

## SUPPLEMENTATION OF *WITHANIA SOMNIFERA* L.ROOTS AND PRODUCTIVE PERFORMANCE OF HEAT STRESSED JAPANESE QUAIL

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### ABSTRACT

An experiment was conducted to assess the anti-stress efficacy of *Withania somnifera* root on productive performance of Japanese quail hens reared under high environmental temperature (27-37-27°C). Three hundred Japanese quail hens six weeks old were randomly distributed into five treatments: T<sub>0</sub>= control, T<sub>1</sub> and T<sub>2</sub>=quails supplemented orally with 50, 100 mg/kg/day *Withania somnifera* root ethanolic extract respectively, while T<sub>3</sub> and T<sub>4</sub> = quails received 1 and 2 g/kg diet *Withania somnifera* root powder respectively. The productive characteristics included: feed consumption, body weight gain and feed conversion ratio, in addition to total mortality percentage. Results showed that feed consumption increased significantly ( $p \leq 0.01$ ) in quails received 1g/kg root powder (T<sub>3</sub>) in comparison with all other treatments (T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>4</sub>) whereas T<sub>2</sub> group was the lowest in this character. On the other hand, supplemented quails with 100mg/kg ethanolic extract (T<sub>2</sub>) resulted in significant ( $p \leq 0.05$ ) increasing in body weight gain as compared with control group (T<sub>0</sub>), yet, all treated groups didn't differ significantly among each others. The best ( $p \leq 0.05$ ) feed conversion ratio was obtained when the quails supplemented with root ethanolic extract (T<sub>1</sub> and T<sub>2</sub>) or with 2g/kg diet of root powder (T<sub>4</sub>) in comparison with control. *Withania somnifera* root as ethanolic extract or powder resulted in significant ( $p \leq 0.05$ ) reduction in mortality percentage in comparison with untreated group.

Key words: heat stress, Japanese quail, adaptogenic efficacy.

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تأثير المعاملة بجذور نبات *Withania somnifera* L. في الاداء الانتاجي لطير السلوى الياباني المعرض

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### المستخلص

أجريت الدراسة بهدف اختبار الفعالية المضادة للإجهاد لجذور نبات *Withania somnifera* من خلال معرفة مدى تأثيرها في الاداء الانتاجي لطائر السلوى الياباني المربي تحت درجات حرارة بيئية مرتفعة تراوحت معدلاتها 27-37-27°م. استخدم في هذه الدراسة 300 طائر انثى وزعت عشوائيا على خمس معاملات وكما يلي: T<sub>0</sub> مجموعة غير معاملة (السيطرة) و T<sub>1</sub> و T<sub>2</sub> مجموعتي المعاملة بالمستخلص الكحولي لجذور النبات وجرعتي 50 و 100 ملغم/كغم/يوم بالتتابع و T<sub>3</sub> و T<sub>4</sub> مجموعتي المعاملة اليومية بالمسحوق الخام لجذور النبات وبمستوى اضافة 1 و 2 غم/كغم علف بالتتابع. الصفات التي تم قياسها تضمنت كمية العلف المستهلك والزيادة الوزنية وكفاءة التحويل الغذائي اضافة الى قياس النسبة المئوية للهلاكات الكلية. بينت نتائج المعدل العام للصفات المدروسة أن كمية العلف المستهلك من قبل طيور المعاملة T<sub>3</sub> هو الاعلى معنويا ( $p \leq 0.01$ ) من بين كافة المعاملات الاخرى بما فيها مجموعة السيطرة (T<sub>0</sub>) في حين اظهرت طيور المعاملة T<sub>2</sub> اقل كمية علف مستهلك، ومن ناحية اخرى امتازت طيور المعاملة T<sub>2</sub> بكونها هي الأعلى معنويا ( $p \leq 0.05$ ) في الزيادة الوزنية للجسم بالمقارنة مع مجموعة السيطرة (T<sub>0</sub>). كانت كفاءة التحويل الغذائي للطيور المعاملة بالمستخلص الكحولي لجذور النبات او بالمسحوق عند مستوى اضافة 2غم/كغم علف (T<sub>4</sub>) هي الأفضل معنويا ( $p \leq 0.05$ ) بالمقارنة مع مجموعة السيطرة (T<sub>0</sub>). أدت المعاملة بجذور نبات *Withania somnifera* الى انخفاض معنوي ( $p \leq 0.05$ ) في النسبة المئوية للهلاكات الكلية بالمقارنة مع الطيور غير المعاملة به.

