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The Relevance of Egg Shape, Colouration and Day of Lay in Japanese Quails Production

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Abstract: ***The study was conducted to determine the effect of egg shape, coloration pattern and the day of lay of Japanese quail on fertility, hatchability and sex of chicks. A total of 100 quails (50 males and 50 females) of 4-5 weeks of age were paired in a ratio of 1:1 in cages. Eight hundred and nineteen (819) eggs collected for the duration of 5 weeks and were sorted into twelve (12) groups on the basis of their shape, colour and day of lay. The eggs were incubated at various batches. The chicks were maintained into their various groups after hatching and reared for 5-6 weeks their sex was determined. It was observed that there was no significant (P>0.05) difference between the observed egg shapes and colour patterns in Japanese quail .However, the result showed that the number of spherical oval eggs were more than the conical oval eggs. The tan coloured eggs were more than the brown eggs while the straw coloured eggs were few in the distribution. There was no significant (P>0.05) difference between the shape, colour, day of lay and batch of incubation on sex of the chicks. The result of the effect of egg shape, colour, day of lay and batch of incubation on fertility showed that there were no significant (P>0.05) influence of egg shape ,colour, day of lay and batch of incubation on fertility. Egg shape, colour, day of lay and batch of incubation had no significant (P>0.05) influence on hatchability but the combinations of egg shape, colour and day of layhad a significant (P<0.05) influence on hatchability. The result of both egg shape, colour, day of lay and batch of incubation and their combinations had no significant (P>0.05) influence on embryonic mortality. However, the result revealed that spherical oval shape had less embryonic mortality (10.5%) compared to conical oval (21.8).the combination of spherical oval day 1 had minimum embryonic mortality of less than 10% (8.5%) while conical oval day 1 brown had highest embryonic mortality of 38.9%.egg shape, colour, day of lay and batch of incubation had no significant (P>0.05) influence on attainment of sexual maturity but the combination of egg shape, colour and day of lay had a significant (P<0.05) influence on attainment of sexual maturity. This implies that the combination of egg shape, colour and day of lay can be used to determine the hatched chicks that would survive to sexual maturity in quails.***

Keywords: quails, hatchability, colour, egg shape

1. Introduction

Animal protein is essential in human nutrition because of its biological significance and the poultry sub-sector is vital to its provision to the Nigerian populace. The poultry industry in Nigeria has hitherto been dominated by rearing of domestic chickens. However, in recent times there have been new entrants into the sector. One of the poultry species slowly gaining prominence is the Japanese quail (*Cortunixcoturnix japonica*) which is suited for commercial rearing, meat and egg production under intensive management (Egbeyale et al., 2013). Quails have a lower feed requirement compared to the chicken and also require minimal space for rearing (Ijaiya et al., 2013). They thrive well in small cages and can be reared at a cheaper cost within a relative short time (Ojo et al., 2011). Quails require less vaccine per shot because of their resistance to most poultry diseases and they have a high rate of egg production ranging between 200 and 300 eggs during the period of up to 360 days.

Hemid et al. (2010) reported that quails have a short generation interval, high rate of lay and much lower feed and space requirements than the domestic fowl. Quail eggs are very rich in vitamin D, antioxidants which according to Sahin et al. (2008) improve the quality of food from animal origin in terms of colour, oxidative stability, tenderness and storage properties. They have a highly positive effect on people with stress problems, hypertension, digestive disturbance, gastric ulcer, liver problems, bronchitis illness, depression, panic and anxiety illness. The nutritional value of quail eggs is 3–4 times greater than the nutritional value of chicken eggs (Tunsaringkarn et al., 2013). Quail eggs are also known to increase sexual appetite, stimulate brain functions which improve intelligence quotient and generally rejuvenate the body (Onyewuchi et al., 2013). There are also some claims that consumption of quail eggs fortifies the woman's body during pre- and postnatal periods as well as after surgery and radiotherapy (Onyewuchi et al., 2013). Quail meat is tastier than chicken and has less fat content (Igado and Aina, 2010). Generally, products from quail birds are known for their high quality protein, high biological value and low caloric content, making it a choice product for a hypertensive patient (Sahin et al., 2008).

