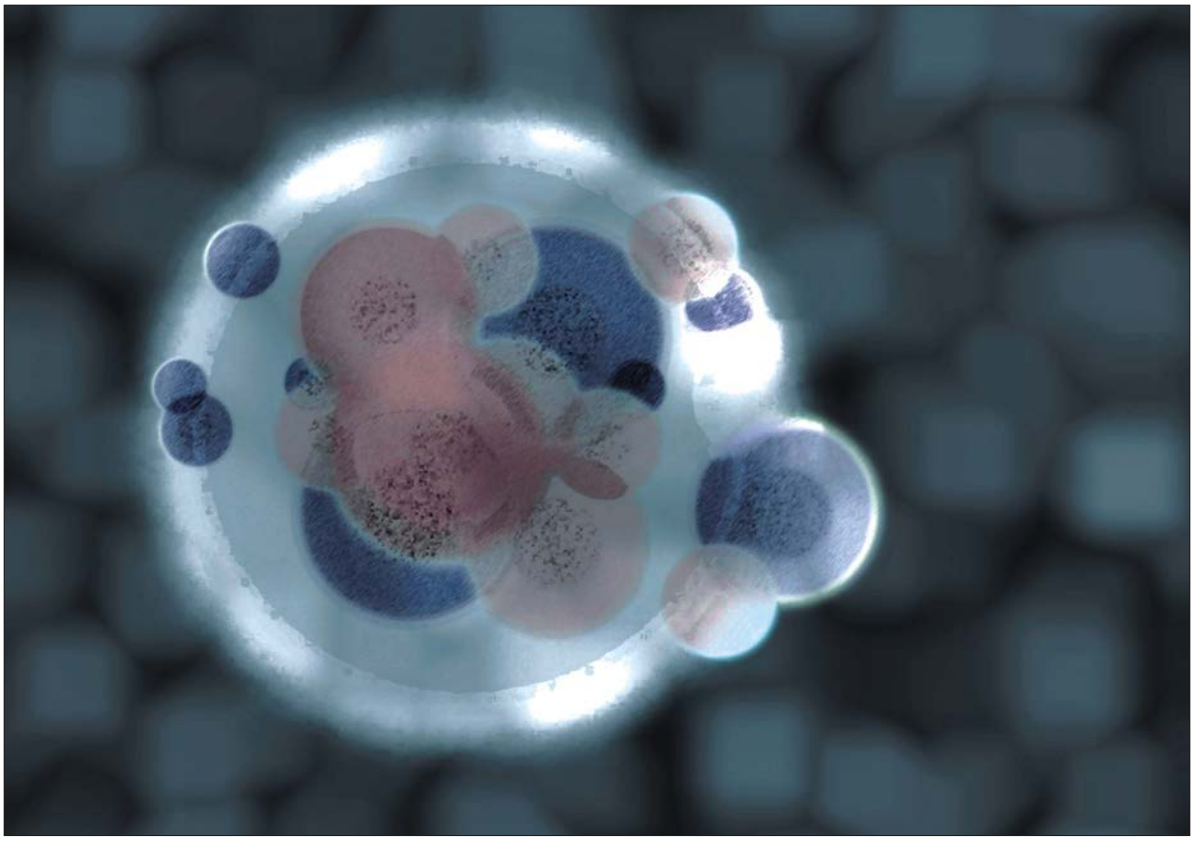

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The Effect of Feeding an Extra Amounts of Arginine to Local Saudi Hens on Luteinizing Hormone Secretion

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Abstract: Twelve local Saudi hens 33 weeks old at their peak egg production were used to determine the effect of an extra 2% supplemental feeding of L-arginine on luteinizing hormone secretion. Hens were randomly assigned into two treatment groups, they were fed either an extra amount of 2% arginine diet (treated) or not (control). Serial bleeding started 2 days after the start of the experimental feeding. One milliliter of blood were collected every 20 min starting at 9 h before the expected time for oviposition until 1 h after oviposition for the measurement of luteinizing hormone level. The results showed that feeding a 2% extra amounts of arginine to local Saudi hens significantly ($p<0.05$) increased mean LH level during the 9-6 h before the time of oviposition in arginine treated (2.8±0.33 ng mL^{-1}) compared to control group (1.9±0.18 ng mL^{-1}). Mean LH surge amplitude was also found to be higher in arginine treated compared to control group. The onset of the preovulatory LH surge was found to start earlier ($p<0.05$) in arginine compared to control group (260±30, 335±25 min before the time of oviposition, respectively). No significant differences were found between the two groups in the preovulatory LH surge duration. Further studies are needed to examine the effect of feeding an extra amounts of arginine on LH secretion and egg production in commercial breeds of hens.