كلمات مفتاحية: إجهاد حراري، طير السلوى الياباني، الفعالية التكيفية.

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**INTRODUCTION**

Among natural feed additive herbs, *Withania somnifera* (*W.somnifera*) also known as Ashwagandha or Indian ginseng, family Solanaceae, has been an important herb in the Ayurvedic medicinal system in Indian. It has historically and traditionally been used in Asia for safely managing and treating stress by restoring homeostasis and increasing the capability of individual to resist adverse environmental factors (9), collectively known as the antistress-adaptogenic effect (14). Several studies have launched to recommend the beneficial effects of *W.somnifera* and its extract in animals as growth promoter and appetizer and observed improvement in feed conversion ratio and increasing in average body weight (7) which may be due to adaptogenic ,antistress activity of Withanolides present in roots of *W.somnifera*. Ashwagandha promotes growth especially during active growth period; it's also stimulation of appetite leading to enhanced food intake (13). A significant higher body weight was seen in broiler chicks given *W.somnifera* extract as compared with untreated birds (23). Administration of aqueous extract of *W.somnifera* (10, 20 and 30 g/Litter) to broilers with drinking water for 35 days, improves their feed intake and body weight gain in all treated groups (15). Different dietary treatments of Ashwagandha at six wks of age revealed significant effect on body weight gain, feed consumption and feed conversion ratio in broilers (1). Supplementation of *W.somnifera* root powder at the rate of 1% to Japanese quails, resulted in significant improvement in body weight, feed efficiency and immune and general health status(4). Feed consumption and body weight gain were significantly increased in day-old broiler chicks when supplemented with 0.5 % of the diet *W.somnifera* for a period of 6 weeks (19). In a comparative study between adding Ashwagandha or commercial compound, to broiler diet during hot weather, results showed that both supplemented groups recorded significant improvement in live body weight, feed conversion ratio and weekly body weight gain, in addition to the economic returns as compared with unsupplemented group (22). An improvement were found in growth and

egg production when the root powder of *W. somnifera* was adding to the diet (5 and 10 g/kg) of white leghorn, 32 wks old for 10 wks (5). Recent study is the first one that conducted to investigate the antistress-adaptogenic efficacy of alcoholic extract or crude powder of *W.somnifera* root in alleviating heat stress of Japanese quail hens reared under high environmental temperature.

**MATERIAL AND METHODS**

**Plant Materials and Extraction**

Fresh healthy plants of *W.somnifera* ,2-3 years old were collected from several places in Baghdad. The herb was identified and authenticated by the Iraqi National Herbarium, Abu Ghariab. The roots were separated, cleaned, washed, air dried in shades, crushed and then pulverized with the help of an electric grinder. The fresh powder was extracted with 70% ethyl alcohol (10), suspension was left stirring for 72 hours at room temperature and then sieved by using sterile gauze to get rid of coarse particulars, filtered through Whiteman filter paper. The filtrate was evaporated to dryness in a vacuum oven. The sticky brownish extract placed in sterile tube and kept in freezer until use.

**Animals and Experimental Treatments**

A total of three hundred, 6 weeks (wks) old Japanese quail hens, proximate in weight, were randomly allocated (20 hens per pen) to floor pens during the study period. Birds were fed *ad libitum* with standard basal diet containing 20% crude protein and 2903 Kcal/Kg ME (Table 1).

**Table 1. Composition and calculated analysis of the experimental diet**

Ingredient	%
Yellow corn	56.1
Soybean meal	31.1
Protein concentrate *	5.0
Vegetable oil	2.0
Limestone	4.9
Dicalcium phosphate	0.6
food salt	0.3
*Calculated composition	
%crude protein	20.0
ME(Kcal /Kg)	2903
%Lysine	1.11
Mehionine %	0.77
Calcium %	2.54
%Available phosphorus	0.35

\*calculated composition according to (18)