Protein nutritional insecurity is still prominent in most developing countries (including Nigeria). Protein intake has been on a decline due to the ever increasing population (Etim et al., 2008) and this level of animal intake has a direct effect on the health and general well-being of the teeming Nigerian populace (Bamgbose et al., 2002). Chicken meat and egg which have been a major source of animal protein have been unable to meet the demands for protein (Igado and Aina, 2010) .in order to maximize food production and meet the protein requirements in Nigeria, viable options need to be explored and evaluated (Owen et al., 2008).Among such alternatives is the use of species that have a promising economic, health and nutritional benefits of which quails production is one.

Every business plan must be clearly defined and need to answer the question of what to produce, Service or services to render. The major products of any poultry business could be egg, meat or day old chicks and as such commercial poultry companies; small-scale and individual poultry farmers must be explicit in terms of their products. The supply of day old chicks is very paramount to the success of the poultry chain. It becomes very imperative for sex of a chick to be determined at day old so that buyers of day old

chick scan now buy the sex that suit the particular business plan they have that is male chicks for meat production and female chicks for egg production. Unlike chicken that their sex can be separated at day old, up till date, there is no clear method to separate the sex of quail bird at day old. This study therefore was an attempt to relate the shapes, coloration pattern and day of lay of an egg to the sex of the chick.

2. Materials And Methods:

Site of the experiment

The experiment was conducted at the poultry unit of the teaching and research farm, department of animal science Ahmadu Bello University, Zaria. Zaria is located within the northern guinea savannah of Nigeria, latitude $11^{0}12^{1}$N and longitude $7^{0}33^{1}$E, at an altitude of 610m above the sea level. The climate is relatively dry, with a mean annual rainfall of 700-1400mm, occurring between the months of April and September .the dry season begins around the middle of October, with dry cold weather that ends in February. This is followed by relatively hot, dry weather from March to sometimes in April, whenthe rain begin. The mean minimum and maximum daily temperature is from about 14^{o}c to 24^{o}c during the cool season and from about 19^{o}c to 36^{o}c during the hot season. The relative humidity varies between 19% and 35% in dry season and between 63% and 80% in the wet season (Akpaet al.2002)

Source and management of experimental birds

Japanese quail (Coturnixcoturnix japonica) used for the study was purchased from a quail merchant in PZ Zaria.Experimental Birds and Design: Hundred (100) point of lay, Quails at 5-6weeks (50-males and 50-females) were used for the study. The birds were paired in cages using a mating ratio of 1:1 i.e. one male to one female for the first phase of the experiment. The second phase of the experiment was when the bird started laying. The experimental design was that of a factorial arrangement considering the shape of the egg (grouped into two i.e. spherical oval and conical oval shapes), colourationpattern (grouped into three i.e. Brown, tan and straw colors as the main effect and the day of lay separated into day 1 and day 2 as the interaction making up a 2*3*2 factorial arrangement in a randomized completely blocked design. Feed and water were given ad libitum throughout the experimental period. Also standard management practices were strictly observed. Daily record of egg laid were taken indicating parameters such pen number and the weight of the egg (g).Total egg collection per day were sorted into the various shapes, colors and the day of lay.Parmanent marker was used to mark the eggs into, their group of shape, color and the day of lay in accordance with the experimental design. The total collections for the period of seven days were incubated for 16-18 day. The hatched chicks with their existing groups established already were housed in their different compartment and raised to maturity until their sex were determined.

Statistical Analysis

The data collected were imputed and subjected to analysis of variance using the general linear model (GLM) procedure of SAS (2001).However, fertility, hatchability and sex determination data were subjected to chi square analysis.

3. Results

Egg shape and colouration pattern

Table 1 shows the observable shape and colour pattern in Japanese quails. The chi-square analysis showed no significant (P>0.05) difference between the egg shapes and colour pattern distribution in Japanese quail.However,the frequency distribution showed that the spherical oval shaped eggs in Japanese quail was 6% higher than those of conical oval shaped eggs. Also in terms of colour distribution, the tan coloured eggs (53.1%) was 7.7% more in number to brown eggs (45.4%). The table also showed that the Japanese quail rarely laid straw colour eggs, which was only 1.5%.