Key words: Local saudi hens, arginine, luteinizing hormone, feeding

INTRODUCTION

L-arginine is a basic amino acid known for it's stimulatory effect on Luteinizing Hormone (LH) and Growth Hormone (GH) release in sheep (Recabarren *et al*., 1996a, b; Davenport *et al*., 1990) and goats (Basiouni *et al*., 1999). A role for L-arginine in the initiation of puberty in immature rats was also suggested (Pau and Milner, 1982, 1984). Feeding an arginine-deficient diet to adult rats or humans impaired reproductive function (Shettles, 1960; Holt *et al*., 1942). In hens, the effect of feeding arginine in excess of the Leghorn requirements to Saudi local (Baladi) chickens has also been studied. Increasing arginine level to local Baladi Saudi chicken to 1.5% over that required for the Leghorn breed requirements was found to improve hen-day egg production (Najib and Basiouni, 2004; Basiouni *et al*., 2006). Furthermore, feeding arginine in excess amounts of the Leghorn requirements to local Saudi Baladi chicken was found not to affect some ovulation and oviductal measurements such as ovarian weight, oviduct weight and number of hierarchy follicles. However, an insignificant increase in F_1 follicles weight was found in chickens fed an extra amount of arginine compared to control (Basiouni *et al*., 2006). It is suggested that the significant increase in egg production (Najib and Basiouni, 2004) and the non significant increase in F1 follicles weight (Basiouni *et al*., 2006) in these hens may be due to a specific stimulatory effect of arginine on LH secretion and ovulation rather than acting directly on the ovary and its follicles. However, to the best of our knowledge, there is no available previous studies examined the effect of feeding arginine to hens on LH secretion. Therefor, the main objective of this study, is to examine the effect of feeding an extra amounts of L-arginine to local Saudi chicken on LH level.

MATERIALS AND METHODS

This study was conducted in a private chicken farm near the city of Al-Taif in Saudi Arabia during the period of May 2007-Jan 2008.

Fifty local Saudi one day old female chicks were bought from a local source. During the 0-4 weeks of age starting period, chicks were kept in 10 grower house cages (4 $cage^{-1}$). On arrival, chicks were weighed by groups and fed commercial starter diet containing 20% crude protein and 2850 Kcal kg^{-1} Metabolizable Energy (ME) till 4 weeks of age. Thereafter, they were fed a commercial grower diet. All chicks were vaccinated against most

prevailing disease in Al-Taif area such as Newcastle, Infectious Bronchitis and Infectious Bursal disease. During the first week of their live, all chicks were exposed to continuous lighting regime, then lighting was decreased by 2 h week^{-1} till it reached 8 h were it held constant at this level. Debeaking was performed at 4 and 16 week of age. During the production period, fresh water and feed was supplied *ad-libitum*. At the age of 33 weeks and during their peak egg production twelve hen/treatment were housed in individual cages 3 days before the start of serial bleeding and canulation procedure have been performed as described by Liu *et al.* (2001) and Chapman *et al.* (1994). One day later, they were fed either a 2% extra amount of arginine diet over the 0.89% arginine already present in the diet (treated) or no extra arginine diet (control). The serial bleeding procedure started two days after the start of the experimental feeding were 1 mL of blood samples were collected every 20 min starting at 9 h before the expected time for oviposition until one hour after oviposition for the measurement of LH levels, the determination of the onset of the preovulatory LH surge and duration. Blood samples were centrifuged soon after collection and plasma was decanted and stored at -20°C until assayed later.

LH assay: The reagents and antibodies specific for the measurement of chicken LH level were provided by J. Proudman (USDA-Agricultural Research Service, USA.). Mean LH concentrations were measured using 100 μL of plasma for each duplicate by RIA as described by Krishnan *et al.* (1994). All samples were measured in one assay. The intra-assay coefficient of variation was 5.4% and the limit of sensitivity was 0.15 ng mL^{-1}.

Statistical analysis: t-test was used to compare mean LH levels and preovulatory LH surge duration between treatments using SAS (SAS, 2001), the homogeneity of variance was also tested using variance homogeneity test. One way analysis of variance was used to compare the time of onset of preovulatory LH surge between treatments.

RESULTS

Results from this experiment shows that the addition of an extra amounts of arginine into the diet of local Saudi hens increased ($p<0.05$) mean LH levels during the 9-6 h before the time of oviposition (2.8±0.33 ng mL^{-1}) as compared to the control group (1.9±0.18 ng mL^{-1}) (Fig. 1).

