation, growth, and processing characteristics of desi ducks.

Six hundred desi duck (Anas platyrhynchos) eggs were procured from a large breeding flock in South Kerala. On the same day of collection, these eggs were properly packed and transported to Kerala Agricultural University hatchery. Immediately on receipt, they were unpacked, cleaned and candled. Twenty eight eggs were found to be unsuitable for hatching and hence were discarded. The balance of 572 eggs that were apparently good as adjudged by their physical and candling characters were stored in a well ventilated room. All the eggs were weighed individually to the nearest gramme. Length and breadth were also measured for all eggs. Shape index($\frac{\text{Breadth}}{\text{length}} \times 100$) was calculated by using the formula described by Romanoff and Romanoff (1967) and were assigned to four groups according to the shape index.

Eggs were subjected to preincubation fumigation and were arranged in setting trays at random in Dayal Incubator, which was previously cleaned, disinfected

and tested.

The following temperature and humidity were maintained in the incubator.

Setter	Temperature°C (Dry bulb)	Humidity°C (Wet bulb)
(1-24 days)	37.2 - 37.5	32.2 - 33.3
Hatcher (25th - 28th day)	37.2	33.3 - 34.4

Warm water was sprayed over the eggs during the last four days of incubation with a view to give higher humidity (McArdle, 1966). Eggs were turned six times daily from 4th to 24th day. Eggs were candled on 6th, 18th and 24th days of incubation. Infertiles and dead germs were removed and subjected to bacteriological studies. Fertile eggs were transferred to pedigree bags individually and numbered (Fig 1). Hatch was taken out on the 29th day morning. Dead embryos were also subjected to bacteriological and pathological studies.

Out of 362 ducklings hatched out 9 ducklings had congenital deformities which were weighed and destroyed after noting the sex. All the ducklings were weighed individually to the nearest gramme and wing banded.

A total of 328 ducklings formed the experimental subjects for further studies. Of these, 224 ducklings were taken at random and were assigned to two identical

floor pens, each pen having 112 ducklings (Fig 2). The remaining 104 ducklings were again divided into 4 groups of 26 each at random and each group was assigned one tier in an electrically operated chicken battery brooder (Fig 3 and 4). The assignment of the groups to the different tiers of the battery brooder was also carried out at random. Temperature of the floor brooders as well as battery brooder was maintained at 32°C, 29°C and 26°C during the first, second and third week respectively.

Floor brooders were removed after 3rd week. Artificial light was provided during night till 6th week of age. At 7th week, the ducklings were transferred to semiintensive system after identifying males and females based on phenotypic differences.

Ordinary chicken feeders and waterers were used during brooding. Daily records of feed and water intake were maintained. The ducklings were given duck starter mash from 1st day to 4 weeks and duck grower mash from 5th week to 12th week (Table 1).

Individual body weights were recorded at weekly intervals from 1st to 12 weeks. Those ducklings that died during brooding and rearing period were subjected to detailed autopsy and the causes ascertained.

F1 strain vaccination was given on the day of hatch against Ranikhet disease. Fowl pox vaccination was

Table: 1. Composition of Basal Diet

Sl. No.	Ingredients	Ducklings starter mash (0 to 4 weeks) (Parts/100Kg.	Ducklings grower mash (5 to 12 weeks (Parts/100Kg).
1.	Maize (Yellow)	30	30
2.	Rice polish	20	22.5
3.	Tapioca	10	17
4.	Gingely oil cake	17.5	10
5.	Coconut cake	10	10
6.	Fish meal	10	8
7.	Mineral mixture (Starmin P.S.)*	2.5	2.5
8.	Vit. A, B_2, D_3 (Vitablend) **	0.025	0.025

* Starmin P.S., a product of Shaw-Wallace contained % by weight calcium-28.0, phosphorous-7.0, magnesium-trace, iron-0.5, iodine-0.008, copper-0.013, manganese-0.25, zinc-trace, cobalt-0.005, sodium chloride-17.0, Flourine-0.25, calcium/phosphorous ratio-4:1, moisture-7.0.

** Vitablend (Glaxo Ltd) contained Vitamin A, Vitamin B_2 and Vitamin D_3 at 40,000 I.U., 25 mg and 600 I.U. per g respectively.

done at the age of 6th week. Duck plague vaccine (Avianized freezed dried) was also given at the age of 12th week.

At 12 weeks of age 30 male ducklings were taken at random and slaughtered to find out dressing losses and carcass yields. They were fasted for six hours prior to slaughter. Fasting shrinkage was calculated. Birds were killed by outer cut method and after complete bleeding they were submerged for 50 seconds in agitated water kept at 71°C. Birds were dressed and eviscerated as per the procedure described in the Marketing Bulletin, No. 7 (U.S.D.A., 1966) Defeathering was done using poultry feather picker and the leftover feathers and pin feathers were removed by hand. After pinning, the hairs on the body were removed by singeing. Carcass was then washed thoroughly and left for evisceration. Edible and inedible parts were weighed seperately.

For bacteriological studies of dead embryos and dead germs, eggs were cleaned with 70% ethyl alcohol and were opened aseptically for collection of specimens. Isolation and identification of bacteria were carried out as per the methods described by Osbaldiston (1973).

Cultures were made from the contents of the eggs on blood agar and MacConkey's agar and the plates were incubated at 37°C for 24 to 48 hours. Smears made from individual colonies were stained by Gram's method of staining.

Growth characters of different colonies on blood agar and MacConkey's agar were observed. Further, individual colonies from blood agar and MacConkeys agar were tested on TSI agar. Biochemical properties of the isolates were studied for further identification.

The mean values with their standard errors were calculated in all cases using the formula described by Snedecor and Cochran (1967). Chi-square test was applied to ascertain relationship among shape index, fertility and hatchability. The data on weekly body weight of ducklings, reared in battery and floor were analysed by two way classificatón analysis of variance.

Correlation coefficients of shape index and hatch weight, egg weight and hatch weight, hatch weight and body weight at 1st, 4th, 8th and 12th week and live weight at slaughter and ready to cook yield were calculated using the formula described by Snedecor and Cochran (1967).