Table 1: Observable egg shape and color patterns in Japanese quails

Traits	Observed	Frequency	X^2_{value}	Los
Shape	819	100		
Spherical oval	432	53	0.021	Ns
Conical oval	387	47		
Color	819	100		
Brown	372	45.4		
Tan	435	53.1	0.0411	Ns
Straw	12	1.5		

Laying Pattern, Egg Size, Fertilityand Hatchability

Sixty days laying pattern, egg size, fertility, hatchability in Japanese quail is shown in table 2.high level of variability exists in sixty days laying pattern ranging from 7.8% (in average egg weight) to 94.5% (in embryonic mortality).the 60 days average pattern of lay in Japanese quail was for period inlay (8.87),number of days inlay/period (3.76),number of period skipped (8.08) and average number of day/skip (1.9).the egg size of Japanese quail in sixty days laying period was :total number of egg laid (1237) .Average egg weight (8.9) .fertility,hatchability,embryonic mortality of Japanese quail egg was :51%,81% and 31% respectively. In Japanese quail 58.1% of hatched eggs lived to attain sexual maturity, 44.7% of this number were males and 55.3% female

Table 2: Sixty days laying pattern, egg size, fertility, hatchability in Japanese quail

Characteristics	N	Mean+Se	CV	Min	Max
Pattern of lay					
Period inlay	38	8.87±0.55	37.66	2	16
Average number of days	38	3.7±60.26	42.02	1	15
Inlay /periods					
Number of period skipped	38	8.08±0.55	41.60	1	15
Average number of days per skip	38	1.90±0.17	54.74	1	23
Egg size					
Total number of egg laid per hen	38	32.60±1.97	37.00	2	52
Egg weight at point of lay(g)	38	8.20±0. 181	3.54	6	11
Average egg weight (g)	1237	8.90±0.11	7.80	5	13
Fertility and hatchability					
Fertility (%)	819	51±3.74	37.00	15	100
Hatchability (%)	398	81±3.20	25.00	23	100
Embryonic mortality (%)	398	0.31±6.10	94.50	0	67
Number of quails at sexual maturity	335	197 (58.8%)			
Number of male quails at sexual maturity		88 (44.7%)			
Number of female quails at sexual maturity		109 (55.3%)			

Sex Determination of Japanese Quail

Table 3 shows the determination of sex of Japanese quail chicks using egg shape, colour and day of lay and batch of incubation.Chi-sqare analysis of the distribution of male and female quail chicks showed that these factors had no significant (P>0.05) influence on the sex determination of the chicks. All the same, the spherical oval shaped eggs had 6% more females than males while the conical oval shaped eggs had 17% more females than males. The brown colored eggs had 20.76% more females than male .Therefore; egg shape on its own cannot differentiate the sexes while egg colour could be a promising tool of use. Irrespective of the day of lay, female quail chicks were more than the male chicks. On the account of batch of incubation, batch 5 had 53.84% more females than males and batch 1 had 5% more males than females while thepercentage of females was higher than that of males in the rest of the batches (i.e. batch 2, 3 and 4).

Table 3: Distribution of male and female quails according to shape, color, day of lay and batch of incubation

Factor	N	Male (%)	female	X^2_{value}	Los
Egg shape	197				
Spherical oval	115	47.00	53.00	0.572	Ns
Conical oval	82	41.50	58.50		
Egg color	197				
Brown	91	50.55	49.45		
Tan	106	39.62	60.36	2.410	Ns
Day of lay	197				
Day 1	99	40.40	59.60		
Day 2	98	48.98	51.02	1.449	Ns
Batch of incubation	197				
1	80	52.50	47.50		
2	56	42.86	57.14		
3	32	43.75	56.25	5.619	Ns
4	16	31.25	68.75		
5	13	23.08	76.92		

The distribution male and female quails according to the combinations of egg shape, colour and day of lay are shown in Table 4.the result showed that in all combinations, there was no clear distinction of either of the sexes. However, in using shape and day, conical oval eggs laid on day 1 had 71.43% of hatched eggs to be female while 28.57% of them were males .other combinations in this category were near 50:50 distributions. Under shape and colour combinations, conical oval shaped eggs that were tan coloured had 61.20% of them as females while spherical oval tan coloured eggs had 59.65% of them as females. Other combinations in this category were near 50:50 sex distributions. In combining shape, day of lay and colour of egg to determine sex of chicks, female chicks were favored by conical oval day 1 brown eggs (70%) and conical oval day 1 tan eggs (72.20%).the male chicks were favored spherical oval day 1 brown eggs (53.80) and conical oval day 2 brown eggs (52.20).

