تأثير العمر وبعض الاضافات الدقيقة على الكفاءة الجنسية لديوك دقى (٤)

دكتور أ٠ م٠ عثمان ـ دكتور ح٠ د٠ الحمادى ـ دكتور م٠ ن٠ مقلد

الملخص

تمت دراسة تأثير اضافة مخلوط من معادن المنجنيز والزنك والنحاس وكذلك اليود والغدة الدرقية المجففة على الكفاءة الجنسية لطيور دقى (٤) فى الفترة ما بين ٨ ، ٢٤ أسبوع من أعمارهم . ولقد لوحظ تحسن فى عدد الحيوانات المنوية فى الجرام الواحد من الخصية عند عمرى ٢٠ ، ٢٤ أسبوعا . كما لوحظ زيادة تركيز هذه العناصر فى خصى هذه الطيور عنها فى الطيور العادية .

لقد استطعنا فى هذا البحث تعيين الحيوانات المنوية فى الخصية عن عمر ١٢ أسبوعا . وكان معدل انتاج الحيوانات المنوية اليومى هو ٤١ره بليون . وتم تجميع السائل المنوى من الوعاء الناقل لعدد كبير من الطيور التى درست عند عمرى ٢٠ ، ٢٤ أسبوعا وكان تركيز الحيوانات المنوية عند هذه الأعمار هى ٢٨ر٤ ، ٨ر٨٧ مليون على التوالى .

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EFFECT OF AGE AND CERTAIN MICROADDITIVES ON THE REPRODUCTIVE CAPACITY OF DOKKI-4 COCKERELS

(With 3 tables)

By

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(Received 16/1/1974)

SUMMARY

Rations Supplemented with minera's mixture (Mn, Zn and Cu), iodine or desiccated thyroid were fed to 8 weeks old Dokki-4 cockerels to study their effect (from 8 to 24 weeks) on the reproductive capacity of males. The effect of age on the same criteria was also determined. It was proved that the mentioned microadditives favoured the sperm count per gramme testicular tissue at 20 and 24 weeks of age. Also, it was detected that the contents of such trace elements, at the same ages, were higher in the testes of the treated chicks rather than in those of their controls.

It was possible to diagnose spermatozoa as early as 12 weeks of age. The daily rate of sperm production was 4.41×10^9 sperm at 24 weeks of age. Semen was collected from the vase deferentia of many cockerels at 20 and 24 weeks of age with average concentrations of 4.28 and 8.87×10^6 spermatozoa/mm^3 at the two ages respectively.

INTRODUCTION

The high economic income of poultry, which come directly after that of meat and dairy products, lead many investigators to conduct a lot of research in the fields of their breeding, feeding and management. Moreover, different aspects of reproduction in poultry especially the cock, have been studied by GRAY (1937), WHEELER and ANDREWS (1943), FREDEEN (1953) LORENZ (1959), MANN (1964), VERMA, SHARMA and SINGH (1966), LEEHMAN (1970) and LAKE (1971). The available literature about the effect of age on the gonadal and extragonadal sperm reserves in chicks, however, seemed very meagre. The works of ORENT and Mc COLLUM (1931), MAQSOOD (1952), BUTTLER (1963), UNDERWOOD and SOMERS (1969) and UNDERWOOD (1971) have directed our attention to study the influence of adding manganese, zinc, copper and iodine upon the sperm storing capacity, weight of certain endocrine glands and the live body weight of growing cockerels under local conditions of management and feeding.

MATERIALS AND METHODS

The present investigation was carried out on 361 one-day-old Dokki-4 cockerels. During the first 8 weeks of age they received a basal ration (B.R.) which was composed of the following ingrdients in percentages: corn 50, decorticated cottonseed meal 10, horse beans 5, wheat bran 24, protelane 5, blood meal 3, limestone 2.5, common salt 0.5 and vitamin premix (A + D_3) 0.1. This ration cotained 48.6 ppm manganese, 12 ppm zinc, 4.8 ppm copper and 279 ppb iodine.

