

STUDY OF PHYSIOLOGICAL CHANGES AS A RESULT OF OIL GLAND REMOVAL AND/OR BURNING THE REAR COMB IN LOW PRODUCTIVE HENS

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ABSTRACT

A total number of 240 Mandarah laying hens at 70 weeks of age (End of 52 weeks of egg production) were used to investigate the impact of removing the oil gland and / or burning the rear comb on egg production traits when the percentage of egg production decreased to 17.5%. The birds were divided into four equal groups. The first group served as a control group, the second group had surgically removed the oil gland, the third group was burned by fire at the rear comb and the birds of last group were treated in the same way as done in the second and third groups. Hens were housed in individual cages. Feed and water were given ad. Libitum and a photo period was 16 L: 8D. Egg production traits and some blood constituents were recorded through the six weeks after treatment.

The main results could be summarized as follows:

- 1-Hens started laying eggs again after 6.53, 7.20 and 6.03 days of treatment for the second, third and fourth groups, respectively.**
- 2- Average egg production percentage during the six weeks after treatment was 12.06, 31.11, 29.05 and 34.84%, while the average egg weight was 49.27, 51.69, 48.79 and 52.76 g. for the first, second, third and fourth groups, respectively.**
- 3- The fourth treatment improved both of shell weight percentage (14.20%), shell thickness (0.32 mm) and Haugh units (91.25).**
- 4- Treatment in the fourth group improved the relative weight of thyroid, ovary and oviduct as compared to the other treatments.**

5- Birds in the fourth group had higher values for Estrogen (E₂), Progesterone (P₄) hormones and had a lower ratio between E₂/P₄.

6- Also, treatment in the fourth group had a higher values than the other treatments for blood serum constituents (Albumin, total lipids, glucose and Alkaline phosphatase) while the reverse was observed for testosterone, total proteins, calcium and phosphorus.

In conclusion, these results indicate that the group treated by removal oil gland and burning by fire the rear comb had higher significant means for all most studied traits when the plateau of egg production had decreased.

Key words: Chickens, oil gland, egg production, egg quality and blood constituent.

INTRODUCTION

Oil gland is a small bilobated organ located above the tail at the base of the rump in most species of birds. It produces an oily substance through a duct at the surface of the skin. It is sometimes called the "uropygial gland". Bird species with an oil gland, such as ducks, repeatedly press oil from it with their bills, and then spread it over the feathers during preening (Sturkie, 1976) .

The uropygial gland is a holocrine secretory gland of birds. The lipids and waxy sebum secretions are coated on the peak and transferred to the plumage during preening (Montalti, et al. 2005). The function of the oil gland is oiling the feathers in waterfowls where's this function is much less important in chickens compared to water birds.

Several investigations are able to demonstrate a certain relationship between the composition of uropygial gland secretion and the position of birds in the natural system (Jacob and Poltz 1974). Birds unable to oil their feathers spend much more energy to maintain their body temperature than the birds with oil glands. Their metabolism, in relation to this, works on heat production much more.

Removal of the oil gland and cell destruction by cauterization can help the enzymatic retention which play a role in fatty acids metabolism for producing prostaglandines in blood circulation. This process leads to stimulate pituitary gland which helps in secretion hormones and in turn the ovary growth which produces estrogen and androgen hormones and this plays a role in changing body measurements for chickens as it enlarges the space between pubic bones (El-Hanoun et al.2005). Androgens play a part in growing the comb and the barren birds begins for laying eggs (Naji, 2002). The plateau of egg production decline at 70 weeks of age. Resulting in hens consumed more feed with low egg production which causes high loss for breeders. Therefore, this study was carried out to investigate the effect of removing the oil gland and / or burning by fire the rear comb on productive and reproductive performance in local chicken strains.