Table 4: Distribution of male and female quails according to combination of egg shape, colour and day of lay

Combinations	N	Male (%)	Female (%)
Shape and day			
Spherical oval day 1	71	45.07	54.93
Spherical oval day 2	44	50.00	50.00
Conical oval day 1	28	28.57	71.43
Conical oval day 2	54	48.15	51.85
Colour and day			
Brown day 1	49	48.98	51.02
Brown day 2	50	32.00	68.00
Tan day 1	42	52.38	47.62
Tan day 2	56	46.43	53.57
Shape and colour			
Spherical oval brown	58	53.45	46.55
Spherical oval tan	57	40.35	59.65
Conical oval brown	33	45.45	54.55
Conical oval tan	49	38.80	61.20
Shape, day and colour			
Spherical oval day 1 brown	39	53.80	46.20
Spherical oval day 1 tan	32	34.40	65.60
Spherical oval day 2 brown	19	52.60	47.40
Spherical oval day 2 tan	25	48.00	52.00
Conical oval day 1 brown	10	30.00	70.00
Conical oval day 1 tan	18	27.80	72.20
Conical oval day 2 brown	23	52.20	47.80
Conical oval day 2 tan	31	45.20	54.80

Fertility Determination in Quail Eggs

Table 5 shows the fertility of quail eggs according to shape, colour, and day of lay and batch of incubation. The chi-square analysis showed that there was no significant

(P>0.05) influence of egg shape, colour and batch of incubation on fertility. The two showed 50:50 fertility, tan colour had 49.4% fertility and brown colour had 49.2% fertility but the straw colour had 0% fertility and therefore, this colour was discarded for further analysis. On the basis of batch of incubation, batch 1 showed the highest fertility (72.1%) while batch 4 had the lowest (37.2%).

Table 5: Fertility of quail eggs according to shapes, colour, and day of lay and batch of incubation

Factor	N	Fertility (%)	X^2_{value}	Los
Egg shape				
Spherical oval	432	48.6	0.0089	Ns
Conical oval	387	48.6		
Egg colour				
Brown	372	49.2		
Tan	435	49.4	0.00089	ns
Straw	12	0		
Day of lay				
Day 1	421	46.6	0.0097	ns
Day 2	398	50.8		
Batch of incubation				
1	172	72.1		
2	178	51.1		
3	140	42.9	0.0141	ns
4	129	37.2		
5	200	37.5		

The fertility of quail eggs according to the combinations of egg shape, colour and the day of lay is shown in table 6.the chi-square analysis showed no significant (P>0.05) difference in the egg fertility of the various combinations. All the same, on the basis of shape and day, the best combination was conical oval by day 2 with 52.4% level of fertility. For shape and colour, more than 50% level of fertility was produced by conical oval by brown (54.30%) and spherical oval by tan 52 (52.70%).shape by day by colour combinations produced the best fertility i.e. Conical oval by day 2 by brown eggs (61.33%); followed by spherical oval by day 2 by tan eggs (55.00%) and spherical oval by day 1 by tan eggs (50.50).

Table 6: Fertility of quail eggs according to the combinations of egg shape, colour and day of lay

Combinations	N	Fertility (%)	X^2_{value}	Los
Shape and day				
Spherical oval day1	221	47.96		
Spherical oval day 2	211	49.30	2.1732	ns
Conical oval day 1	200	45.00		
Conical oval day 2	187	52.40		
Shape and colour				
Spherical oval brown	221	45.70		
Spherical oval tan	207	52.70		
Conical oval brown	151	54.30	4.296	ns
Conical oval tan	228	46.50		
Colour and day				
Brown day 1	187	47.06		
Brown day 2	185	48.00		
Tan day 1	225	51.31	1.069	ns
Tan day 2	210	50.95		
Shape, day and colour				
Spherical oval day 1 brown	111	46.80		
Spherical oval day 1 tan	107	50.50		
Spherical oval day 2 brown	110	45.00		
Spherical oval day 2 tan	100	55.00	7.873	ns
Conical oval day 1 brown	76	47.40		
Conical oval day 1 tan	118	45.80		
Conical oval day 2 brown	75	61.33		
Conical oval day 2 tan	110	47.30		

Hatchability determination in quail eggs

Table 7 presents the hatchability of quail eggs according to egg shape, colour, day of lay and batch of incubation .chi-square analysis none of the factors can significantly (P>0.05) could be used to determine hatchability .However, the hatchability distributions along the factors are high (78.2 to 93.8%) and only moderate for batch 5 (56.0%).the hatchability distribution shoed that the spherical oval eggs had (11.3%) better hatchability than the conical oval eggs. The brown coloured eggs (1.4%) and day 2 laid eggs (6.0%) had slightly better hatchability than the tan eggs and the day 1 laid eggs respectively.in terms of batch of incubation, the best hatchability was in batch 4 (93.8%) while the lowest was in batch 5 (56.0%).

