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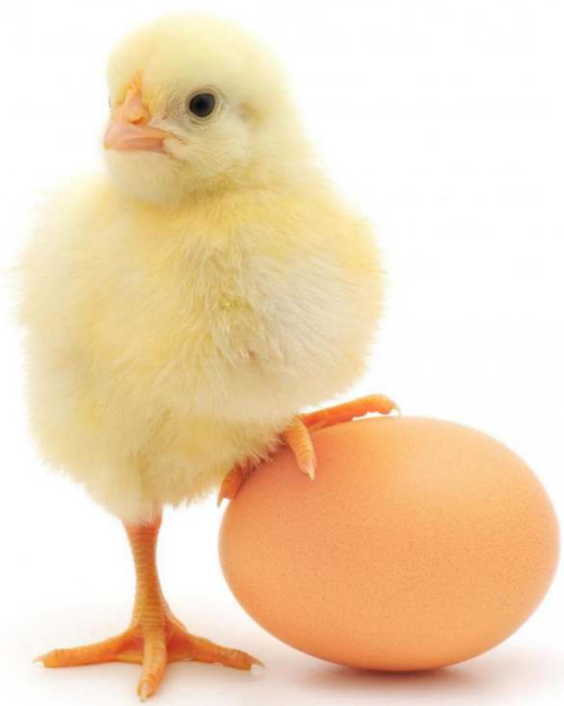

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ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Effect of Acetyl Salicylic Acid (ASA) in Drinking Water on Productive Performance and Blood Characteristic of Layer Hens During Heat Stress

Abdullah A. Mohammed
Department of Animal Resources, College of Agriculture, University of Basra, Basra, Iraq

Abstract: Effect of Acetyl Salicylic Acid (ASA) on hen day egg production, egg quality and blood characteristic during periods of heat stress was studied in layer hens. Four treatments with three replicated of six hens each were given 0, 0.5, 1.0 and 1.5 g/L ASA in drinking water from 58-68 weeks of age. Hen day egg production, egg weight, shell thickness and shell percentage were significantly ($p<0.05$) increased for hens watered 0.5, 1.0 and 1.5 g/L ASA. RBC, Hb, WBC and PCV did not show significant differences, but glucose, cholesterol and H/L of treated hens significant ($p<0.05$) low. There is new evidence that layer hens can make their own salicylic acid but adding 0.5, 1.0 or 1.5 g/L ASA significantly ($p<0.05$) increased SA in serum 18.70, 25.12 and 31.29 µg/ml respectively.

Key words: Acetyl salicylic acid, layer hens, heat stress

INTRODUCTION

Heat stress is one of the most important factors adversely affecting overall production in the tropics and subtropics countries. Average heat temperature is above fourty during summer in Iraq IMO-Basra (2009). Heat stress reduces the body weight (Lecui *et al.*,1998) and egg production (Daghir, 2008). Cooling poultry buildings is very expensive, such several compounds have been used as agents to minimize the harmful effects of high temperature on performance of broiler chicks and layer hens e.g. sodium chloride (Smith *et al.*, 1983); carbonated drinking water (Koelkebeck *et al.*, 1992), ascorbic acid (Khan and Sardar, 2005) and potassium chloride (Ahmad *et al.*, 2008). Al-Obaidi and Al-Shadeedi (2010) found that feeding of 0.2% ASA to broilers increased live body weight. Al-Mashhadani *et al.* (1988) obtained that a significant, increase in broilers body weight in the group receiving 1000 mg of aspirin in their diet. Few reports are available on the effect of dietary aspirin on laying hens. Balog and Hester (1991) reported that feeding 0.05% ASA to aged layer breeders for a periods of four weeks reduced production of shell-less eggs. It has also been found that feeding ASA to hens during heat stress conditions improved egg quality and production (Olyemi and Adebanjo, 1979). However, the high temperatures associated with a large portion of the year in Basra have led to investigate of a number of dietary factors which might alter the adverse effects of temperature. There fore the experiment reported here studied the effects of ASA in drinking water during a period of hot months on the performance of laying hens under high ambient temperature.

MATERIALS AND METHODS

This study was carried out at poultry research unit, Animal Resources Department, College of Agriculture, University of Basra from 1/5/2009 to 9/7/2009. Seventy two Hi-Line layer hens of fifty six weeks age were distributed randomly with three replicates. Each replicate was housed in one cage contained six hens. Treatments of 0, 0.5, 1.0 and 1.5 g/L ASA mixed daily in drinking water were assigned. The average daily temperature during the experimented period in the hen house ranged from 33-39°C. The composition of the basal diet employed is shown in (Table 1). Feed and water were supplied ad-Libitium. Hens were subjected to a 16L = 8D.