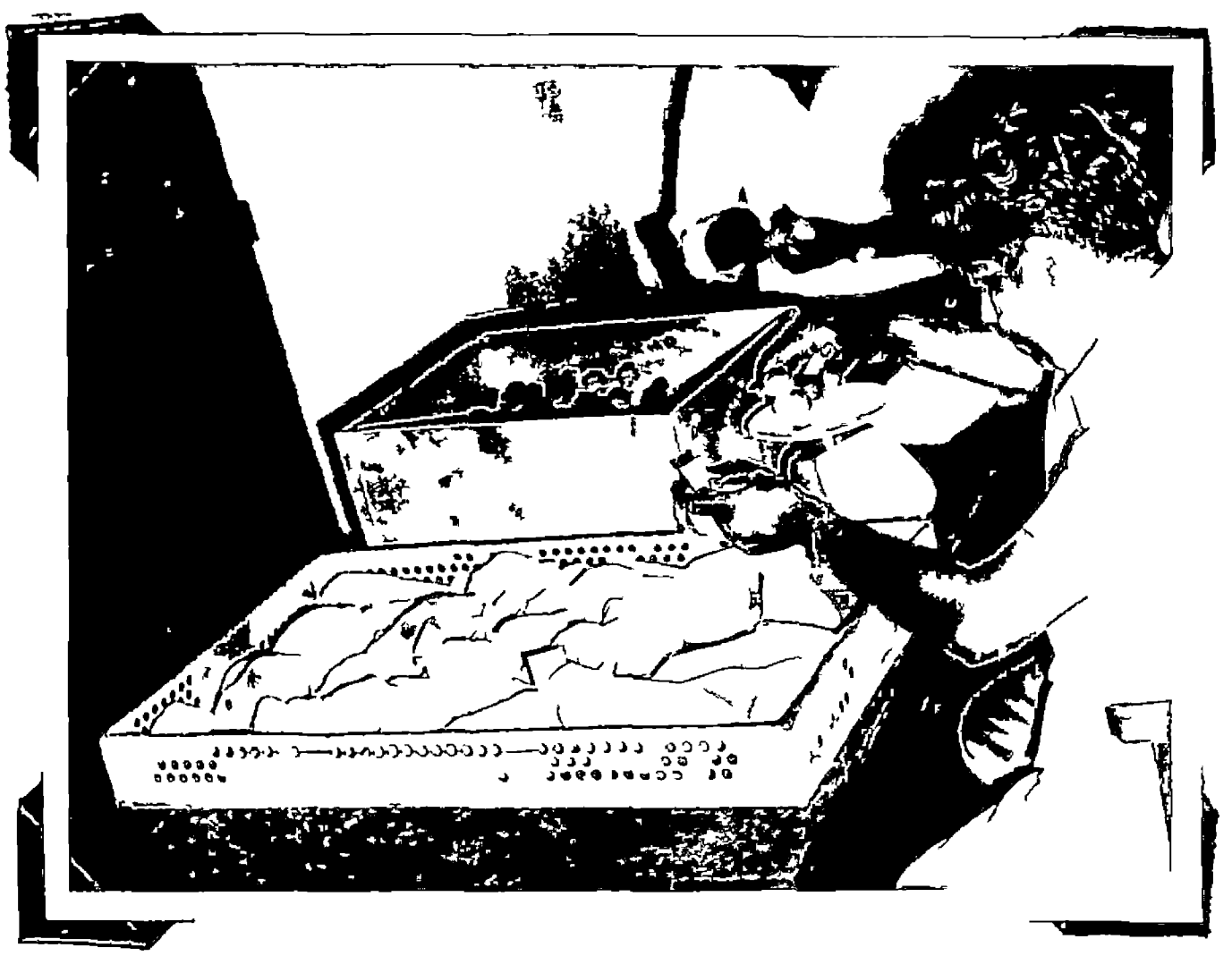


Fig 1. - Weighing and recording of ducklings taken out from pedigree pens.

Fig 2. - Watering of ducklings in battery.

Fig 3. - Feeding of ducklings in battery

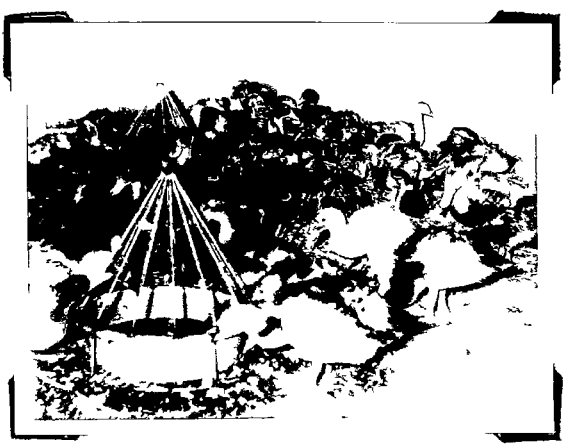


Fig 4. - Ducklings on litter floor

RESULTS

RESULTS

Egg characteristics

The weight of 572 desi duck eggs studied gave a mean egg weight of 68.86 g with a range of 55 to 85 g. The shape index of 362 eggs studied (Table 2) showed that 156 eggs belonged to the index group of 68.6 to 73.1 and 161 eggs belonged to the group of 73.2 to 77.7. The number of eggs that were in the range of 64 to 68.5 and 77.82 to 82.3 were substantially low (18 and 27 respectively). A comparison of the shape indices with the mean egg weight indicated that irrespective of the shape index the egg weight tended to be more or less similar for the four groups.

It could be seen further from Table 2, that irrespective of the variation in the shape index as well as the egg weight, the mean percentage of duckling weight over egg weight before incubation was 61.75. Mean duckling weight was found to be 42.25 g.

When the correlation coefficient between egg weight and duckling weight at hatching were analysed for 362 desi ducklings, it was observed that there was a highly significant correlation ($P < 0.01$) between egg weight and hatch weight of ducklings. Since the correlation was found to be 0.77, it could be safely surmised that

Table 2. Relationship among shape index, egg weight and hatch weight of desi ducklings

Group No	Shape index	Number of eggs	Mean egg weight before incubation (in g)	Duckling weight at hatch (in g)	Percengage of duckling weight over egg weight at hatch
1	64-68.5	18	69.66	43.16	61.96
2	68.6-73.1	156	68.44	42.06	61.45
3	73.2-77.7	161	68.03	42.17	61.99
4	77.8-82.3	27	69.81	43.18	61.86
Mean	72.99		68.42	42.25	61.75

Table 3. Incubation results of desi duck eggs

Group	Shape index	No.of eggs set	No.of fertile eggs *	Fertility (Percent)	No.of dead germs	Dead germ (percent)	No.of dead in shells	Dead in shell (Percent)	No.of chicks hatched **	No.of weaklings	Weakling (percent)	Overall hatchability (Percent)	Hatchability over fertiles (percent)
1	64-68.5	29	20[a]	68.96	-	-	2	6.89	18[a]	1	5.50	62.07	90.00
2	68.6-73.1	253	224[a]	88.53	24	9.49	44	17.39	156[a]	4	2.56	61.66	69.64
3	73.2-77.7	247	226[a]	91.49	21	8.50	44	17.81	161[a]	4	2.48	65.18	71.24
4	77.8-82.3	43	37[a]	86.04	4	9.30	6	13.95	27[a]	-	-	62.79	72.97
Total	.	572	507	.	49	.	96	.	362	9	.	.	.
Mean	72.99	.	.	88.63	.	8.57	.	16.78	.	.	2.49	63.29	71.40

a - Figures carrying atleast one similar superscript do not differ significantly ($P<0.05$)

Chi-square value. * 1.49

** 0.34

59.3 per cent of the body weight of the duckling is dependent on the egg weight.