MATERIALS AND METHODS

The present study was carried out at El-Sabahia Poultry Research Station, Animal Production Research Institute, Ministry of Agriculture, Egypt. A total of 240 laying hens of Mandarah strain at 70 weeks of age (End of 52 weeks of egg production) when egg production percentage decreased to 17.5% were housed in individual cages. A photoperiod of 16L:8D was provided during the laying period. Birds were fed on a basal diet (15.5 crude protein and 2748 k.cal/kg ME). Feed and water were provided *ad libitum*. Birds were divided into four equal groups. The first group served as a control group, while the second groups feathers were removed from the tail around the oil gland and surgically removed, the third group was burned by fire at the rear comb and the last one was treated in the same way as done in the second and the third groups together. These methods for oil gland removal and head cauterization was used as described by Naji, (2002)

After caring out the treatment for each group, the period (days) between treatments and starting of laying eggs again was estimated. Average egg number, egg weight and rate of laying during the six weeks were recorded.

Thirty eggs were randomly chosen from each group after one month of the treatment for measuring the egg quality traits: shell thickness (mm) and Haugh units (H.U) according to Stadelman (1977) and weight of shell, yolk and albumin weight as a percentage of egg weight were calculated according to Carter (1968).

Six hens were randomly chosen weighed and slaughtered. The ovary, oviduct and thyroid gland were weighed. The oviduct length was measured (cm). Also, the largest 5 follicles were individually weighed. Blood serum was obtained by centrifugation the blood at 3500 rpm for 20 minutes, and the samples were stored at -20 °C for later analysis. Total proteins (Armstrong and Carr, 1964), albumin (Doumas et al., 1977), total lipids (Frings et.al, 1972), glucose (Hyvarinen and Nikkila, 1962), calcium and phosphorus (Sarkar and Chauhan, 1967), and alkaline phosphatase (Richmond, 1973) were estimated. Estradiol (E₂), Progesterone (P₄) and Testosterone concentrations were determined in serum with Radio-immunoassay using commercial diagnostic kits.

Statistical analysis:

Data were analyzed applying SAS program (SAS, 1998). Duncan's Multiple Range-test was used to detect any significant differences among the group means (Duncan's 1955).

RESULTS AND DISCUSSION

Figure (1) shows that rate of laying for Mandarah strain before treatment was 17.5% at end of 52 weeks of egg production. Un shown data revealed that hens stopped egg production after treatment by 6.23, 7.20 and 6.03 for the second, third and fourth groups, respectively. The first group (control) leaved 7 days before recorded the egg production traits through six weeks after treatment. The fourth group laid their first egg earlier than those of the other groups.

The results in Table 1 and Fig 2 showed that through six weeks after treatment the egg number, egg weight and rate of laying were significantly higher means for treated groups compared those for control group. The fourth group was higher value followed by second and third ones. The fourth group was higher values comparing with control group by 9.56 egg/hen for egg number, 3.49 g for egg weight and 22.78% for rate of laying. The increase in egg number was due to the increase in estradiol secretion from ovary as reported by Kalifa, et al.(1983) and Hamdy, et al.(2002). The results showed that fourth group produced significantly heavier eggs (52.76 g) than those of first and third groups (49.27 and 48.79 g), respectively.

Results for egg quality traits are presented in Table 2. In general, hens of the second and the fourth groups produced eggs with significant thicker shell thickness, as compared with those for control and third groups. to the control one. This might be due to more available calcium, since higher eggs were produced. These results are in agreement with El-hanoun, et al. 2005 who found that hens without oil gland produced thicker egg shell than those of normal ones. Also, control group was significantly lower Haugh unit score as compared to the fourth ones by – 5.56 units.

Results presented in Table (3) indicate a profound effect of removal oil gland and / or burning the rear comb on the relative weight of the thyroid gland and the reproductive organs. Significant

increase was detected in relative weight of the thyroid gland, ovary, oviduct and length of oviduct for birds of all treated groups compared with those for control. Also, the 5th follicles weights were significant higher mean for treated groups compared to control ones and this increase could be due to the effect of treatments.