Table 1: Composition of the diet

In gradient	%
Yellow corn	60.00
Barley	7.00
Soybean meal (44%)	23.00
Vitamins and minerals mixed	2.00
Limestone	7.00
Sodium chloride	1.00
Total	100.00
Calculated composition (%)	
Kcal ME/kg diet	2708.00
Crude protein	16.00
Calorie:protein ratio	169.00
Calcium	3.36
Phosphorus available	0.44

The trial lasted for seventy days which was conveniently divided into five 14-day interval, all eggs produced from different replicate groups were collected and weighted individually during the experimental period. Eggs were broken on the next day to estimate the relative yolk, albumen and shell weights were calculated as a percentage of egg weight. Shell thickness was measured using a digital metric micrometer (Al-Fayadh and Naji, 1989). Feed conversation ratio was calculated as gram feed consumed per gram egg produced.

At the end of the experiment three hens per treatment were slaughtered, blood samples were collected in either heparinized tubes or without heparin for analysis, red and white blood cell were measured according to the method of Natt and Herrick (1952). Packed cell volumes were measured according to Archer (1965). Hemoglobin and Heterophil/Lymphocyte (H/L) ratio were measured according to Varley *et al.* (1980), Shen and Patterson (1983) respectively. Blood serum cholesterol and glucoes concentration were determined according to the method of Tietz (1999) using commercial kits (Biolabo SA., Francel). Spectrophotometric method was used to determination of aspirin (Salicylic acid) in serum samples (Maruf Ahmed *et al.*, 2001). All data were subjected to an ANOVA procedure of SPSS (1999). Significant treatment means were separated by using the multiple range test of Duncan (SPSS, 1999).

RESULTS AND DISCUSSION

Hen day egg production and egg weight were significantly ($p<0.05$) increased. Feed conversion was not affected by ASA treatments (Table 2). The improvements in egg production amounted to 18.35, 15.9 and 9.67% supplemented treatments respectively. These results were agreed with the observation of Olyemi and Adebanjo (1979) who reported an increase by 9.81 in egg production where hens were fed 0.05% aspirin in the diet. Hassan *et al.* (2003) observed an increase in egg production when Japanese quail were provided with 0.5, 1.0 and 1.5 g/L ASA in drinking water. However, egg production was significantly decreased when 0.4% ASA fed to hens (McDaniel *et al.*, 1993). Elene *et al.* (2004) suggested that the increasing Hen-day egg production and egg weights during heat stress conditions were attributed to aspirin suppressing prostaglandin synthesis, thus allowing soft-shelled eggs to become completely calcified. It also appears to be an inverse relations between serum concentrations of corticosterone and LH as it suppresses LH release from pituitary cells (Connolly and Callard, 1987).

Therefore, it could be assumed that blocking prostaglandins synthesis by aspirin supplementation might probably be helpful in reducing corticosterone levels and hence, increasing LH and FSH concentrations which consequently activate ovaries to produce more eggs (Abou El-Soud *et al.*, 2006). Laura *et al.* (2009) obtained that the stress can induce an inflammation in the intestine thereby increasing the risk for lower increase in villus/crypt ratio which introduce syndrome of chronic enteritis and can be characterized by decreasing the digestibility which produced low production, but treatment with aspirin significantly decrease the number of inflammatory cells and increase villus/crypt ratio which improved the digestibility than eggs production.

Incorporating of ASA into layer hens water supplies did not influence egg yolk, albumin percentage and pH of yolk and albumin. Shell percentage and shell thickness were significantly ($p<0.05$) higher (Table 3). These results are in agreement with observation of Olyemi and Adebanjo (1979) who indicated that hens fed 0.05% aspirin showed an increase in shell percentage and shell thickness. The improvement in egg shell percentage and egg shell thickness may be attributed to the enhancement in calcium absorption associated with adding ASA into the diet (Balog and Hester, 1991). Data concerning blood characteristic of hens received different levels of ASA in water are reported in (Table 4). No significant effect of ASA supplementation were noticed on red blood cell, white blood cell, packed cell volume and hemoglobin. The results are in accordance with those of Tras *et al.* (2000), who showed that ascorbic acid, aspirin, vitamin E and selenium had no significant effect on any of the haematological parameters. All ASA doses significantly ($p<0.05$) declined serum cholesterol and glucose levels compared to control. It could be speculated that ASA may reduce the stress of high ambient temperature by reducing serum corticosterone releasing. This also may explain the reduction in serum glucose and cholesterol levels which accompanied the reduction of corticosterone and T3 levels that consequently may affected glucose and cholesterol metabolism (Muller *et al.*, 1988). The H/L ratios of hens supplied 1 and 1.5 g/L ASA in water were significantly ($p<0.05$) lower than those 0.5 g/L and control. Previous studies indicated that increase in circulating H/L ratio have been reported to be an indicator of physiological stress (Gross and Siegel, 1983). According to Aengwanich and Chinrasri (2003), the H/L ratio measures a physiological change in organs such as an a trophy of the bursa of fabricius and thymus that is influenced by the effect of heterophils. Thus, adding ASA may reduce H/L ratio through depressing corticosterone concentration and consequently relieves the heat stress during the summer season (Abou-El-Soud *et al.*, 2006). All treatment had ASA in their serum (Table 4), but water supplemented with 0.5, 1.0 and 1.5 g/L had significantly higher ($p<0.05$) than the control. Therefore, the a new evidence is that layer hens can make their own salicylic acid as human do. Baxter (2009) reported that salicylic acid exists in the blood of people who have not taken aspirin and the vegetarians people had much higher levels of aspirin almost matching those in patients taking low doses of aspirin, Based on these findings conducted that the endogenous salicylic acid came from the diet since salicylic acid is a natural substance found. Raskin *et al.* (1990) obtained that salicylic acid has been characterized in thirty six whole plants, such as soybean, barley and rice which contain approximately lg/kg salicylic acid, for that reason the treatment which