Table 7: Hatchability of quail eggs according egg shape, colour, and day of lay and batch of incubation

Factor	N	Hatchability (%)	X^2_{value}	Los
Egg shape				
Spherical oval	210	89.50	0.00092	Ns
Conical oval	188	78.20		
Egg colour				
Brown	183	84.20	0.0004041	ns
Tan	215	85.60		
Day of lay				
Day 1	196	81.10	0.0269	ns
Day 2	202	87.10		
Batch of incubation				
1	124	89.50		
2	91	89.00		
3	60	90.00	0.00788	ns
4	48	93.80		
5	45	56.00		

The hatchability of quail eggs according to combinations of egg shape, colour and day of lay is shown in Table 8.the chi-square analysis showed a highly significant (P<0.05) effect of the various combinations on hatchability All combinations gave high hatchability .Good hatchability was between (61-68) and high hatchability was (74-92).However, the combination that gave the best hatchability was spherical oval day1 brown eggs (92.0%) while the conical oval day 1 brown eggs (61.15%) gave the lowest.

Table 8: Hatchability of quail eggs according to the combination of egg shape, colour and day of lay

Combinations	N	Hatchability (%)	X^2_{value}	Los
Shape and day				
Spherical oval day 1	106	91.50		
Spherical oval day 2	104	87.50	21.443	**
Conical oval day 1	90	68.90		
Conical oval day 2	98	86.70		
Shape and colour				
Spherical oval brown	101	90.00		
Spherical oval tan	109	89.00	9.824	**
Conical oval brown	82	76.80		
Conical oval tan	106	79.20		
Colour and day				
Brown day 1	88	79.55		
Brown day 2	95	93.68	3.079	ns
Tan day1	108	77.78		
Tan day 2	107	85.98		
Shape ,day and colour				
Spherical oval day1 brown	52	92.00		
Spherical oval day 1 tan	54	90.70		
Spherical oval day 2 brown	49	87.80	24.603	**
Spherical oval day 2 tan	55	87.30		
Conical oval day 1 brown	36	61.10		
Conical oval day 1 tan	54	74.00		
Conical oval day 2 brown	46	89.00		
Conical oval day2 tan	50	84.60		

Embryonic mortality determination of quail eggs

Table 9 shows the embryonic mortality of quail eggs according to shape, colour, day of lay and batch of incubation. The chi-square showed a non-significant (P>0.05) effect of egg shape, colour, day of lay and batch of incubation on embryonic mortality. The distribution showed that spherical oval eggs had less embryonic mortality (10.5%) while conical oval eggs had (21.8%).the brown and tan coloured eggs had equal embryonic mortality (15.8%).Day 1 eggs had less embryonic mortality (11.2%) compared to day 2 eggs that had (20.3%).embryonic mortality was minimal with respect to the batch of hatch (6.3 to 10.9%) except for batch 5 where it was highest (44%).

Table 9: Embryonic mortality of quail eggs according to egg shape, colour, day of lay and batch of incubation

Factor	N	EM (%)	X^2_{value}	Los
Shape of egg				
Spherical oval	210	10.50	0.000175	Ns
Conical oval	188	21.80		
Egg colour				
Brown	183	15.80	0.000026	Ns
Tan	215	15.80		
Day of lay				
Day 1	196	11.20	0.00018	Ns
Day 2	202	20.30		
Batch of incubation				
1	124	8.90		
2	91	10.90		
3	60	10.00	0.032	Ns
4	48	6.30		
5	76	4.40		

EM (embryonic mortality)

Table 10 shows the embryonic mortality of quail eggs according to combinations of egg shape ,colour and day of lay .the chi-square analysis showed a no significant (P>0.05) effect .minimal embryonic mortality of less than 10% was found in the spherical oval day 1 (8.5%) spherical oval brown (9.9%) ,spherical oval day1 brown (7.7%).moderate embryonic mortality (10.15%) were observed in (conical oval day 2 brown ,spherical oval day 2 tan ,spherical oval day 2 brown, spherical oval tan ,conical oval day 2 and spherical oval day 2) and embryonic mortality (>15% to 38.9%) were observed in various combinations (conical oval day 1,conical oval brown ,conical oval tan ,conical oval day 1 brown, conical oval day 1 tan and conical oval day 2 tan.

