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**Effect of induced molting on egg quality and some blood constituents in Hy-Line hens**

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**ABSTRACT**

 The present study aimed to investigate theeffect of different molting procedures on the post molt egg quality and someplasma blood constituents.Two hundred and seventy Hy-Line laying hens aged 60 weeks were randomly chosen from a large commercial flock. All hens were approximately of an equal body weight and similar performance.

 Birds were divided into three groups. Birds of the first group (30 birds) were fed ad-libitum and considered as control. The second group (120 birds) was force molted by adding 1% zinc oxide on diet for 14 days. While birds of the third group (120 birds) were force molted by feed restriction (25%) for 7, days then fasting fore subsequent 7 days.

 At the end of the force molting treatments (14 days) when hens completely ceased egg production, the 2nd and 3rd groups were equally divided into 4 subgroups each (30 birds each) and injected as follows:-1-Distilled water (1 ml) for 6 days. 2- Estradiol 17 ß (10 mg/ml) for 6 days. 3- Indomethacin (10 mg/ml) for 3 days then Bromocriptine (10 mg/ml) for 3 days. 4- Human Chorionic Gonadotrophin (HCG) 50 IU for 6 days.

 Results indicated that: Injecting fast molted hens with either estradiol 17β or HCG increased shell thickness, yolk index, plasma albumen and plasma cholesterol. Fast molted hens injected with HCG improved Haugh units score and increased plasma total lipids and calcium. However, injecting fast molted hens with estradiol 17β increased the levels of plasma total protein, globulin and inorganic phosphorus. From this study, it could be recommended to use fasting to force laying hens to rest and injected with either estradiol 17 ß (10 mg/ml) or HCG (50 IU) to improve internal egg quality of laying hens during the second laying cycle.

**INTRODUCTION**

 As laying hens age, egg production and egg quality decreases. Induced molting is an important economic tool used by the egg industry to recycle an aging layer flock. Egg producer can impose an induced molt on older hens that increased egg productivity and decreased hen mortality compared with non- molted hens of the same age (Golden et al., 2008). There are many methods to induce molt, but feed removal until hens lose a specific weight is the most prevalent molt strategy (Holt, 2003). It has been adopted by the commercial egg industry to induce molt because it is the easiest method to apply and produces the best results (Webster, 2003). Feed deprivation stimulates multiple egg- laying cycles in laying hens (Moore et al., (2004) and Woodward et al., 2005).

 The use of various levels of dietary zinc (as zinc oxide) for inducing pauses in egg production had been reported by several researchers (Shippee et al,. 1979; Cantor and Jonson, 1984; Hussein et al., 1988 and Reddy et al., 2008). The action of zinc for inducing pauses in egg production may be a result of reducing feed intake (Gibson et al., 1982 and Berry and Brake, 1985).

 Force molting resulted in better egg quality traits after molting (Ghatas, 1994; Awadin, 1998; Bar et al., 2003 and Salem et al., 2005) and also affected plasma blood constituents (Ali, Mervat et al., 1999; Peeples et al., 2004 and Salem et al., 2005).

 Plasma estradiol decreased when molting was induced, (Elaroussi et al., 1993). They added that, reproduction ceased when the estrogen Antiguans (tamoxifen) was administrated to laying hens. Plasma estradiol increased with increasing estradiol (E2) dosages applied (Qin and Klandorf, 1995). Estradiol reduced feed intake and fitness, increased plasma T3 and T4 without affecting the resting metabolic rate, raised plasma total lipids and reduced fat deposition in its depots sites to increase its availability for yolk production (Jaccoby et al., 1995).

 Indomethacin inhibits prostaglandin biosynthesis (Seeley and Rodny, 1983;Murakami et al., 1991; Mazes and Hidas, 1992 and Magdi, 1993). This inhibitory effect leads to blockage of ovulation. Prostaglandins play a role in ovulatory process within the ovary (Armstrong and Grinwich, 1972; Yang et al., 1973 and 1974 and Wallach et al., 1975). Wallach et al., (1975) noted that, PGF2α injection caused not only ovulation, but also induced oocyte maturation

 Bromocriptine is an inhibitor of prolactin (Magdi, 1993). Parker, (1979) reported that, bromocriptine (a dopamine against) is used widely for treatment of prolactinomas. In addition, Buys et al., (1990) noted that, a high dopamine level inhibits prolactin secretion. Vender et al., (1977) found that, bromocriptine induced ovulation. Reddy et al., (2006) noted that, birds fed with bromocriptine significantly reduced the prolactin concentration, increased estrogen and progesterone.