Table 2: Effect of supplementing drinking water with acetyl-salicylic acid levels on layer hens performance

	Treatments of ASA g/L				
Characteristic	0	0.5	1.0	1.5	Significance
Hen. day egg production %	$49.67^{b}\pm2.36$	$60.95^{a}\pm1.76$	$59.04^{a}\pm2.30$	$55.09^{ab}\pm1.10$	0.05
Egg weigh (g)	$61.72^{b}\pm0.92$	$68.63^{a}\pm0.98$	$66.42^{a}\pm1.05$	$64.18^{a}\pm0.85$	0.05
Feed intake (g/hen/day)	108.00±12	112.00±6.00	109.00±9.00	106.00±5.00	NS
Feed conversion g feed/g egg	$1.76^{a}\pm0.3$	$1.63^{b}\pm0.4$	$1.64^{b}\pm0.6$	$1.65^{b}\pm0.4$	0.05

Table 3: Effect of watering acetyl-salicylic acid levels on egg components, yolk and albumin pH

	Treatments of ASA g/L				
Characteristic	0	0.5	1.0	1.5	Significance
Shell thickness (mm)	$0.324^{b}\pm0.007$	$0.364^{a}\pm0.008$	$0.358^{a}\pm0.008$	$3.366^{a}\pm0.007$	0.05
Shell (%)	$8.19^{b}\pm0.15$	$9.48^{a}\pm0.16$	$9.24^{a}\pm0.24$	$9.83^{a}\pm0.21$	0.05
Yolk (%)	32.27±0.84	29.76±0.69	30.89±0.54	30.50±0.8	NS
Albumin (%)	59.47±0.52	60.83±0.54	59.54±0.57	60.26±0.53	NS
Yolk pH	6.16±0.11	6.26±0.33	6.23±0.17	6.20±0.09	NS
Albumin pH	7.67±0.37	7.48±0.25	7.55±0.18	7.43±0.12	NS

Table 4: Effect of supplementing drinking water with acetyl-salicylic acid/on hematological traits and salcilic acid concentration of layer hens

	Treatments of ASA g/L				
Blood characteristic	0	0.5	1.0	1.5	Significance
Cholesterol (g/dL)	$215.06^{a}\pm1.56$	$175.83^{b}\pm2.09$	$175.56^{b}\pm4.16$	$170.03^{b}\pm2.83$	0.05
Glucose (g/dL)	$203.1^{a}\pm2.38$	$191.35^{b}\pm1.49$	$179.85^{c}\pm1.23$	$172.60^{c}\pm3.52$	0.05
Red blood cell (Mill. Cell/ml)	2.78±0.05	2.92±0.08	2.85±0.031	2.74±0.10	NS
White blood cell ($x10^{3}$ cell/ml)	24.83±0.22	24.92±0.11	25.02±0.31	25.28±0.74	NS
Packed Cell Volume (PCV%)	30.86±0.69	32.45±0.21	29.36±1.10	31.95±0.88	NS
Hemoglobin (Hb) (g/100 ml)	7.96±0.11	8.23±0.05	8.29±0.08	8.48±0.34	NS
H/L ratio	$0.32^{a}\pm0.01$	$0.30^{a}\pm0.008$	$0.27^{b}\pm0.004$	$0.24^{c}\pm0.019$	0.05
Salcilic acid (µg/ml)	$39.36^{b}\pm4.58$	$48.42^{ab}\pm8.46$	$52.57^{a}\pm0.74$	$57.29^{a}\pm1.55$	0.05

had not ASA in their water formed aspirin their blood and the three supplemented treatments (0.5, 1.0 and 1.5 g/L) had increased 18.76, 25.12 and 31.29 µg/ml aspirin in there serum respectively.

The positive effects of watering ASA during summer season could have potential benefits for poultry performance, as reflect of a reduction of H/L ratio and enhancement of physiological resources.

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