Environmental temperatures were recorded along the experiment period and the average house temperature was 27-37-27°C. The hens were randomly distributed into five equal groups: T<sub>0</sub>= control group without any additions, T<sub>1</sub> and T<sub>2</sub> = daily oral administration with 50 and 100 mg/kg(body weight) alcohol root extract (WSRE) respectively, T<sub>3</sub> and T<sub>4</sub> = supplemented with root powder (WSRP) mixed with the diet at 1g and 2g/kg respectively. For ethanolic extract dosing (T<sub>1</sub> and T<sub>2</sub>), it was done by using stomach tube which inserts the substance into the crop. Feed consumption (g/bird/day), body weights gain (g/bird) and feed conversion ratio (g diet/g weight gain) was estimated every two weeks of experimental period. The dying birds were daily recorded and the total mortality percentage was calculated at the end of experiment. A completely randomized design within the statistical analysis system (20) was used to analysis of data for the effect of difference factors in the studied parameters. Multiple range tests (8) were used to significant compare between means.

**Table 2. Effect of supplementing *Withania somnifera* root as ethanolic extract or crude powder on average feed consumption (g/bird/day) of Japanese quail reared under high environmental temperature**

Age (wks)	Treatments					Significant level
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	
8	21.34±0.82	20.39±0.747	20.05±0.80	21.22±1.22	20.04±0.76	NS
10	22.32±1.23	21.99±0.464	22.47±0.70	21.46±0.03	22.56±0.51	NS
12	b 22.21±0.78	ab 23.33±0.049	c 19.97±0.07	a 24.66±1.09	bc 21.58±0.65	**
14	b 20.25±0.14	b 19.61±0.202	b 20.02 ±0.38	a 26.86±0.66	a 26.18±1.31	**
Total Average	c 21.53±0.26	c 21.33±0.24	d 20.62±0.25	a 23.55±0.13	b 22.58±0.15	**

\*\*Significant differences between treatments at (p≤0.01) in the same raw.

NS= Non Significant differences between treatments, Values are expressed as mean ± SE

**RESULTS AND DISSCUSION**

**Feed Consumption (FC)**

Results presented in Table (2) revealed no significant differences among the treatments at 8 and 10 wks of age. Average feed consumption from 7-14 wks of age indicated that the higher value (p≤0.01) was in T<sub>3</sub> and the lower value (p≤0.01) was in T<sub>2</sub>, besides, T<sub>3</sub> and T<sub>4</sub> were significantly (p≤0.01) higher than control, while T<sub>2</sub> was significantly (p≤0.01) less than control and all other treatments.

**Body Weight Gain (BWG)**

Table (3) showed that there were significant differences between treatments in BWG at all experimental period except at 14 wks of age. Overall mean recorded significant (p≤0.05) increasing in weight gain in T<sub>2</sub> in comparison to control (T<sub>0</sub>), besides, no significant changes were found between T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>. Results showed that under high environmental temperature, supplementing Japanese quails with 100mg /kg b.wt WSRE resulted in significant increased in body weight gain.

**Table 3. Effect of supplementing *Withania somnifera* root as ethanolic extract or crude powder on average body weight gain (g/bird) of Japanese quail reared under high environmental temperature**

Age (wks)	Treatments					Significant level
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	
8	b 14.94±1.95	b 17.10±0.70	a 29.79±4.49	b 16.32±1.85	b 13.11±4.98	*
10	a 17.35±2.91	ab 12.28±0.04	ab 10.50±0.46	b 8.10±3.00	a 18.80±3.63	*
12	b 6.99±1.44	ab 14.42±0.90	b 8.43±2.46	a 21.16±3.14	ab 14.23±5.78	*
14	8.40±2.91	14.17±0.47	17.54 ±5.77	8.69±3.57	14.13±1.98	NS
Total Average	b 11.90±0.34	ab 14.49±0.55	a 16.56±0.41	ab 13.56±0.18	ab 15.06±1.60	*

\*Significant differences between treatments at (p≤ 0.05) in the same raw, NS= Non Significant differences

**Feed Conversion Ratio (FCR)**

The values of FCR showed significant differences among groups during all measurement periods (Table 4). At 8 and 14 wks of age, T<sub>2</sub> was significantly (p≤0.05 and p≤0.01 respectively) better than control and other treatments, while T<sub>4</sub> was better (p≤0.05) than T<sub>2</sub> at 10 wk of age. At 12 wk of age, we found significant (p≤0.01) improvement in FCR in groups supplemented with plant root as compared to control. Total means showed that supplemented quails with root as ethanolic extract significantly (p≤0.05) improved feed conversion ratio in comparison with root

powder or with untreated groups. To discuss the results of FC, BWG and FCR, we can say that the significant increasing in feed consumption in groups supplemented with *W. somnifera* root as powder maybe due to digestive tract expansion which tacking a place as a result to diet dilution induced from fiber content in root (16). This result is in agreement with (4) who found that supplementation of Ashwagandha (*W. somnifera*) root powder at inclusion rate of 1 percent was found optimum and had significant effect on feed consumption of Japanese quails.