These results indicate that removing the oil gland and cauterizing the rear comb by fire in the low productive laying hens caused the increase of estrogen hormone level in hens blood from the ovary which is responsible for oviduct growth and weight. Also, weight of the hens ovary and oviduct had increased rapidly when the hens change its reproductive phase from rest to laying condition. These results are in agreement with those reported by Khalifa et al. (1983) who mentioned that weight of the ovary and the oviduct increased rapidly when the hen changes its reproductive phase from rest to laying conditions, also, Elkomy (2003) suggested that correlated relationship between the hens egg production, and /or with the increase of estrogen hormone in hen's blood and the increase in ovary and oviduct weight.

Data presented in Table (4) shows the effect of removal oil gland and / or burning the rear comb on the reproductive hormones measured in treated groups. The serum testosterone of the treated groups was significantly ($P \leq 0.05$) reduced by 52.8, 38.5 and 67.1% for the second, third and fourth groups, respectively, compared with those for control group. On the other hand serum progesterone increased by 124.4, 26.5 and 185.5% in compare with control. These results are in agreement with those reported by Elnagar, et al. (2005) who found the estrogen hormone was reduced versus increased the progesterone. Also, this table show that the serum calcium and phosphorous of treated groups were decreased by - 14.0, -17.8 and -31.2% for calcium and by -15.8, -7.6 and -22.4% for phosphorous of the second, third and fourth groups, respectively, compared with this for control group. The decrease in serum calcium and phosphorus levels was due to increase in egg production and using them for egg-shell formation. These results are in agreement with those reported by Elnagar, et al.(2005) who found that the serum calcium level was decreased after reaching the egg production peak for Gimmizah and Silver Montazah strains.

The fourth group with removing the oil gland and cauterizing by fire rear the comb represents estradiol and progesterone hormones levels increase compared with the control group whereas testosterone hormone was significantly decreased for the treated group and the differences between the four groups were significant ($p \leq 0.05$). This increase in estradiol and progesterone secretion in the treated groups may be due to the ovary stimulation by removing the oil gland beside the stimulation which occurred by fire cauterization. This increase in estradiol secretion reverse on increase in egg production, ovary and oviduct weight and oviduct length as found by Elkomy (2003). Highest egg production was also correlated with the lowest estrogen/progesterone ratio which is a better parameter for estimating egg production than estrogen or progesterone alone (Leszczynski et al., 1985).

CONCLUSION

This study indicates that, removing oil gland and / or burning the rear comb from the low productive laying hens are helpful tool to increase egg number and egg weight without adverse effect on body weight and egg quality traits.

Table (1): Effect of removal the oil gland and / or burning the rear comb on egg number, egg weight and rate of laying for Mandarah strain through six weeks after treatment.

Group	Egg number (Egg/hen)	Egg weight (g)	Rate of laying (%)
Control	5.07±0.19 ^d	49.27±0.67 ^b	12.06±0.45 ^d
Removal	13.07±0.23 ^b	51.69±0.65 ^a	31.11±0.54 ^b
Burn	12.20±0.24 ^c	48.79±0.91 ^b	29.05±0.58 ^c
Removal & burn	14.63±0.22 ^a	52.76±0.61 ^a	34.84±0.54 ^a

a, b and c, Means in the same column and having different letters are significantly different ($p \leq 0.05$)

Table (2) Effect of removal the oil gland and / or burning the rear comb on egg quality traits in Mandarah strain after one month of treatment.