 The aim of the current study was to detect theeffect of different molting procedures and some hormonal treatments on the post molt egg quality and some blood plasma constituents.

**MATERIALS AND METHODS**

 The present study was carried out at the Poultry Research Farm belonging to Animal Production Department, Faculty of Agriculture, Benha University. Two hundred and seventy Hy-Line laying hens aged 60 weeks were randomly chosen from a large commercial flock. All hens were approximately of an equal body weight (Mean ± S.E) and similar performance. Birds were leg banded, and divided into three groups. Birds of the first group (30 birds) were fed ad-libitum and considered as control. The second group (120 birds) was force group (120 birds) were force molted by feed restriction (25%) for 7 days, then molted by adding 1% zinc oxide on diet for 14 days. While birds of the third fasting fore subsequent 7 days. When hens of second and third groups completely ceased egg production, nine experimental groups of 30 hens each were formed and treated as shown in table (1) to detect the response of molted hens to the hormonal treatments investigated. All groups were housed in floor pens at a density of 5 hens / m2. All birds were reared under the same managerial and hygienic conditions and fed laying ration as indicated in table (2).

Table (1): Experimental design and number of birds:

|  |  |
| --- | --- |
|  **Post-molt hormonal treatments** | **Molt induction method** |
| 1- Control | Non molted (n=30) |
|  2- Injection with 1 ml distilled water (d.w.) for 6 days (n=30) 3- Injection with 10 mg/1 ml (d.w).estradiol 17 ß for 6 days (n=30) 4- Injection with 10 mg/1 ml (d.w.) Indomethacin for 3 days  followed by 10 mg Bromocriptine for 3 days (n=30) 5- Injection with Human Chorionic Gonadotrophin (HCG) 50 IU  for 6 days (n=30)  | 1% dietary zinc oxide for 14 days (n=120) |
| 6- Injection with 1 ml distilled water (d.w.) for 6 days (n=30) 7- Injection with 10 mg/1 ml (d.w.) estradiol 17 ß for 6 days (n=30) 8- Injection with 10 mg/1 ml (d.w.) Indomethacin for 3 days followed by 10 mg Bromocriptine for 3 days (n=30) 9- Injection with Human Chorionic Gonadotrophin (HCG) 50 IU  for 6 days (n=30)  | Feed restriction (25%) for 7 days followed by fasting for further 7 days (n=120) |

 Shell thickness was measured to the nearest 0.01 mm , Haugh units calculated according to (Haugh, 1937) and yolk index was also calculated just before molt and at 4, 8, and 16 weeks after molt in eggs of different experimental group.

 Heparinized blood samples were obtained from wing vein of four hens chosen randomly per each treatment for the determination of plasma total protein, albumen, globulin, total lipids, cholesterol, calcium and inorganic phosphorus just before molt, at 2nd week of molt treatments and at 4, 8, and 16 weeks after molt using enzymatic kits (Bio meriex, Laboratories reagent and products, France). Reading was taken using a spectrophotometer adjusted on optimum wave length for each plasma components in the laboratories of the Animal Production Department, Faculty of Agriculture, Benha University.

 All data were analyzed using the general linear model procedure (GLM) of SAS program (1996) according to the following model:

 Y ij = µ +Ti + e Ij

Where:

YIJ = The observation of the jth individual in the ith treatment; µ = The overall mean; Ti = The effect of the ith treatment; e ij= the random error.

#  Test of significance for differences were done using Duncan (1955) multiple comparison option in SAS software (SAS, 1996).

**Results and discussion**

**1-Traits of egg quality**:

**1-1- Shell thickness:**

 Data presented in table (3) showed shell thickness values in all experimental groups at all intervals. It is worthy notice that detecting the effect of methods of force molting could be achieved through comparing the results of control, force molted hens via zinc oxide injected with distilled water and their corresponding fast molted hens. Differences among other groups are mainly due to hormonal treatments within each force molting treatment.

 Shell thickness was decreased in eggs obtained from hens molted by fasting and injected with distilled water, while it increased in their corresponding force molted via zinc oxide at the 4th week after molting. These results agreed with those of Bar et al., (2003) who reported that, shell thickness was significantly (p<0.05) increased by zinc oxide (2.5% zinc) molting treatment.