Table 10: Embryonic mortality of quail egg according to combinations of egg shape, colour and day of lay

Combinations	N	Embryonic mortality (%)	X^2_{value}	Los
Shape and day				
Spherical oval day 1	106	8.50		
Spherical oval day 2	104	12.50	0.043	ns
Conical oval day 1	90	31.10		
Conical oval day 2	98	13.30		
Shape and colour				
Spherical oval brown	101	9.90		
Spherical oval tan	109	11.00		
Conical oval brown	82	23.20	0.0071	ns
Conical oval tan	106	20.80		
Colour and day				
Brown day 1	88	20.45		
Brown day 2	95	20.00		
Tan day 1	108	10.20	0.00018	ns
Tan day 2	107	14.02		
Shape, day and colour				
Spherical oval day 1 brown	52	7.70		
Spherical oval day 1 tan	54	9.30		
Spherical oval day 2 brown	49	12.20		
Spherical oval day 2 tan	55	12.70	6.449	ns
Conical oval day1 brown	36	38.90		
Conical oval day 1 tan	54	25.90		
Conical oval day 2 brown	46	10.90		
Conical oval day 2 tan	52	15.40		

Attainment of sexual maturity in quails

The distribution of the number of quails birds that attained sexual maturity in accordance with egg shape ,colour ,day of lay and batch of incubation is shown table 11.chi-square analysis of the distribution of attainment of sexual maturity in bird showed no significant (P>0.05) influence of egg shape ,colour, day of lay and batch of incubation on it.However,the percentage distribution of sexual maturity of quail chicks hatched from spherical oval eggs showed 5.4% superiority over conical oval eggs in attainment. Quails hatched brown eggs were 0.5 superior to those of from tan eggs while chicks from eggs laid on day1were 6.6% superior to those on day 2.attainment of sexual maturity decreased from batch 1 (70.8%) to batch 5 (30.5%) at an increasing rate of 9.97%.

Table 11: Distribution of attainment of sexual maturity in quails by egg shape, colour, and day of lay and batch of incubation

Factor	N	Attainment of sexual maturity	X^2_{value}	Los
Egg shape				
Spherical oval	188	115 (61.2)	0.0102	Ns
Conical oval	147	82 (55.8)		
Egg colour				
Brown	154	91 (59.1)		
Tan	181	106 (58.6)	0.0033	Ns
Day of lay				
Day 1	159	99 (62.3)		
Day 2	176	98 (55.7)	0.0051	Ns
Batch of incubation				
1	113	80 (70.8)		
2	81	56 (69.1)		
3	54	32 (59.3)	0.0764	Ns
4	45	16 (35.6)		
5	42	13 (30.9)		

Table 12 shows the distribution of attainment of sexual maturity in quails according to combinations of egg shape, colour and day of lay. The chi-square analysis showed a significant ($P<0.05$) effect of combinations of shape, colour and day of lay on attainment of sexual maturity of quails .this means that the combination of shape of eggs and the day of lay can be used to determine the hatched chicks that would survive to sexual maturity in quails. Considering shape and day of combinations, spherical oval day 1 produced the highest number of chicks that survived to attain sexual maturity (73.2%) followed by conical oval day 2 (63.5%).For shape and colour considerations, the best result was for spherical oval brown egg chicks (63.7%).The three –way combinations showed that the best result for attainment of sexual maturity was for chicks that hatched from spherical oval day 1 tan eggs (81.3%); followed by conical oval day 2 tan eggs (70.5%) and spherical oval day 1 tan eggs (65.3%)

Table 12: Distribution of attainment of sexual maturity in quails according to combination of egg shape, colour and day of lay

Combinations	N	ASM	X^2_{value}	Los
Shape and day				
Spherical oval day 1	97	71 (73.2)		
Spherical oval day 2	91	44 948.4)	15.319	**
Conical oval day 1	62	28 (45.2)		
Conical oval day 2	85	54 (63.5)		
Shape and colour				
Spherical oval brown	91	58 (63.7)		
Spherical oval tan	97	57 (58.8)	2.008	ns
Conical oval brown	63	33 (52.4)		
Conical oval tan	84	49 (58.3)		
Colour and day				
Brown day 1	70	49 (70.0)		
Brown day 2	84	50 (59.52)	0.0004	ns
Tan day 1	89	42 (47.19)		
Tan day 2	92	56 (60.87)		
Shape, colour and day				
Spherical oval day 1 brown	48	39 (81.3)		
Spherical oval day1 tan	49	32 (65.3)		
Spherical oval day 2 brown	43	19 (44.2)		
Spherical oval day 2 tan	48	25 (52.1)	22.832	**
Conical oval day 1 brown	22	10 (45)		
Conical oval day 1 tan	40	18 (45)		
Conical oval day 2 brown	41	23 (56.1)		
Conical oval day 2 tan	44	31 (70.5)		