Group	Traits					
	Egg weight (g)	Shell (%)	Shell thickness (mm)	Yolk (%)	Albumin (%)	Haugh Unit
	$\bar{X} \pm \text{S.E.}$					
Control	46.65 \pm 0.51 ^b	12.67 \pm 0.14 ^c	0.29 \pm 0.45 ^b	34.98 \pm 0.46 ^a	52.36 \pm 0.48 ^b	85.69 \pm 0.69 ^b
Removal	52.10 \pm 0.84 ^a	13.52 \pm 0.26 ^b	0.31 \pm 0.68 ^a	34.75 \pm 0.25 ^a	51.74 \pm 0.36 ^b	89.76 \pm 0.48 ^{ab}
Burn	48.95 \pm 0.40 ^b	12.59 \pm 0.23 ^c	0.30 \pm 0.58 ^b	32.62 \pm 0.42 ^c	54.80 \pm 0.27 ^a	87.81 \pm 0.85 ^{bc}
Removal & burn	54.03 \pm 1.26 ^a	14.20 \pm 0.11 ^a	0.32 \pm 0.38 ^a	33.69 \pm 0.29 ^b	52.13 \pm 0.36 ^b	91.25 \pm 0.67 ^a

a, b and c, Means in the same column and having different letters are significantly different ($p \leq 0.05$)

Table (3) Effect of removal the oil gland and / or burning the rear comb on relative weight of thyroid gland and reproductive organs in Mandarrah strain after one month of treatment

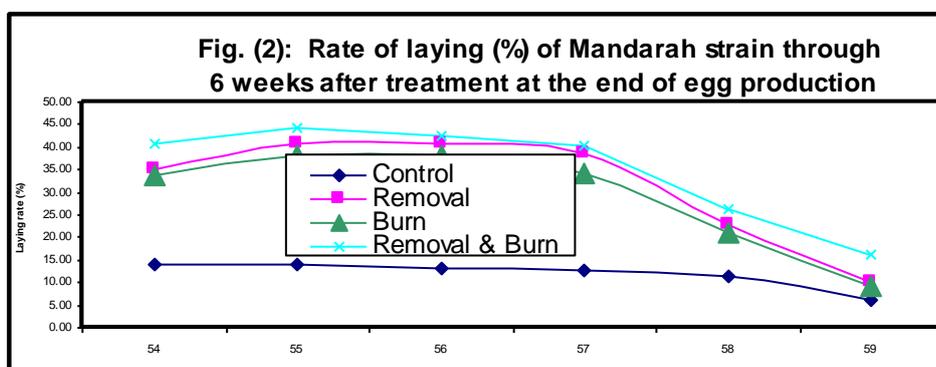
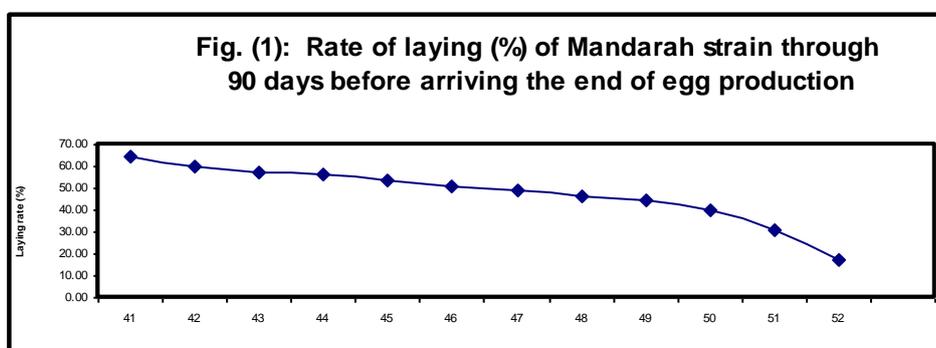
Traits	Control	Removal	Burn	Removal & Burn
	X+SE			
Relative weight				
Thyroid	0.090±0.01 ^b	0.104±0.03 ^b	0.097±0.04 ^b	0.141±0.01 ^a
Ovary	0.32±0.01 ^c	0.41±0.02 ^{ab}	0.39±0.02 ^b	0.44±0.02 ^a
Funnel	0.064±0.04 ^c	0.079±0.01 ^b	0.074±0.03 ^b	0.093±0.01 ^a
Magnum	1.48±0.05	1.58±0.03	1.57±0.06	1.66±0.04
Isthmus	0.067±0.007 ^b	0.082±0.003 ^{ab}	0.071±0.006 ^b	0.093±0.005 ^a
Uterus	0.52±0.03 ^c	0.64±0.06 ^{ab}	0.60±0.04 ^b	0.67±0.05 ^a
Vagina	0.39±0.05 ^c	0.51±0.03 ^b	0.49±0.09 ^b	0.58±0.06 ^a
Oviduct	2.19±0.31 ^c	2.71±0.19 ^b	2.62±0.24 ^b	3.44±0.21 ^a
Length (c.m)				
Funnel	5.94±0.26 ^c	7.14±0.23 ^a	6.55±0.32 ^b	7.85±0.24 ^a
Magnum	30.42±0.64 ^c	33.87±1.29 ^{ab}	31.73±0.91 ^b	36.71±0.51 ^a
Isthmus	5.96±0.09 ^c	6.93±0.26 ^{ab}	6.44±1.15 ^b	7.13±0.35 ^a
Uterus	5.62±0.20 ^b	6.24±0.17 ^a	5.71±0.22 ^b	6.35±0.20 ^a
Vagina	4.26±0.09 ^b	5.12±0.18 ^a	4.87±0.09 ^b	5.66±0.23 ^a
Oviduct	52.20±0.53 ^c	59.30±1.78 ^b	55.30±0.77 ^{bc}	63.70±0.73 ^a
Follicles weight (g)				
F1	6.10±0.93 ^c	9.40±0.68 ^b	8.53±0.41 ^b	11.20±0.23 ^a
F2	5.07±0.76 ^c	7.63±0.43 ^{ab}	6.87±0.38 ^b	9.00±0.17 ^a
F3	3.87±0.49 ^c	5.43±0.38 ^b	4.90±0.15 ^b	6.97±0.33 ^a
F4	2.80±0.44 ^c	4.40±0.25 ^{ab}	3.83±0.09 ^b	5.17±0.18 ^a
F5	1.63±0.28 ^c	2.57±0.50 ^b	2.40±0.12 ^b	3.60±0.06 ^a