 Injecting fast molted hens with estradiol 17β significantly increased shell thickness averages after molting (at 8th week and at the end of the experimental period) when compared with other treatments applied or control. These results disagree with those reported by Qin and Klandorf (1995) who stated that, estradiol 17 β had no significant effect on egg shell thickness or any improve in egg shell quality.

 Eggs laid by fasted hens injected with HCG had significantly the highest average of egg shell thickness at the 4th week after molting when compared with other hormonal treatments applied.

**1-2-Haugh unit**:

 As shown in table (3) Haugh units sharply increased after molting reached its highest score at 4th week and remained approximately constant at 8th week, then it slightly decreased up to the end of the experimental period at values above these recorded just before molting treatments. These results agree with those reported by Alodan and Mashaly (1999) who found that, inducing molting increased Haugh units' value of laid eggs.

 Differences in Haugh units score between force molted hens by fasting and injected with distilled water and their corresponding force molted via 1% zinc oxide at all experimental intervals were not significant. It leads to observe that, molt induction method had insignificant effect on Haugh units. Salem et al., (2005) concluded the same result. In addition, Berry and Brake (1987); Ingram and Mather (1988); Soliman (1993) and Zapata and Gerant (1995) reported that, no significant effects on egg quality traits due to force molting methods.

 Injecting fast molted hens with HCG increased the average of Haugh units value compared with that eggs laid by all hormonal treatments and non-molted hens.

**1-3-Yolk index:**

 Data presented in table (3) showed yolk index values in all experimental groups at all intervals of estimation. After molting, yolk index increased in all experimental groups with different rates. Yolk index value increased significantly with higher rate in eggs laid by fast molted hens injected with distilled water (10%) when compared with their corresponding of force molted hens by applying zinc oxide (3.5%) or those of non-molted hens (5.8%) during 4th week after molting. These results lead to observe that, molt induction method had significant effect on yolk index value. This result agreed with those reported by Ibrahim et al., (2002) who reported that, treatment of force molting affected significantly on yolk index.

 Fast molted hens injected with HCG or estradiol 17β, respectively had the highest value of yolk index when compared with other hormonal treatments applied or those of non-molted ones at 4th week after molting. At 8th week, fast molted hens injected with Indo. +Brom. Had significantly the highest value when compared with other treatments applied or control.

 Force molted groups of hens injected with HCG recorded the lowest value of yolk index at the end of the experimental period.

**3-1- Blood plasma constituents:**

**3-1- Plasma protein fractions:**

 Table (4) showed plasma total protein, albumen and globulin levels in all experimental groups at all intervals. Plasma total protein and albumen levels decreased in almost experimental groups of hens at the 2nd week of molt induction treatments. The depression in plasma protein level which happened directly after force molting may be due to the absence of estrogen. Force molted hens by zinc oxide injected with distilled water had the higher decrease in plasma total protein when compared with their corresponding fasted ones. This was quite logically due to the effect of force molt induction method.

 Plasma total protein level increased in all experimental groups with different rates at 4th week after molting. It had no constant trend up to the 12th week, and then decreased towards the end of the experimental period. Similar results were observed by Ibrahim et al., (2002) who found significant lower in the concentration of plasma total protein, albumen and globulin after treatments. Brake and Thaxton (1979) noticed that, plasma total protein did not exhibit consistent trend.

 Fast molted hens injected with estradiol 17β had significantly the highest plasma total protein level at the 4th week after molting and at the end of the experimental period when compared with all treatments applied or control. These results agreed with those obtained by Whitehead (1995) who stated that, estradiol increased plasma protein concentration. Estrogen may allow the liver to more efficiently produce elevated level of plasma protein.

 Plasma albumen level slightly increased in all experimental groups and reached its highest level at 8th week, and then it sharply decreased reached its lowest level at the end of the experimental period.

 Fast molted hens injected with HCG had significantly the highest level of plasma albumen at 4th and 8th week after molting when compared with other hormonal treatments applied or those of non-molted group. On the other hand, the highest level at the end of experimental period was observed in fasted hens injected with estradiol 17β.

 Plasma globulin level had no constant trend along the experimental period (table, 4). It decreased in force molted hens by applying zinc oxide which injected with distilled water, however it remained approximately constant in their corresponding fasted ones.

 Fast molted hens injected with estradiol 17 β had significantly the highest level of plasma globulin at 4th week after molting when compared with all treatments applied. However, the highest level at the end of the experimental

period was found in those molted by fasting and injected with Indo. +Brom.