Incubation

The incubation data of desi duck eggs are presented in Table 3. It reveals that the highest fertility was recorded for the group with a shape index of 73.2 to 77.7, while the lowest fertility was recorded for the group with the shape index of 64 to 68.5. In contrast, the highest per cent hatchability was observed for the group with the shape index of 64 to 68.5, while the lowest was recorded for the group having an index of 68.6, to 73.1. However when the data on fertility and hatchability from the four index groups were subjected to statistical analysis using chi-square test, it was found that the shape index had no influence either on fertility or hatchability.

Growth

The weekly body weight of ducklings reared both on floor and in battery recorded upto 12 weeks of age are tabulated in Table 4 and the statistical analysis of the data in Table 5. It could be seen that the body weights of ducklings during the first 2 weeks of age were not influenced by the system of brooding adopted. However, during the 3rd, 4th, 5th and 6th week of age, ducklings maintained in battery showed significantly better body weights than those maintained on floor. But during the 7th and 8th weeks the

Table 4. Mean weekly body weights (grammes) of ducklings from 0 to 12 weeks

	Age in weeks											
	0	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
BATTERY													
MALE	41.10 ±0.14	83.21 ±1.56	129.63 ±3.94	379.48 ±8.15	520.74 ±11.18	683.80 ±8.96	798.72 ±14.99	903.51* ±17.48	1120.95 ±12.28	1218.19 ±17.92	1375.31 ±17.84	1460.21 ±16.54	1467.06 ±16.43
FEMALE	40.18 ±0.38	80.31 ±1.15	122.43 ±10.69	341.84 ±6.46	468.79 ±10.79	624.09 ±10.10	738.63 ±8.80	816.45* ±13.60	1009.77 ±12.03	1065.90 ±21.22	1211.81 ±6.29	1285.90 ±19.52	1302.40 ±10.33
FLOOR													
MALE	43.12 ±0.53	83.87 ±2.56	139.10 ±4.87	317.40 ±14.42	469.39 ±14.48	615.42 ±12.24	721.32 ±15.10	891.38 ±18.71	1103.72 ±19.62	1291.80 ±17.77	1481.86 ±21.55	1573.72 ±22.88	1586.22 ±24.05
FEMALE	42.79 ±0.62	78.15 ±2.34	125.97 ±5.23	289.88 ±10.47	433.25 ±6.98	582.27 ±14.11	684.39 ±14.07	835.77 ±15.96	1031.95 ±15.73	1188.90 ±15.41	1343.57 ±18.19	1394.06 ±18.87	1417.88 ±21.54

* Ducklings on battery were transferred to semi intensive system on 7th week.

Table 5. Analysis of weekly body weight of ducklings for 12 weeks of age

	Source	df	SS	MSS	F
First week	Type	1	89.55	89.55	0.41NS
	Sex	1	1856.58	1856.58	8.52**
	Error	305	66391.76	217.67	
	Total	307	68337.89		
Second week	Type	1	1946.31	1946.31	0.30NS
	Sex	1	9097.24	9097.24	1.41NS
	Error	305	1958075.06	6419.91	
	Total	307	1969118.61		
Third week	Type	1	226820.10	226820.10	37.42**
	Sex	1	91125.13	91125.13	15.03**
	Error	305	1848612.33	6061.02	
	Total	307	2166557.56		

contd.in p 26

Table 5 (contd.)

	Source	df	SS	MSS	F
Fourth week	Type	1	139935.83	139935.83	12.65**
	Sex	1	147129.57	147129.57	13.30**
	Error	305	3372233.89	11056.50	
	Total	307	3659299.29		
Fifth week	Type	1	217810.15	217810.15	15.59**
	Sex	1	154141.18	154141.18	11.03**
	Error	305	4261103.67	13970.83	
	Total	307	4633055		
Sixth week	Type	1	1344071.03	1344071.03	139.53**
	Sex	1	1215613.96	1215613.96	126.19**
	Error	305	2937967.86	9632.68	
	Total	307	5497652.85		

NS - Non significant

** - Significant ($P < 0.01$)

contd.in p 27

Table 5 (contd)

	Source	df	SS	MSS	F
Seventh week	Type	1	17.29	17.29	-
	Sex	1	322903.05	322903.05	14.68**
	Error	305	6704744.84	21982.76	
	Total	307	7027665.18		
Eighth week	Type	1	1303.20	1303.20	0.08NS
	Sex	1	539517.21	539517.21	34.16**
	Error	305	4816940.23	15793.24	
	Total	307	5357760.64		
Nineth week	Type	1	506827.13	506827.13	14.23**
	Sex	1	937932.20	937932.20	26.34**
	Error	305	10857289.38	35597.67	
	Total	307	12302048.71		

contd. in p 28

Table 5 (contd.)

	Source	df	SS	MSS	F
Tenth week	Type	1	736906.08	736906.08	43.30**
	Sex	1	1444930.10	1444930.10	84.90**
	Error	305	5190588.74	17018.32	
	Total	307	7372424.92		
Eleventh week	Type	1	590321.58	590321.58	17.93**
	Sex	1	2217540.39	2217540.39	67.36**
	Error	305	10039380.57	32916.00	
	Total	307	12847242.54		
Twelth week	Type	1	684799.23	684799.23	33.22**
	Sex	1	1933630.89	1933630.89	93.82**
	Error	305	6285998.52	20609.83	
	Total	307	8904428.64		

NS - Non significant

** - Significant (P<0.01)

body weight of ducklings was not significantly different. On the contrary, during the 9th, 10th, 11th and 12th week ofage the ducklings raised on litter floor from the day of hatch showed significantly higher body weight than those that were maintained in battery upto 7th week of age and subsequently transferred to floor.

In all ages except during the 2nd week of age, male ducklings had significantly higher body weights than females, irrespective of the method of housing (Fig 5, 6 & 7).