a, b and c, Means in the same column and having different letters are significantly different ($p \leq 0.05$)

Table (4) Effect of removal the oil gland and / or burning the rear comb on serum E₂, P₄, Testosterone and some blood constituents in Mandarrah strain after one month of treatment.

Group	Traits			
	Control	Removal	Burn	Removal & burn
	X±S.E.			
Estradiol E₂ (pg/ml)	174.6±8.31 ^c	310.3±6.87 ^{ab}	281.2±9.16 ^b	338.2±7.53 ^a
Progesterone P₄ (ng/ml)	0.283±0.081 ^d	0.635±0.118 ^b	0.358±0.073 ^c	0.808±0.096 ^a
E₂/ P₄ ratio	0.616±0.043 ^b	0.488±0.051 ^c	0.785±0.066 ^a	0.418±0.057 ^c
Testosterone (ng/ml)	0.210±0.007 ^a	0.099±0.002 ^c	0.129±0.008 ^b	0.069±0.0005 ^d
Total proteins (g/dl)	8.09±0.46 ^a	7.33±0.62 ^b	6.89±0.37 ^c	5.84±0.28 ^d
Total lipids (g/dl)	4.15±0.23 ^a	2.18±0.20 ^c	3.12±0.36 ^b	1.47±0.46 ^d
Albumin (g/dl)	2.41±0.34 ^c	2.85±0.18 ^b	3.06±0.39 ^{ab}	3.37±0.22 ^a
Calcium (mg/dl)	16.34±0.43 ^a	14.05±0.29 ^b	13.42±0.24 ^b	11.24±0.35 ^c
Phosphorus (mg/dl)	7.46±0.34 ^a	6.28±0.17 ^b	6.89±0.22 ^b	5.79±0.26 ^c
Glucose (mg/dl)	79.79±3.11 ^c	106.18±4.25 ^{ab}	98.73±3.19 ^b	110.02 ±2.37 ^a
Alkhalin phosphatase	15.64±1.18 ^d	24.52±1.41 ^b	21.38±1.24 ^c	29.18±0.98 ^a

a, b and c, Means in the same row and within each groups having different letters are significantly different (p≤ 0.05)