**Table 4. Effect of supplementing *Withania somnifera* root as ethanolic extract or crude powder on average feed conversion ratio (g diet /g weight gain) in Japanese quail reared under high environmental temperature**

Age (wks)	Treatments					Significant level
	T <sub>0</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	
8	a 1.42±0.05	a 1.19±0.03	b 0.67±0.02	a 1.30±0.03	a 1.52±0.04	*
10	bc 1.28±0.02	ab 1.79±0.02	ab 2.14±0.03	a 2.64±0.01	c 1.20±0.03	*
12	a 3.17±0.07	c 1.61±0.05	b 2.36±0.04	d 1.16±0.02	cd 1.51±0.07	**
14	b 2.41±0.05	d 1.38±0.03	d 1.14±0.05	a 3.09±0.12	c 1.85±0.04	**
Total Average	a 1.80±0.06	ab 1.47 ±0.04	b 1.24±0.04	a 1.73±0.04	ab 1.50±0.03	*

\*Significant differences between treatments at (p≤0.05) in the same raw.

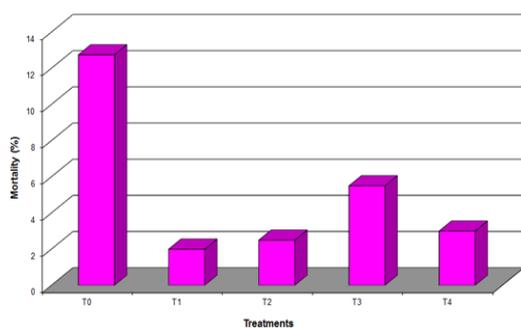
\*\*Significant differences between treatments at (p≤0.01) in the same raw.

NS= Non Significant differences between treatments, Values are expressed as mean ± SE

The significant increasing ( $p \leq 0.05$ ) in weight gain that found in T<sub>2</sub> group may be resulted from the increasing in their liver weight due to daily supplemented with high dose of extract, this result agreed with (3) who reported that oral administration with Ashwagandha extract increased liver and body weight of rats, also the result agreed with (2) who found a significant increasing in final body weight of mice administrated orally with ethanolic extract of WS leaves and he explained this result by the increasing in protein synthesis in liver due to effect of the extract. The combination of significant reduction in feed consumption with the significant improvement in feed conversion ratio together with significant increasing in body weight gain of quails supplemented with 100 mg/kg b.wt ethanolic extract of *W.somnifera* indicated the advantage of this treatment on productive performance of quails reared under heat stress conditions.

#### **Mortality Percentage**

As shows in Figure 1 hens fed control diet had the highest mortality rate and differ significantly ( $p \leq 0.05$ ) with treated groups; T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>. The significant reduction of mortality percentage for quails fed *W.somnifera* root powder and extract may be due to antimicrobial effects of the plant(12)which could be attributed to (i) increased immune response of quails bodies due to possible increasing in nitric oxide (NO) production as a result to supplementation with *W. somnifera* (6).



**Figure 1. Effect of supplementing *Withania somnifera* root as ethanolic extract or crude powder on mortality (%) of Japanese quails reared under high environmental temperature**

No is a product derived from the amino acid L-arginine by the enzymatic activity of inducible NO synthase, and functions as antimicrobial molecule in vitro and in vivo (18), (ii) the increase of phagocytic cell along with their increase phagocytic potential which has been well documented in the treated quails (12, 21). Recent results substantiate the utilization of *W.somnifera* to; overcome many diseases, increase body immunity and Suring the health status of the birds. Also, we anticipate that an immunomodulatory as well as an anti-inflammatory potential of *Withania* roots might have contributed to its overall efficacy.

#### **Conclusion**

Results of recent study indicated that supplementing heat stressed quails with 100mg/kg ethanolic extract of *W.somnifera* root are conduce to significant decrease in feed consumption, significant increase in body weight gain and significant improvement in feed conversion ratio in comparison with those supplemented with crude powder or with control group.

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