The correlation of the hatch weight with the body weight at 1st, 4th, 8th and 12th week of age were worked out separately for males and females (Table 6). Significant correlations between hatch weight and body weight of males kept on floor at the end of 1st, 4th, 8th and 12th week were observed. The correlation was highly significant during the 1st, 4th and 8th week ($P < 0.01$). In the case of females reared on floor, the correlation coefficient was highly significant ($P < 0.01$) at 1st and 8th week of age, while it was significant ($P < 0.05$) at the end of 4th week and was not significant at the end of 12th week.

In the case of male ducklings maintained in battery, significant correlation between hatch weight and body weight was observed only at 1st and 4th week of age and this was highly significant ($P < 0.01$) only during the

Table 6. Correlation of hatch weight with body weight of desi ducklings at 1st, 4th, 8th & 12th week of age

		1st week	4th week	8th week	12th week
Floor					
	Male	0.46**	0.31**	0.35**	0.25*
	Female	0.36**	0.22*	0.34**	0.12
Battery					
	Male	0.38**	0.30*	0.21	0.09
	Female	0.35*	0.21	0.16	0.04

** Significant ($P < 0.05$)

* Significant($P < 0.01$)

first week of age. At the end of 8th and 12th week of age, coefficients of correlation were not significant. The female ducklings maintained in battery showed a significant correlation ($P<0.05$) only during the 1st week of age, while during the other three periods, it was not significant.

Feed consumption

The mean weekly feed consumption per duckling upto 12 weeks of age are set out in Table 7. The average daily feed consumption of duckling at 12 weeks of age was 200 g.

The feed efficiency for growth upto 4th week of age (feed consumption/Kg gain) for the ducklings maintained on deep litter was 3.34 and that for ducklings maintained in battery was 2.62. The corresponding figures upto 8 weeks of age were 4.82 and 4.88 respectively. The overall feed efficiency from 0 to 12 weeks of age for ducklings maintained on deep litter and battery were 6.91 and 7.89 respectively.

Water consumption

The mean weekly water consumption of ducklings upto 12 weeks of age are presented in Table 8. The mean daily water consumption per duckling at 12 weeks of age was 924 ml.

Table 7. Mean weekly feed consumption per duckling (grammes) from 0 to 12 weeks of age

System of brooding	Age in weeks											
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
Battery	110.6	247.1	430.4	578.6	746.1	847.4	1010.5*	1212.8	1304.4	1358.7	1413.0	1461.6
Floor	185.9	289.9	442.7	581.0	755.5	816.9	930.9	1107.0	1207.4	1267.3	1313.4	1356.4

* Ducklings on battery were transferred to semi intensive system at 7th week of age.

Table 8. Mean weekly water consumption per duckling from 0 to 12 weeks of age (ml)

System of brooding	Age in weeks											
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
Battery	534	1630	2217	2863	3280	3698	4726*	4649	5652	5761	6087	6484
Floor	852	1633	2301	2896	3294	3416	4041	4596	5530	5714	6037	6452

* Ducklings on battery were transferred to semi intensive system at 7th week of age

The ratio between feed and water consumed by ducklings at different ages upto 12 weeks of age are presented in Table 9. The overall feed to water ratio at 12 week of age (both systems of housing combined) was observed to be 1:4.6.

Mortality

The overall percentage of mortality observed during the course of the experimentation was 6.1. The mortality upto 7th week of age was 8.6 and 2.2 per cent respectively for those that were reared in battery and on floor. The percentage of mortality from 7th to 12th weeks of age for the groups brooded in battery and floor were 4.2 and 0.9 respectively.

Bacteriology of dead embryos

From 145 dead embryos (both dead germs and dead in shells) 49 embryos were randomly selected for detailed bacteriological examination. A total of 21 species of bacterial isolates were obtained as pure culture from the specimens examined. These 21 species of bacterial isolates were identified to belong to six different genera viz., Escherichia, Staphylococcus, Bacillus, Klebsiella, Proteus and Pseudomonas. The detailed results of the bacterial isolates recorded are shown in Table 10.

In all the cases where Bacillus species were isolated, it was invariably associated with other species

Table 9. Feed water ratio for straight-run ducklings maintained in confinement

Age in weeks		Feed consumed (in g)	Water consumed (in ml)	Feed/water ratio
1st	F	26	129	1:5.0
	B	16	79	1:4.9
2nd	F	41	233	1:4.9
	B	35	233	1:6.6
3rd	F	63	329	1:5.2
	B	61	317	1:5.2
4th	F	83	414	1:5.0
	B	83	409	1:4.9
5th	F	108	471	1:4.4
	B	107	469	1:4.4
6th	F	117	488	1:4.2
	B	121	528	1:4.4
7th	S	139	626	1:4.5
8th	S	166	660	1:4.0
9th	S	179	799	1:4.5
10th	S	188	820	1:4.4
11th	S	195	866	1:4.4
12th	S	200	924	1:4.6

F - Floor
B - Battery
S - Semi intensive

Table 10. Bacterial isolates from dead duck embryos

Type of organism	No. of isolates	Percent
Escherichia coli	6	28.60
Staphylococcus aureus	4	19.05
Bacillus sp.	4	19.05
Klebsiella sp.	3	14.30
Proteus sp.	2	9.50
Pseudomonas sp.	2	9.50

of bacteria.

Pathology of dead embryos

The dead in shells obtained during incubation (96 Nos) were opened and studied for pathological abnormalities. It was observed that the embryonic death in 35 cases were due to bacterial causes discussed earlier and 46 due to developmental defects of abdominal muscles and 6 due to nonspecific lesions. Of the remaining 9 embryos 4 showed cephalocoele, 3 short and deformed beak and 2 imperfect fusion of cranium (Fig 6).