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الملخص العربي

دراسة التغيرات الفسيولوجية الناجمة عن ازاله الغدة الدهنية و/أو الكي قرب العرف في الدجاجات منخفضة الإنتاج

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استخدم في تلك الدراسة عدد 240 دجاجة بياضه من سلالة المندره عمر 70 أسبوع (في نهاية الأسبوع 52 من إنتاج البيض) عندما انخفض معدل إنتاج البيض إلى 17.5% لمعرفة تأثير ازاله الغدة الدهنية و/ أو الكي بالنار بالقرب من الحافه الداخلية للعرف على صفات إنتاج البيض. قسمت الطيور عشوائيا خلال كل فتره إلى أربعة مجاميع متساوية. المجموعة الأولى استخدمت كمجموعه مقارنه ، بينما المجموعة الثانية تم ازاله الغدة الدهنية منها جراحيا ، والمجموعة الثالثة تم كي منطقه الرأس بالنار بالقرب من الحافه الداخلية للعرف ، أما المجموعة الأخيرة فتم معاملتها مثل المجموعتين الثانية والثالثة معا. تم وضع الدجاجات في أقفاص تربيته فريده مع تقديم الغذاء والماء لها بصوره حره واستخدمت فترة الاضاهه 16 ساعة اضاهه: 8 ساعات إظلام وتم تسجيل صفات إنتاج البيض وبعض مكونات الدم عليها لمدته ست أسابيع بعد المعاملة.

ويمكن تلخيص أهم النتائج المتحصل عليها فيمايلي:

- 1- بدأت الدجاجات في وضع البيض بعد مرور 6.53 ، 7.20 ، 6.03 يوم بعد المعاملة للمجاميع الثانية والثالثة والرابعة على التوالي.
 - 2- بلغ متوسط نسبة إنتاج البيض خلال 6 أسابيع من الوضع بعد المعاملة 12.06 ، 31.11 ، 29.05 ، 34.84%. بينما كان متوسط الوزن للبيض 49.27 ، 51.69 ، 48.79 ، 52.76 جم للمجاميع الأولى والثانية والثالثة والرابعة على التوالي.
 - 3- المعامله فى المجموعه الرابعه حسنت كلا من وزن القشرة النسبي (14.20%) ، سمك القشرة (0.32 مم)، وحدات هيو (91.25).
 - 4- المعاملة في المجموعة الرابعة حسنت من وزن الغدة الدرقية ووزن المبيض وقناة البيض بالمقارنة مع المجاميع الأخرى.
 - 5- أيضا المعاملة في المجموعة الرابعة حققت أعلى قيم لنسبه هرموني الأستروجين والبروجسترون بينما كان قيمه كليهما للأخر أقل نسبه.
 - 6- المعاملة في المجموعة الرابعة أيضا حققت أعلى القيم لبعض مكونات سيرم الدم (البروتينات الكليه ، الألبومين ، الجلوبيولين ، الدهون الكليه ، الجلوكوز ، الألكالين فوسفاتيز) بينما كان العكس صحيح بالنسبة لهرمون التستسترون والكالسيوم والفسفور
- * عموما، هذه النتائج أشارت إلى أن المجموعة المزال منها الغدة وكويت بالنار بالقرب من الحافة الداخلية للعرف حققت أعلى متوسطات معنوية لمعظم الصفات المدروسة عندما أنخفض منحنى إنتاج البيض.