**3-2- plasma total lipids and cholesterol:**

 Data presented in table (5) showed plasma total lipids and cholesterol levels for different experimental groups at all intervals of estimation. Plasma total lipids level decreased at the 2nd week of molt induction with different rates in all experimental groups.

 Fast molted hens by applying zinc oxide that injected with distilled water had the higher decrease (1135.7 mg/dl) in plasma total lipids comparing with those of their corresponding fasted ones (1053.8 mg/dl). This difference was quite logically attributed to force induction method.

 After molting, plasma total lipids level increased gradually and recorded its highest level at 8th week, then it decreased slightly up to the end of the experimental period. Changes in plasma total lipids may be correlated with the differences in metabolic rate which may be individually varied. Results obtained agree with those of Held and Badman (1963); Harris and Wilcox (1963) and Wills et al., (1972) who stated that, total lipids was at its lower level when laying commences.

 Force molted hens via zinc oxide then injected with distilled water had the higher rate of increase in plasma total lipids at 4th and 8th week after molting when compared with their corresponding fasted ones. However, they decreased with higher rates at the 12th week and at the end of the experimental period. This was quite logic due to molt induction method effect.

 Injecting fast molted hens with Indo. + Bromo. decreased plasma total lipids with highest rates from 4th to 8th week and from 12th week to the end of the experimental period. However, injecting fast molted hens with HCG caused the highest rate of increase in plasma total lipids from 4th to 8th week after molting when compared with all hormonal treatments applied.

 Force molting sharply decreased plasma cholesterol level at the 2nd week of molt induction treatments. Fast molted hens injected with distilled water had significantly the higher rate of decrease (110.22 mg/dl) in plasma cholesterol level when compared with their corresponding fed 1% zinc oxide (69.19 mg/dl). This lead to observe that, fasting as a force molting method decreased significantly plasma cholesterol level when compared with applying 1% zinc oxide.

 Plasma cholesterol level had no trend up to the 4th week after molting; it sharply decreased reached its lowest level at 8th week, then, increased to reach its highest level at the 12th week. Finally, plasma cholesterol level decreased again at the end of experimental period.

 Fast molted hens injected with HCG had significantly the highest level of plasma cholesterol at the 8th and 12th week. However, fast molted hens that injected with estradiol 17 β had the highest levels at 4th week and at the end of the experimental period. These results agree with those reported by Rath et al., (1996) who found that, injection with estradiol caused an increase in plasma cholesterol level.

**3-3-Plasma calcium and inorganic phosphorus:**

 Data presented in table ( 6 ) showed that, plasma calcium level decreased and recorded its lowest level at the 2nd week of molt induction treatments with different rates in all experimental groups. This was more pronounced in fast molted hens that injected with distilled water when compared with their corresponding molted via zinc oxide. These results agree with those of Brake and Thaxton (1979) who reported that, plasma total calcium and inorganic phosphate decreased significantly at the duration of the pause in egg production.

 Plasma calcium level sharply increased at 4th week after molting. However, it decreased at 8th week, and then it slightly increased up to the end of the experimental period. Results obtained are in agreement with those of Roland and Brake (1982) who noted that, force molting increased plasma calcium. They attributed this result to improvement occurred in calcium absorption and mobilization. Salem et al., (2005) added that, Plasma calcium increased with relative of the egg production after molting period, which may be attributed to the effect of the increase in estrogen during that period which increase calcium release in blood stream.

 Fast molted hens injected with HCG had significantly the highest levels of plasma calcium at 4th week after molting and at the end of the experimental period when compared with other hormonal treatments applied. On the other hand, fast molted hens injected with estradiol 17β recorded significantly the lowest levels at 8th week and at the end of the experimental period.

 Plasma inorganic phosphorus levels in all experimental groups at all intervals of determination are shown in table (6). At the 2nd week of molt induction treatments, plasma inorganic phosphorus level decreased in hens force molted by zinc oxide and then injected with distilled water at a rate of 0.6 mg/dl. However, it increased with the same value in their corresponding fasted ones. This result reflects the effect of the force induction method.

 Plasma inorganic phosphorus had no trend; however it increased in almost experimental groups at the 4th week after molting. It fluctuated between decreasing and increasing toward the end of the experimental period.

 Plasma inorganic phosphorus level reached significantly its highest rate in force molted hens via zinc oxide that injected with estradiol 17 β, Indo. +Brom. (at 4th week) or HCG (at 8th week). However, fasted hens injected with Indo. +Brom. or HCG had significantly the highest levels at 12th week and at the end of the experimental period.

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