Therafter, the chicks were classified into class A (normally grown chicks with average body weight of 325 g. and class B (subnormally grown chicks with average body weight of 225 g. Class A was divided into two groups (I and II), while class B was divided into three groups (A, B and C), Group I was further divided into subgroup 1 (control : fed the basal ration) and subgroup 2 (fed the basal ration + 25 ppm Mn, 25 ppm Zn and 2.5 ppm Cu). Group II was further subdivided into subgroup 3 (control : fed the basal ration), subgroup 4 (fed the basal ration + 400 ppb iodine) and subgroup 5 (fed the basal ration + 800 ppb iodine). Group A was considered as control (fed the basal ration) while groups B and C were supplemented with 400 ppb iodine and 116 mg desiccated thyroid/kg basal ration, respectively.

SCHEME OF THE EXPERIMENT

Class	Group	Subgroup	Rations
A	I	1 (control)	Basal ration
(Normally grown chicks)		2	Basal ration + 25 ppm Zn. 25 ppm Mn + 2.5 ppm Cu
	II	3 (control)	Basal ration
		4	Basal ration + 400 ppb I_2
		5	Basal ration + 800 ppb I_2
B	A (control)	—	Basal ration
(Subnormally	B	—	Basal ration + 400 ppb I_2
grown chicks)	C	—	Basal ration + 116 mg deisccated thyroid/kg.

Manganese, zinc and copper were added in the forms of $MnSO_4$. H_2O, $ZnSO_4$. $7H_2O$ and $CuSO_4$. $5H_2O$. Iodine was supplemented in one of two forms: Lugol's solution (5g elemental iodine + 10 g potassium iodide/100 ml distilled water) or desiccated thyroid. The supplemented amount of desiccated thyroid (116 mg/kg) provides 400 ppb iodine, since the dry gland contains about 0.346% iodine (SAUCHELLI, 1969). The two forms of iodine supplements were thorough mixed with the ration every week to avoid the problem of unstability. The addition of the mentioned microelements to the basal ration was continued from 8 to 24 weeks of age.

Moreover, a number of 2-10 cockerels from each treatment were randomly chosen at 12, 16, 20 and 24 weeks of age and their live body weight were determined. The length and height of comb and the length and width of wattle of each cockerel were measured. After slaughtering, the paired testes and vase deferentia as well as the pituitary and thyroid glands were removed from the dressed carcass and weighed in mg. The sperm reserve in the testes and vase deferentia was diagnosed and calculated according to OSMAN (1972a and b respectively).

At 20 and 24 weeks of age Mn, Zn, Cu and I_2 contents of the testes were determined after TAOTSIN (1968), OLL (1962), ALIKAIEV *et al.* (1967) and BARAKAT *et al.* (1968) respectively. The obtained data were subjected to statistical analysis using the "t" test as outlined in SNEDECOR (1956).

RESULTS

The results of the different criteria in the different treatments of the present work are presented in tables 1-3. It is important to note that the "t" test revealed the presence of significant differences in the weight of pituitary between subgroups 1 and 2 as well as between group A and those of groups B and C ($P < 0.05$). Similar differences were also detected with thyroid weight between subgroups 3 and 4 and between subgroups 4 and 5.

DISCUSSION

The obtained data showed that the addition of either iodine or manganese, zinc and copper mixture to the ration of growing cockerels have a favourable influences on the number of sperm per gramme tissue, while their

effects on the testicular weight appeared insignificant. PARKER and MARSHALL (1960) reported that feeding of thyroid at low levels increases testes weight and stimulate spermatogenesis. The effect of feeding thyroid upon reproduction as mentioned by LORENZ (1959) was due to its influence on total body metabolism and in part from a specific effect on the hypophysis. The stimulus effects of iodine, manganese, zinc and copper microelements upon the sperm producing capacity of the studied cockerels support the findings of ORENT and McCollum (1931), BUTTLER (1963) and UNDERWOOD and SOMERS (1969) in mammals and birds. It is noteworthy to add that there may be a direct physiological relationship between the activity of the testes and their contents of I_2,Mn,Zn and Cu. This is the case since the testicular contents of the mentioned trace elements were highly increased in the treated groups.

Our results indicate that the paired testes weight of Dokki-4 cockerels at 20 and 24 weeks of age simulate largely those published for other breeds of chicks by *LORENZ* (1959) and *LAKE* (1971). The pattern of testicular growth of the studied breed conincide to some extent with that mentioned by *PARKER* (1962), who found that Leghorns attain their mature testicular size at 24-29 weeks of age, a time which is longer than that observed with Dokki-4 cockerels. The percentages of testes weight to live body weight increased with age and these results agree with those published by *PARKER* (1949). Both findings can lead us to conclude that after puberty, the testes of chick grow faster than its body.