Processing studies

Processing studies with 30 desi drakes of 12 weeks of age selected at random revealed the following (Table 11). Mean shrinkage due to fasting for six hours prior to slaughter was found to be 2.6 per cent of final body weight. The mean dressing losses represented by the loss of weight of blood and feathers worked out to be 11.7 per cent giving a dressed yield of 88.9 per cent. Average losses due to evisceration observed in this study was 14 per cent representing the losses due to head, feet and viscera. The giblet (heart, liver and gizzard) represented 6.9 per cent of the weight of the bird at slaughter. The ready to cook yield was estimated to be 74.3 per cent showing a shrinkage of 25.7 per cent from live to ready to cook weight representing

Table 11. Mean estimated losses and yields of Processed desi drakes at 12 weeks of age

No.	Particulars		
1.	Live weight	a)Prefasting (g)	1423
		b)After fasting (g)	1386
2.	Fasting shrinkage	a) in grammes	37
		b) percentage	2.6
3.	Dressed weight (g)		1224
4.	Dressed yield (Percentage)		88.3
5.	Loss due to dressing	a) in grammes	162
		b) Percentage	11.7
6.	Eviscerated weight excluding giblets (g)		934
7.	Eviscerated yield (percentage)		67.4
8.	Giblets (Liver, heart & gizzard) weight (g)		95.7
9.	Giblets yield (percentage)		6.9
10.	Ready to cook weight including giblets (g)		1030
11.	Ready to cook yield (percentage)		74.3

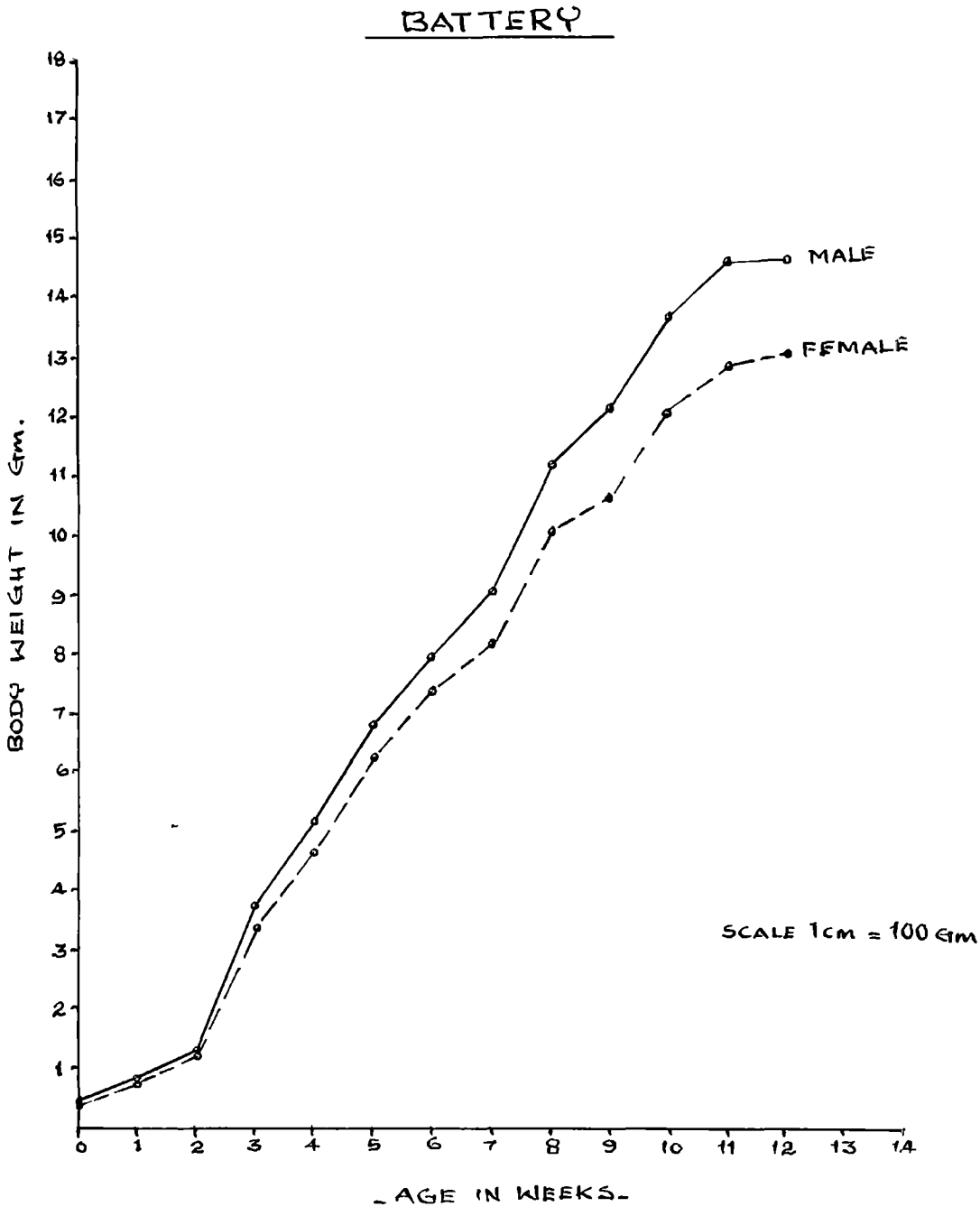
Table 12. Estimated yields of inedible products from processing of desi drakes of 12 weeks age

Inedible parts	Average weight in g	Percentage of live weight
1. Blood	78.47	5.6
2. Feathers	84.47	6.1
3 Head	71.06	5.1
4. Feet	41.16	3.0
5. Viscera	82.80	5.9

both dressing and drawing losses.

The mean values for the inedible products from processing desi drakes are presented in Table 12. Average weights of blood and feathers were 5.6 and 6.1 per cent, while the mean weights of head, feet and viscera were 5.1, 3.0 and 5.9 per cent respectively. Analysis of the data on ready to cook yield revealed that this parameter is significantly correlated to body weight at slaughter (0.47).

Fig 5.