Similarly, mean LH surge amplitude levels in arginine treated group was found to be higher ($p<0.05$) (4.5±0.045 ng mL^{-1}) compared to control

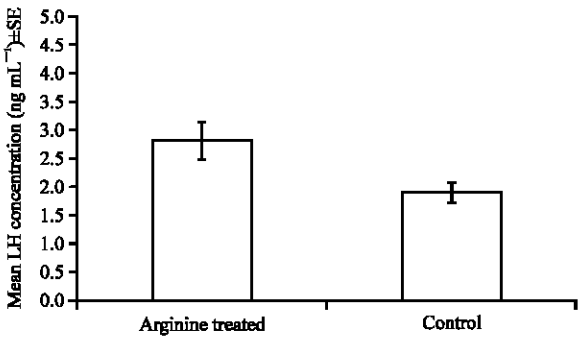

Fig. 1: Mean LH concentrations at 9-6 h before the time of oviposition in arginine and control treated groups

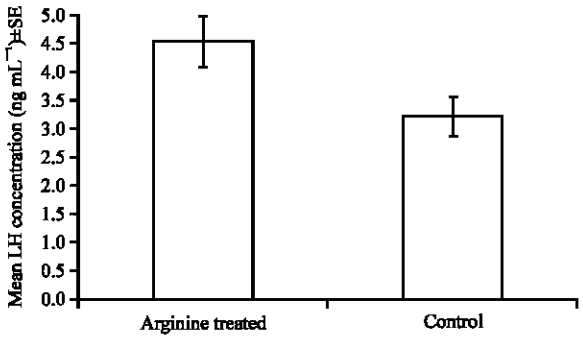

Fig. 2: Mean LH surge amplitude in arginine and control treated groups

Table 1: Onset and duration of preovulatory LH surge

Treatments	Onset of preovulatory LH surge (minutes before the time of oviposition)	Duration of preovulatory LH surge (h)
Arginine treated	260±30^{a}	7.55±1.62^{a}
Control	335±25^{b}	7.61±1.51^{a}

Means in each column followed by different superscript are significantly different at the 5% level

(3.2±0.35 ng mL^{-1}) (Fig. 2). The onset of the preovulatory LH surge (minutes before the time of oviposition) was also found to occur earlier ($p<0.05$) in arginine compared to control treated group (260±30, 335±25 min, respectively) (Table 1). However, The duration of the preovulatory LH surge was not found to be significantly different between the arginine treated and the control group (7.55±1.62, 7.61±1.51 h, respectively) (Table 1).

DISCUSSION

Results from the present study shows for the first time that feeding an extra amounts of arginine to local Saudi hens caused an increase in mean LH levels during the 9-6 h before the time of oviposition preceding the

onset of preovulatory LH surge. These results are in line with previous reports involving pre-pubertal sheep and goats were the infusion of arginine was found to be able to increase mean LH pulse frequency and consequently increase mean LH levels (Recabarren *et al*., 1996a, b; Basiouni *et al*., 1999). These findings, therefore, do support the suggestion proposing the stimulatory effect of L-arginine on luteinizing hormone secretion. This increase in mean LH levels preceding the preovulatory LH surge which is an indication of an increase in its pulse frequency was also followed by a significantly earlier onset of the preovulatory LH surge and a higher LH surge amplitude. It appears that the stimulatory effect of arginine on LH secretion preceding the preovulatory LH surge elicited an earlier onset of the preovulatory LH surge and consequently increased the surge amplitude. However, the non significant differences found in the duration of the preovulatory LH surge may indicate that neither the earlier onset of the preovulatory LH surge nor its higher amplitude affected the duration of the preovulatory LH surge regardless of arginine treatment. Similar results were found in turkey hens in which the duration of LH surge was not found to be different between early and late egg laying hens even though the onset of the preovulatory LH surge was found to start earlier in the early laying hens compared to the late laying hens (Liu *et al*., 2002). This is also in agreement with the result of another study by Liu *et al*. (2004) in which the preovulatory LH surge duration was not found to be different between broiler hens fed *ad-libitum* or restricted fed. It can be concluded from the results of this study that feeding an extra amount of L-arginine to the Saudi local hens increased the preovulatory LH surge levels and caused an earlier onset of the preovulatory LH surge.

It is suggested that this stimulatory effect of the amino acid L-arginine on LH secretion maybe mediated through the stimulation of GnRH neurons in the hypothalamus and consequently, LH release. Further studies are necessary to be repeated on commercial breeds of hens to examine the effect of arginine feeding on LH secretion, egg production and its economical visibility, if any.

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