The successful determination of spermatozoa in the testes of cockerels as early as 12 weeks of age concords the histological results of KUMARAN and TURNER (1949 a and b), working on light breeds of ckicks. The absence of spermatozoa from the testes of cockerels in subgroups 5 may be explained on the basis of genetical variations. However, it was noticed that the averages of the different studied criteria of the subnormally grown cockerels, rather than their live body weight, were more or less similar to those of the normally grown ones. This may lead us to conclude that the factors controlling the development of such criteria are independent from those controllling the growth of live body weight.

The vast increase in the number of spermatozoa per gramme tissue from 16 to 20 weeks of age may be due to the earlier attainement of maximum spermatogenesis in the testes, which were still growing after that age. Thus, after 20 weeks of age the total sperm reserve in the testes of Dokki-4 cockerels

is markedly influenced by the testicular size rather than by the rate of spermatogenesis. The daily rate of sperm production at 24 weeks of age was 5.41 $\times$ 10^9 spermatozoa as calculated from the assumption of OSMAN (1972a). This value is higher than that of 2.5 $\times$ 10^9 which was reported by SWIERSTRA and STRAIN (1964) in one-year old white Leghorn chicken. Variations in techniques and methods of calculation may be responsible for such difference. In comparison with the rabbit, ram, boar, buffalo and cattle bulls as reported by AMANN (1971), it is evident that the testes of cocks have the highest spermatogenic activity per gramme tissue.

The appearance of semen in the vase deferentia at 20 and 24 weeks of age in most of the examined cockerels indicates that the capacity of the testes to produce spermatozoa is greatly achieved at these ages. However, the sperm concentration in the semen of cocks no collected by the massage technique is 3.5 $\times$ 10^6 as reported by PARKER *et al.* (1942), LORENZ (1959), LAKE, (1962) and MANN (1964). The generation of lymphlike fluid from the phallus of cock during erection (LORENZ, 1959 and LAKE, 1971) is responsible for the lower concentration of spermatozoa in the collected semen than that in the vasa deferentia.

SMITH and JEFFREY (1960) and MANN (1964) claimed that the ejaculate may contain about 2.8 $\times$ 10^9 spermatozoa, a value which represents 65% of the total sperm reserve in the vase deferentia of mature cock. Thus, it is possible for the fertilizing capacity of cocks to be markedly reduced after a few numbers of natural matings, since TAKEDA (1969) reported that mature spermatozoa take 3-4 days to traverse the Juxta-testicular duct system and the ductus deferens. In connection with this, PARKER (1962) observed that some male chickens could mate 35-40 females per day and less than a third of these females were fertilized.

The growth observed in the dimensions of both comb and wattles of Dokki-4 cockereis resembled to a great extent that observed by PARKER *et al.* (1942) in other breeds of chicks. However, difinite correlations between the pituitary and thyroid glands to the sperm producing capacity would not be emphasized in the studied cockerels, although IRWIN *et al.* (1943) observed that thyroprotein treatment tended to cause some decrease in the weight of pituitary and thyroid.

On the ground of the present results it can be advised to supplement the ration of chicks with either iodine or manganese, zinc and copper mixture in order to raise the spermatogenic activity and consequently the rate of egg fertility.

TABLE 1.—Reproductive capacity and endocrine development of normally grown Dokki-4 cockerels which received Mn, Zn and Cu additives (Class A, Group I)