BATTERY
BODY WEIGHT IN Gm.
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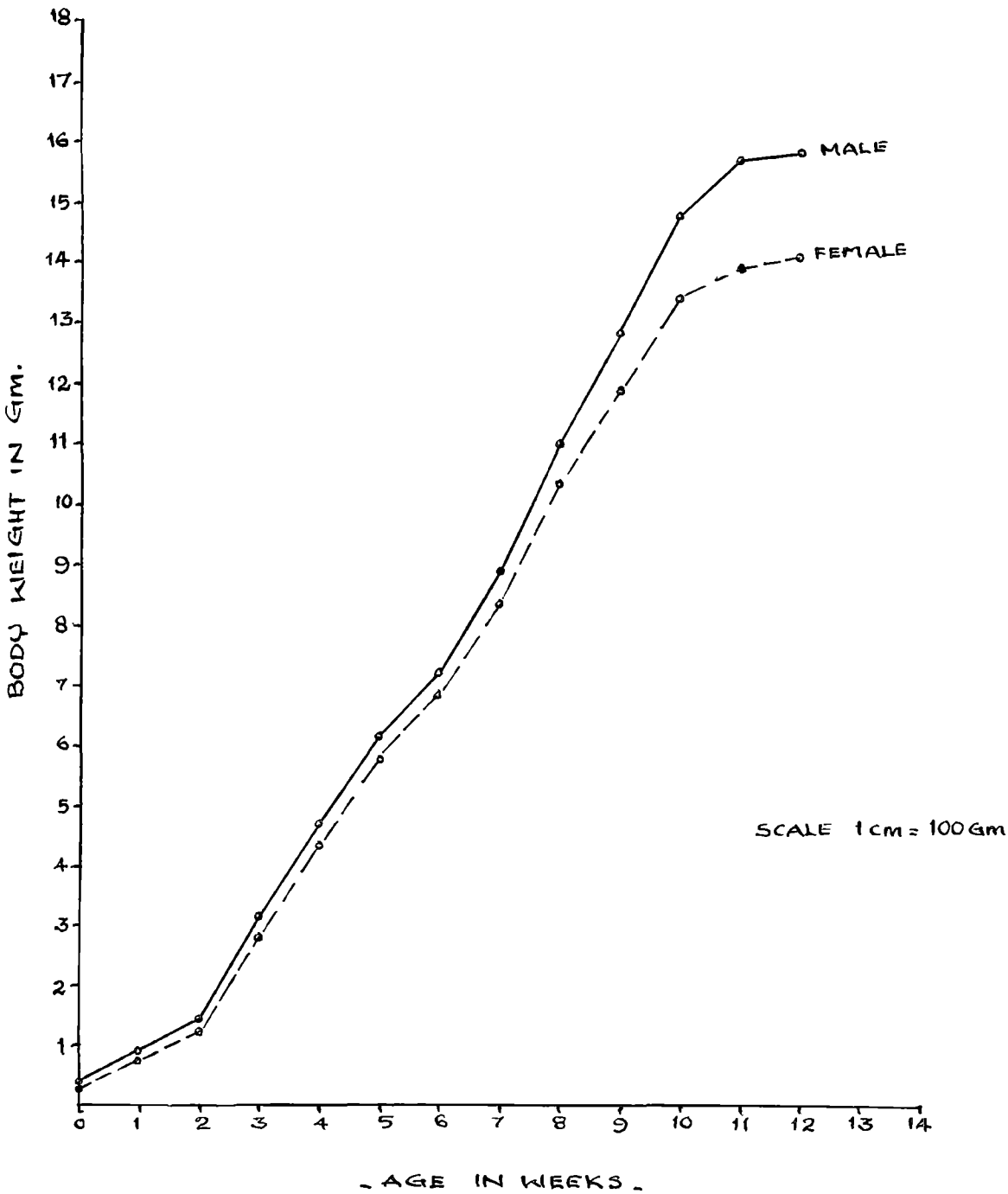
AGE IN WEEKS
MALE
FEMALE
SCALE 1cm = 100 Gm

FLOOR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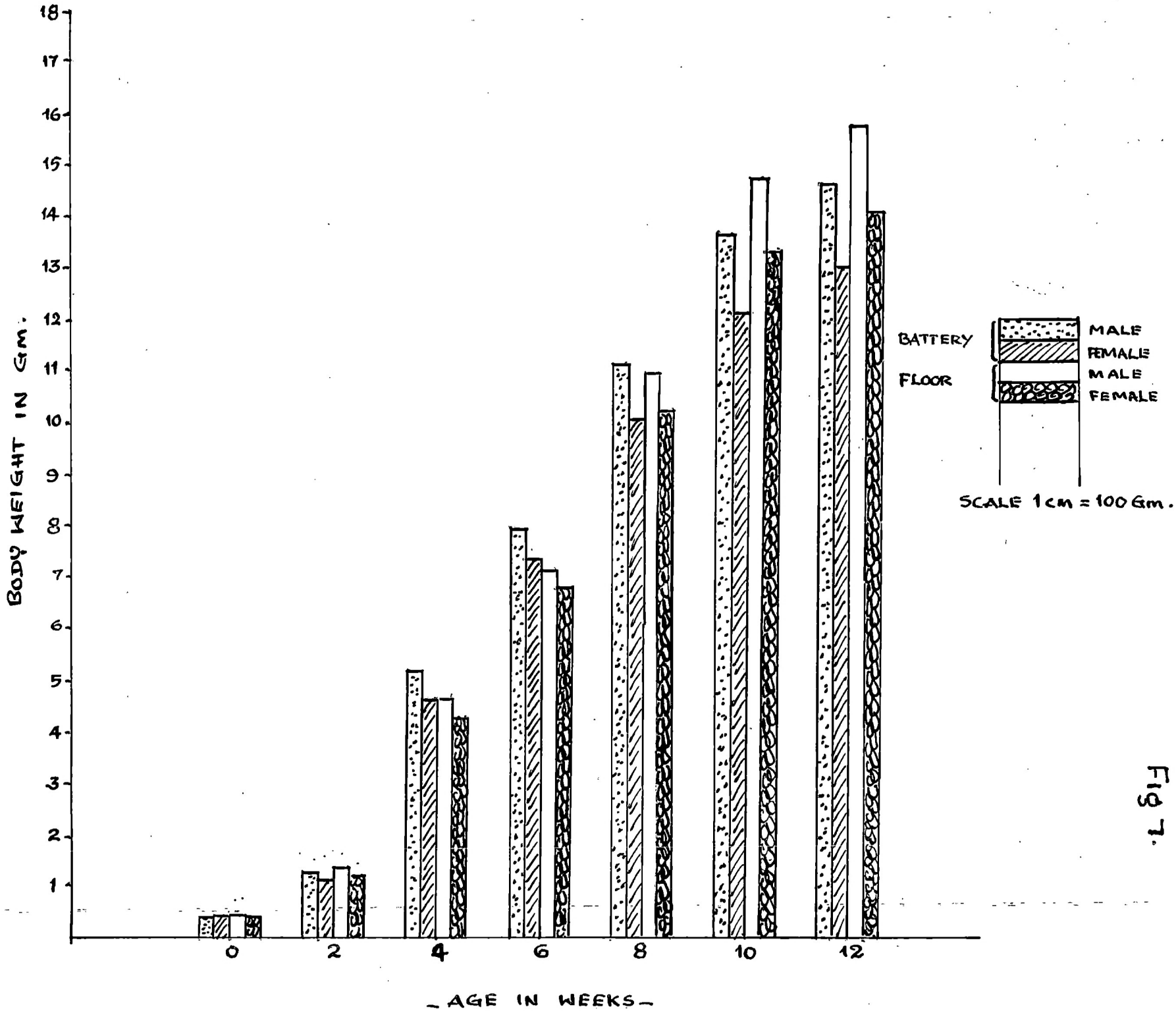
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AGE IN WEEKS
BATTERY
FLOOR
MALE
FEMALE
MALE
FEMALE
SCALE 1 cm = 100 Gm.