ASM (attainment of sexual maturity)

4. Discussion

Egg shape and colouration pattern in Japanese quails

The identified egg shapes (i.e. conical oval and spherical oval shapes) are fairly in agreement with a documentary from Alberta government 2006 and 2010 which states that "egg shape is usually fairly consistent within a given species, but eggs from different species can vary in roundness and include spherical, sub spherical and elongate shapes with the ends either equal or asymmetric".

Spherical and conical oval shapes are also in agreement with the Wikipedia report in March, 2005 which says that "egg shape has oval shape with small differences among species .The shape of an egg has considered as an important factor to characterize species of birds. The egg of pheasant, chukar, quail and quinea fowl showed circular oval conical shape with blunt and pointed ends.

Coturnix eggs according to Poole, (1965) are characterized by a variety of colour patterns, ranging from dark brown, blue and white to buff each heavily mottled with black brown and blue. Thesis not far from the identified brown, tan and straw colours.The little variation may be due to some environmental and physiological factors that affects egg colouration and also the scale of measurement.

Effect of egg shape and colouration pattern on fertility, hatchability and embryonic mortality

There are many contradicting report in literature as regards to the effect of egg shape and colouration on fertility, hatchability and embryonic mortality. The chi-square analysis of the combination of egg shape, colour and day of lay showed a highly significant ($p<0.01$) effect on hatchability. This is in support of the Narashin and Roanov (2002) who reported that; "egg shape and colour are highly heritable and affect the number of eggs that hatch.

The spherical oval shaped eggs had (11.3%) better hatchability than the conical oval eggs. This is in disagreement with Joseph et al (2010) who reported that egg closest to the ovoid shape hatched best and that excessively long, thin or completely round eggs do not hatch.

According to Moreno et al (2006),"dark coloured eggs had higher fertility rate and also hatched at higher rate that did light coloured eggs". This statement is fairly in agreement with the result though not significant ($P>0.05$) the brown and tan colour eggs showed 50:50 fertility but on hatchability, the brown coloured eggs had slightly better hatchability than the tan coloured eggs.

Effect of egg shape and colouration on sex determination

The result of the effect of egg shape on sex showed that egg shape had no significant influence ($P>0.05$) on sex. All the same, the spherical oval eggs had 6% more females than male while the conical oval shaped eggs had 17% females than the males. This is fairly in agreement with Bramwell et

al, (2003) who reported that different sexes require different shaped egg for optimum growth within the shell and that the hen's body knows which sex the chick would be .football shaped eggs house boy chicks and more oval or round shaped eggs will house girl chicks. The result disagreed with Don et al, (20011), who stated that the shape of an egg somehow determines the sex of chick that will hatch. According to this school of thought, pointed or elongated eggs will hatch cockerels and round eggs pullets.

According to the literatures, there is no clear report on the relationship between the colour of eggs and the chicks sex or the combinations of shape and colour on sex but according to this study, the shape on its own cannot differentiate the sexes while colour could be a promising tool of use. The result showed that the brown coloured eggs had 1.1% more males than the females while the tan coloured eggs had 20.76% more females than males.in combining shape, colour and day of lay, the result showed that in all combinations, there was no clear distinction of either of the sexes. However combinations of shape and day showed that conical oval eggs laid on day 1, had 71.43% of hatched eggs to be female while 28.57% of them were males. Other combinations showed almost 50:50 sex distribution.

5. Conclusion

The egg shape, colour and day of lay is significant in Japanese quail breeding practices in the Northern guinea savannah zone of Nigeria. Quail egg shape on its own was poor in sex determining of chicks. However, egg colour especially tan colour had good promise in sex determination of chicks overwhelmingly, the combination egg shape and day of lay or egg colour and day of lay have good promise for sex determination in Japanese quails. Also a combination of the shape of an egg and the day of lay can be used to successfully determine the survivability of hatched quail chicks to sexual maturity.

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