Criteria	12 weeks		16 weeks		20 weeks		24 weeks	
	Sub-group 1 (control)	Sub-group 2	sub-group 1 (control)	Sub-group 2	Subgroup 1 (control)	Subgroup 2	Subgroup 1 (control)	Subgroup 2
Number of cockerels	96	96	94	93	91	90	58	58
Number of slaughtered cockerels	3	3	3	3	10	10	6	6
Live body weight (g)	581.7	754.3	1056	1005	1355±53.6	1329±32.7	1608±56.2	1583±55.1
Paired tested weight (g)	0.67	3.71	4.11	3.43	9.19±2.81	7.7 ±1.27	23.03±2.48	21± 5.21
Percentage of testes weight to body weight (%)	0.12	0.49	0.39	0.34	0.68	0.58	1.43	1.36
Pituitary weight (mg per chick)	15.3	15.5	9.2	11.3	12.1±1.3	8.8 ± 1.1	42.0±1.8	19.0±4.5
Pituitary weight (mcg per 100g live body weight).	26	20	9	11	9	7	26	12
Paired thyroid weight (mg per chick)	94.2	77.8	113.3	101.3	138.1±17.8	165.1±11.2	147.8±8.2	173.6±26.8
Paired thyroid weight (mg per 100 g live body weight)	160	103	106	100	103	124	92	110
Percentage of slaughtered cockerls with sperm reserved in their testes	33.3	66.7	66.7	100	80	90	100	100
Number of sperm/g testis (× 10^6)	6.0	5.9	47.5	39.3	243.5±25.8	244.8±27.6	202.5 ±9.7	267.8±49.2
Number of sperm'paired tests (× 10^9)	0.01	0.02	0.29	0.14	3.56±1.33	2.19± 0.56	4.64±0.62	5.81± 1.07
Percentage of slaughtered cockerels with semen reserved in their vase deferentia (%)	0.0	0.0	0.0	0.0	50	55.5	100	83.3
Volume of semen retained in paired vase deferential (ml)	—	—	—	—	0.34±0.05	0.28±0.05	0.35±0.07	0.72±0.12
Concentration of sperm in semen retained in vase dererentia (× $10^6/mm^3$)	—	—	—	—	4.06±0.59	4.64±0.74	7.11±1.14	9.95±1.37
Number of sperm retained in paired vase deferentia (× 10^9)	—	—	—	—	1.42±0.32	1.38±0.32	2.87±0.35	7.28±1.76
Length and height of comb (cm)	4 and 1.8	5.3 and 2.6	5.8 and 3.3	5.2 and 2.7	7.7 and 3.6	7.9 and 5.3	9.5 and 4.9	9.4 and 5.3
Length and width of wattle (cm)	2.2 and 1.5	3 and 2.2	2.9 and 2.8	2.7 and 2.5	3.3 and 3.0	3.4 and 3.5	3.8 and 4.8	4.4 and 4.6
Testicular concentration of:								
Manganese (ppm)	—	—	—	—	6.70	12 94	5.83	16.67
Zinc . . . (ppm)	—	—	—	—	11.53	13.98	16.0	20.21
Cpper (popm)	—	—	—	—	8.31	21.22	4.96	23 6

TABLE 2—Reproductive capacity and endocrine development of normally grown Dokki-4 cockerels which received different levels of iodine additives (Class A, Group II)

Criteria	16 weeks			20 weeks			24 weeks		
	Subgroup 3 (Control)	Subgroup 4	Subgroup 5	Subgroup 3 (control)	Subgroup 4	Subgroup 5	Subgroup 3 (control)	Subgroup 4	Subgroup 5
Number of cockerels	34	42	52	32	40	50	29	37	34
Number of slaughtered cockerels	2	2	2	3	3	3	6	6	6
Live body wight (g)	1029.5	1258.0	1087.5	1498.7	1575.0	1474.7	1423.3±77.33	1558.3±65.9	1584.1±51.7
Paired testes weight (g)	1.68	7.0_2	0.82	10.8_2	9.41	2.9_8	29.7± 6.5	22.0±4.9	22.8± 5.6
Percentage of testes weight to body weight (%)	0.16	0.5_6	0.0_8	0.7_2	0.60	0.2_0	2.09	1.39	1.47
Pituitary weight (mg per chick)	9.0	12.4	9.0	15.7	11.0	11.3	10.2± 2.0	8.8± 2.0	11.5± 2.0
Pituitary weight (mcg per 100 g live body weight)	9	9	8	10	7	8	7	6	7
Thyroid weight (mg perchick)	114.4	104.1	72.7	116.4	87.3	107.9	112.1± 2.6	84.7± 6.9	105.9± 9.1
Thyroid weight (mcg per 100 g live body weight)	111	82	67	77	55	72	78	54	67
Percentage of slaughtered cockerels with sperm reserved in their testes (%)	50	100	50	100	100	—	100	100	100
Number of sperm/g testes ($\times 10^6$)	40.0	95.0	60.0	176.1	170.0	—	173.5±29.4	228.6±31.6	224.5±30.5
Number of sperm/paired testes ($\times 10^6$)	1.08	0.67	0.06	1.91	1.33	—	5.53±1.44	6.26±1.87	5.28±1.57
Percentage of slaughtered cockerels with semen reserved in their vase deferentia (%)	—	—	—	66.7	33.3	—	83.3	66.7	83.3
Volume of semen reserved in paired vase deferentia (ml)	—	—	—	0.4	0.7	—	0.44±0.05	0.5±0.04	0.56±0.04
Concentration of sperm in semen reserved in vase deferentia ($\times 10^6/mm^3$)	—	—	—	2.5	3.8	—	7.66±0.35	9.08±0.54	9.20±0.65
Number of sperm retained in paired vas deferentia ($\times 10^9$)	—	—	—	0.93	2.66	—	3.31±1.82	3.61±1.21	5.30±0.39
Length and height of comb (cm)	6.8 and3.6	7.5 and 4.1	6.5 and 3.5	9.0 and 5.3	8.3 and 5.2	7.5 and 4.6	10 and 5.8	9.6 and 5.2	10 and 5.7
Length and width of wattle (cm)	3.0 and2.7	3.3 and 3.9	2.9 and 2.6	5.1 and4.6	3.6 and 3.7	4 and 3.5	5.5 and 5.1	5 and 4.6	4.3 and 4.2
Testicular concentration of: Iodine (µg/g)	—	—	—	389	432	540	422	509	577