Fig 7.

Fig 8. - Congenital deformities among duck embryos.

DISCUSSION

DISCUSSION

Egg characteristics

The mean egg weight of desi ducks recorded during the course of this investigation agrees well with those reported by Bose and Mahadevan (1956). However the least weight (55 g) recorded in this study appears to be lower when compared to the report of the above authors. The possible reason for the lower mean egg weight than those reported by Romanoff (1967) might be due to the fact that the desi ducks are indiscriminately bred without applying selection yardsticks by the duck farmers. Further, a comparison of the mean egg weight of recognised breeds of ducks with those of desi duck eggs tends to suggest that there is scope for improvement of this trait in desi ducks. In the light of the knowledge that egg weight has a high heritability, it is safe to surmise that this trait could be improved in desi ducks by applying appropriate selection procedures.

The mean shape index of desi duck eggs recorded in the present study (72.9) is fairly in agreement with those reported by Romanoff and Romanoff (1949) and Sergeeva (1975).

The present study revealed that shape index

had no influence on the weight of duckling at hatch. But there was a very high positive correlation between egg weight and hatch weight of ducklings. Similar results have been reported by Oplt et al. (1975).

The mean duckling weight at hatch (42.25 g) observed during this study agrees well with those reported in the literature(Romanoff, 1967).

Duckling weight expressed as percentage of egg weight before incubation recorded in this study was 61.75 per cent. While Romanoff (1967) reported that the hatch weight of ducklings of different breeds as percentage of egg weight to be 65. Upp (1928) observed that the chick weight as percentage of egg weight was 68 and the corresponding value for turkey poults reported was 67 per cent (USDA, 1966).

Incubation

The present study revealed that there was no significant relationship between shape index and either fertility or hatchability. These observations are in contrast to those reported by Sergeeva (1975) who observed a correlation coefficient of 0.15 to 0.26 between shape index of duck eggs and hatchability. Similarly MacLaury et al. (1973) observed a highly significant linear regression of hatchability on shape index on quail eggs. The absence of

any relationship among shape index, fertility and hatchability in the present study might be possibly due to the lesser number of eggs in certain index groups employed.

The overall per cent fertility of 88.63 observed during this study appears reasonably good. It should be considered at this juncture that these eggs were procured from flocks which were provided a male female ratio of 1:25. The normal male female ratio recommended is 1:6 for ducks (Paul Ives, 1951). Therefore the present study clearly indicated that reasonably good fertility could be obtained among desi ducks even with substantially wider ratio, suggesting that desi drakes are able to successfully mate with more females. The incubation results suggest that the methods of incubation practices employed in the present study are satisfactory for obtaining optimum hatch.

Growth

The data on the mean body weight of ducklings revealed that for better body weights at 12 weeks of age raising ducklings on litter floor could be beneficial. The apparent improvement in body weight upto 7th week for the ducklings reared in battery was nullified when these ducklings were transferred to litter floor. Thus at 12 week of age the birds reared on the floor from the start had significantly higher body weights than those that were raised in battery upto 7th week of age and subsequently

transferred to floor. The retarded performance of the birds that were transferred from battery to floor might be due to the change in housing environment. Continued rearing of ducklings in battery beyond 6 weeks was not possible in chicken battery brooders because of their larger body size. In the absence of data regarding body weight of ducklings reared upto 12 weeks of age in battery/ cages no valid conclusion could be drawn on the beneficial results or otherwise of battery rearing.

The better body weight of male ducklings over females during all ages observed in this study is a normal sexual dimorphism.

Feed consumption

It was revealed that the feed consumption by the ducklings, maintained in battery and floor, was more or less similar upto 6th week of age. Thereafter, the ducklings maintained in the battery and subsequently transferred to litter floor at 7th week consumed more than those maintained on floor. The high feed consumption by the former group might possibly be due to their increased activity on the floor and consequent higher energy requirement.

The feed efficiency of the ducklings maintained on litter was better than those maintained in battery. Moudgal et al. (1966) working with White Pekin and Minikos

ducks reported a better feed conversion ratio (2.64 and 3.3). While Rikhter et al. (1973) comparing confinement rearing and free range rearing using broiler ducks observed a feed efficiency of 5.7 to 6.6 for the former. Thus the overall feed efficiency of the desi stock studied indicated that the capacity for feed conversion is fairly good.

The data on weekly feed and water consumption as well as that of feed water ratio observed during the study are placed on record. The feed water ratio observed for duckling is higher than that reported for chicken. Ernest Ross et al. (1954) and Medway and Kare (1959) have recorded a ratio of 1:2 and 1:2-2.6 for chicken. In the absence of any comparable value for ducks in the literature the only inference that could be drawn from the observations of this study is that ducklings should be provided more water for drinking than for chicken, an observation of significance in the management of ducks.

Further it could be seen that the feed water ratio is fairly uniform (1:5.0) irrespective of age or system of housing employed. Similar observation in respect of chicken has been made by Ernest Ross et al. (1954).

Mortality

The mortality data observed suggests that the ducklings that are reared in battery tend to suffer more

than, those that are reared on floor. This is in agreement with those reported by Singh et al. (1976). The absence of any specific lesions or infection warrants to draw a conclusion that rearing of duoklings in chicken battery brooder is not quite suitable. However, further work in this aspect is required before valid conclusion could be drawn.

Bacteriological studies

Bacterial contamination is considered as one of the major factors affecting hatchability of chicken egg. Bean and MacLaury (1959) have studied the microbial aetiology for spoilage of hatching eggs and have reported that Streptococcus faecalis, Proteus morganii, Proteus vulgaris and Pseudomonas aeruginosa are the main species of bacteria responsible for the same. In the present study it was observed that a high percentage of eggs were contaminated with bacteria belonging to Enterobacteriaceae. Similar findings were reported previously by Pathak et al. (1960). Isolation of Bacillus species from dead embryos had not been recorded by any of the previous research workers on the subject. Streptococcus faecalis is reported to be a major cause for chicken embryo mortality (Bean and MacLaury, 1959). But in the present study Streptococcus faecalis was not isolated from any of the embryos examined.

Bacterial aetiology for duck embryo mortality

has not been studied in detail previously. Therefore, no definite conclusion can be drawn from the specificity of the bacterial isolates made in this limited study. A detailed investigation of the bacterial species responsible for the duck embryo mortality is warranted.