TABLE 3—**Reproductive capacity and endocrine development of subnormally grown Dokki-4 cockerels which received iodine and desiccated thyroid additives (Class B)**

Criteria	16 weeks			20 weeks			24 weeks		
	Group A (Control)	Group B	Group C	Group A (control)	Group B	Group C	Group A (control)	Group B	Group C
Number of cockerels	13	20	8	11	18	6	8	14	2
Number of slaughtered cockerels	2	2	2	3	3	3	6	6	2
Live body weight (g)	1105	921	1058.2	1293.2	1333.3	1268.3	1438±33.3	1446.7±52.7	1520
Paired testes weight (g)	7.53	6.64	7.58	11.31	20.27	12.71	25.2±5.21	23.93±3.18	13.92
Percentage of testes weight to body weight (%)	0.68	0.72	0.72	0.87	1.52	1.00	1.74	1.65	0.92
Pituitary weight (mg per chick)	—	—	—	14.1	11.7	7.9	16.3±1.3	10.4±2.2	5.9
Pituitary weight (mcg per 100 g live body weight)	—	—	—	—	—	—	—	—	—
Thyroid weight (mg per chick)	107.0	72.3	70.4	11	9	6	11	7	4
Thyroid weight (mcg per 100 g live body weight)	97	79	67	134.5	131.4	107.7	119.5±12.2	97.1±6.9	130.3
Percentage of slaughtered cockerels with sperm reserved in their testes (%)	100	100	100	104	98	85	83	67	85
Number of sperm/g testes × 10^6	39.0	28.0	40.5	100	100	100	100	100	100
Number of sperm/paired testes (10^6)	0.29	0.19	0.31	275.6	278.6	309.0	200.2±23.2	235.3±24.8	258.0
Percentage of slaughtered cockerels with semen reserved in their vase deferentia (%)	—	—	—	3.12	5.65	3.93	6.05±1.13	6.13±0.53	3.59
Volume of semen reserved in paired vase deferentia (ml)	—	—	—	66.7	100	100	83.3	100	100
Concentration of sperm in semen reserved in vase deferentia × 10^6/mm^3)	—	—	—	0.15	0.51	0.40	0.36±0.07	0.48±0.05	0.40
Number of sperm retained in paired vase deferentia (× 10^9)	—	—	—	4.55	4.90	4.60	7.94±0.41	10.31±0.56	9.75
Length and height of comb (cm)	5.7 and 3.7	6.8 and 4.1	6.8 and 4.2	0.72	2.52	2.05	2.96±0.67	5.16±0.44	3.90
Length and width of wattle (cm)	3.8 and 3.5	3.2 and 3.3	3.5 a 3.1	9.4 and 5.0	9.3 and 5.2	8.9 and 4.6	10.1 and 5.6	10.1 and 5.6	11.1 and 5.9
				4.9 and 4.8	4.8 and 5.3	4.4 and 4.0	3.6 and 4.6	3.7 and 5.2	3.8 and 5.8
Testicular concentration of :									
Iodine (µg/Kg)	—	—	—	559	640	945	521	594	558

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