Processing studies

Processing studies revealed that the fasting shrinkage to be much lower than the values reported for chicken (Ranganathan et al., 1967; Prabhakaran and Ranganathan, 1971). Comparable values are not available for desi ducks. However, Mountney (1966) reported a shrinkage value of 2.9 only for a period of 6 hours during transportation of chicks without feed.

The mean dressing losses represented by the loss of weight of blood and feathers worked out to 11.7 per cent thereby giving a dressed carcass yield of 88.3 per cent. However, Synder (1961) reported a lower dressing yield (85.1%) for Muscovy male ducks at 12 weeks of age. The yield observed in this study followed the accepted dressing losses for chicken (Vernon, 1923).

Feathers, downs and hairs appeared harder to pick than those of chicken. The temperature of scald water maintained in this study (71°C) was just enough to facilitate removal of feathers, specially those on the tail and wings.

A higher temperature was intentionally not employed with a view to avoid possible cooking of the epidermal layer of the skin. Inspite of using a mechanical poultry feather picker, many feathers had to be removed manually. It may be stated here that defeathering of ducks is more time consuming compared to that in chicken. Singeing was also found to be essential in removing the hair like structures for better carcass appearance.

The giblet represented 6.9 per cent of the weight of the bird at slaughter. This finding is in agreement with that reported by Abdel Malek et al. (1976) for Pekin duck at 12 weeks of age. Nevertheless giblet weight reported by Card and Neshiem (1967) for chicken (7.5 per cent) is on the higher side than that for ducks as seen from the results of the study. The ready to cook yield worked out to 74.3 per cent showing a shrinkage of 25.7 per cent from live to ready to cook weight. Similar results have been reported by Varadarajulu et al. (1976) working with native ducks of Krishna district in Andhra Pradesh. Marden and Bean (1957) also reported similarly. However slightly higher shrinkage values were reported for 12 weeks old Muscovy males by Synder (1961). The per cent shrinkage from live to ready to cook weight observed in this study was slightly lower than that reported by Benjamin et al. (1962)

Standard data on the inedible products from duck

processing have not been reported for comparison. However, standard figures for chicken are available in the literature. Percentage yield of blood appeared quite high for desi ducks than for chicken, while per cent feather weight was found to be slightly lower. Head being large in ducks, the percentage weight appears much higher than that of chicken. However per cent weight of feet was comparatively lower for ducks. Weight of viscera as seen in this study is much lower than that of viscera of chicken.

SUMMARY

SUMMARY

The results of an investigation designed to study the incubation, growth and processing characteristics of desi ducks (Anas platyrhyncos) are presented in this thesis.

Six hundred desi duck eggs were locally procured and were screened. Twenty eight eggs were discarded. The balance of 572 eggs which were adjudged as apparently good based on their physical characteristics were weighed and their shape index was calculated. Eggs were distributed into four groups depending upon their shape index and were used for incubation studies. The dead germs and dead in shells were subjected to bacteriological and pathological studi Measures were taken to identify the chicks from which eggs they hatched out.

The ducklings hatched out were wing banded, weighed and allotted at random to two housing conditions: namely battery and litter floor. They were reared to 12 weeks of age. The ducklings in battery as well as those on the litter floor were transferred to semiintensive system at 7th week of age.

Weekly body weights, feed consumption and water

consumption were recorded through out the period of experimentation.

At 12 weeks of age 30 male ducklings chosen at random were subjected to slaughter studies.

The following observations were made and inferences drawn:

The egg weight of desi ducks ranged from 55 to 85 g with a mean of 68.86 g.

The shape index of egg does not influence either fertility, hatchability or hatch weight of ducklings.

The egg weight showed a significant positive correlation to hatch weight of ducklings.

The overall fertility recorded was 88.63. In the light of the fact that the flock from which these eggs were procured, were provided with a male female ratio of 1:25, the results indicate that desi drakes can successfully mate with more females than is usually recommended.

The mean hatchability recorded (71.4 per cent) indicates that duck eggs could be successfully and efficiently hatched in incubators meant for chicken with minor modification in respect of humidity as followed in this study.

A total of 21 species of bacterial isolates

belonging to six genera were obtained from 145 dead embryos in contrast to earlier observations, Streptococcus faecalis was not isolated from any of the embryos examined.

The mean body weight of ducklings observed in this study suggests that for better body weight at 12 weeks of age floor brooding and rearing is beneficial over battery brooding.

The overall feed efficiency of the desi ducklings observed during the study reveals that the present stock has fairly good capacity for feed conversion for growth. The male ducklings recorded better body weight over the females during all ages confirming the normal sexual dimorphism.

The data on feed and water consumption for desi ducks are presented.

The processing study reveals that picking of feathers, down and hairs in ducks is harder and time consuming compared to chicken. Singeing was found to be essential in dressing duck carcass. The dressing yields and dressing losses for desi ducks are reported. The ready to cook yield was significantly correlated to body weight at slaughter.

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STUDIES ON CERTAIN ECONOMIC TRAITS IN DESI DUCKS

BY

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ABSTRACT OF A THESIS

submitted in partial fulfilment of

the requirement for the degree

MASTER OF VETERINARY SCIENCE

Faculty of Veterinary and Animal Sciences

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Mannuthy - Trichur

1977

ABSTRACT

This thesis embodies the results of an investigation carried out to study the incubation, growth and processing characteristics of desi ducks (Anas platyrhyncos). Duck eggs procured from a local farmer were used in this study. Sound eggs were weighed and their shape indices were calculated based on the measurements of length and width of individual eggs. The eggs were grouped into four shape index ranges and were incubated in chicken incubator. The hatch records were obtained. The dead in shells and dead germs were subjected to bacteriological and pathological studies. The ducklings hatched were reared on two systems of management viz., battery and litter floor upto seventh week of age when they were transferred to semi intensive system upto twelve weeks of age. Thirty randomly selected male ducklings were subjected to slaughter studies at twelve weeks of age.

The desi duck egg showed a mean weight of 68.80 g with a range of 55 to 85 g. The study reveals that the shape index has no influence on fertility, hatchability or weight of duckling at hatch. Egg weight was found to be significantly correlated with the hatch weight of ducklings. It was observed that the fertility of eggs was fairly good even with a male female ratio of 1:25.

The incubation data suggested that duck eggs could be efficiently hatched in incubators meant for chicken with suitable measures to provide higher humidity.

Weekly body weight, feed and water consumption data for desi ducklings are placed on records.

The male ducklings recorded better body weights over the females during all ages confirming the normal sexual dimorphism.

The special problems, encountered in the processing of desi ducks are discussed and data on yields and losses during dressing are presented.