J. Agric. Sci. Mansoura Univ., 30 (9): 4991 - 4998, 2005

PERFORMANCE AND SOME PHYSIOLOGICAL PARAMETERS FOR OSIMI RAMS FED HELIA (JERUSALMA ARTICHOKE) DURING SUMMER UNDER ASSIUT CONDITIONS

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ABSTRACT

The objectives of this study were to investigate the effect of feeding helia trunk or nodule to rams on some physiological and biological parameters during summer season under Assiut conditions.

Thirty healthy Osimi male rams divided according to their live body weight into 3 equal groups; ten animals each. They were fed *ad libtum* on helia trunk or helia nodule or wheat straw in groups 1, 2 and 3, respectively. Animals in all groups fed on 600 gm concentrate feed mixture . The trial lasted for 5 months during summer season .

The obtained results showed that group 2 achieved the highest value ($p<0.01$) for body weight, daily feed intake and feed efficiency whereas, the control group have the lowest value for the above parameters .

Group 2 scored the lowest value ($p<0.01$) for respiration rate and rectal and skin temperature among other groups , whereas group 1 have a moderate values for the above parameters among other groups. Also, group 2 achieved the highest value ($p<0.01$) for serum total protein ,globulin, testosterone and thyroxin concentrations. It could be concluded that group 2 which fed helia nodule is the best group for general health and immunity and can diminish the critical values of respiration rate and may improve the heat tolerance in sheep under Assiut summer.

Keywords: Helia, Rams, Heat stress, Performance, Blood metabolites.

INTRODUCTION

Helia (Jerusalem artichoke) is originally a native North American plant .It is also, found in a huge quantity in Upper Egypt . Helia is a concentrated source of inulin and can be taken to help maintain human health because helia plant like bananas, onions, garlic, asparagus, barley, wheat and tomatoes like tuber being in a composite family plant (Ohta *et al.*, 1998). This plant consists of trunk and nodule. Helia plant contains high concentration of thyroxine (T_4) and low level of triiodothyronine (T_3)(Ohta *et al.*, 1998). So, feeding it like Nigella Sativa seeds to animals increased animals heat tolerance during summer (Awad-Allah 2002). Also, it contain high level of protein, so, it may be increased total globulin in animal blood during feeding and enhanced animal immunity (Awad-Allah, 2002). The palatability of helia is very high after air drying due to its high nitrogen and low fiber content especially in nodule. There is limited data on the effects of feeding helia to animals on their growth and physiological status or blood serum constituents.

Therefore, the present study was conducted to determine the influence of feeding helia trunk or nodule to rams on some physiological and biological parameters during summer in Upper Egypt (Assiut) .

MATERIALS AND METHODS

This study carried out at Al -Azhar University farm , Assiut branch during the period from May to September 2004. Helia plants were harvested and air dried for three weeks. Then, helia trunk and nodule after drying were contained 89% and 67.5% DM, respectively. They were chopped and chemically analyzed according to the AOAC (1990) procedures. Thirty healthy Osimi rams over sixteen months old with 30.19 ±0.2 kg average body weight were used in a feeding trial for five months experimental period. They were randomly divided into 3 equal groups, ten animals each. Group 1, fed helia trunk with wheat straw, group 2 fed helia nodule with wheat straw and the last group (control) fed wheat straw only. All groups were fed restricted amount of commercial concentrate feed mixture (600gm/h/d) which cover half quota of energy according to NRC (1985) recommendations at the beginning of the trial. The feeds were offered to all animals once at 9 am. Water was offered to animals all times during the day. Feed intake and approximate analysis of helia (Jerusalem artichoke) trunk, nodule, wheat straw and concentrate feed are presented in Table(1). Respiration rate (RR) , rectal temperature (RT) ,skin temperature (ST) and body weight (BW) were measured every two weeks. Daily gain and feed conversion were also calculated. Also ambient temperature (AT) and relative humidity (RH) were recorded. Respiration rat (RR) was measured by counting the flank movement for 1 min while rectal temperature (RT) was measured by clinical thermometer and skin temperature (ST) was measured by using talethermometer .

Blood samples were collected from all animals every two weeks from the jagylar vein into heparinized tubes at 9.00 before morning feeding and kept at 4 c° for 6 - 12 hr. Then, the serum was separated by centrifugation at 3000 rpm for 20 min as well as stored at -20 c° until analysis for total protein using commercial assay kits supplied by Bio-Aduro . (Egypt) accoroing to the method of Doumas (1975) . Serum albumin was determined using commercial assay kits supplied by Bio - Merieux (France) according to the method of Drupt (1974) .Serum globulin was calculated by the difference between serum total protein and albumin concentration .Serum testosterone triiodothyronine (T_3) and thyroxin (T_4) concentrations were measured by using commercial Elisa kits (Biosource , Belgium) for all samples .

Table(1): Approximate chemical analysis of tested ingredients and chemical composition of tested diets (on dry matter basis).

Item	Helia trunk	Helia nodule	Cone. feed	Wheat straw	Experimental diets		
Chemical composition, %					Group 1	Group 2	Group 3
DM	89.00	67.50	90.20	91.40	89.70	77.00	90.75
CP	6.80	12.40	12.89	3.90	9.80	12.60	8.50
CF	26.00	4.80	14.50	39.60	17.80	10.80	27.01
EE	3.20	3.95	3.80	1.42	3.61	3.90	2.62
Ash	9.80	6.20	6.20	16.60	8.22	6.20	11.40
NFE	54.20	72.65	62.61	38.48	60.57	66.50	50.47

All data were analyzed using General linear Models Procedure of SAS (1985). The differences among means were tested by using least significant difference (LSD). Results were considered significant only at ($p<0.05$) or less (Duncan's test, 1955).

RESULTS AND DISCUSSION

Growth performance

The influence of feeding helia trunk and nodules on total body weight gain and daily gain are shown in Table (2). The data revealed that group 2 which fed helia nodule achieved the highest beneficial effect ($p<0.01$) on average total body weight and daily gain (ADG).

Table(2): Least square means (LSM) and standard error (SE) of growth performance data of rams fed the tested diets.

Item	Dietary treatments		
	Helia trunk,G1	Helia nodule, G2	Control group, G3
Initial body weight (kg)	30.97± 0.147 ^{a}	30.30±0.210^{a}	29.80± 0.120 ^{a}
Final body weight (kg)	62.05±0.215 ^{b}	71.90±0.280^{a}	51.55±0.145 ^{c}
Total gain (kg)	31. 08± 0.068 ^{b}	41.60±0.070^{a}	22.25±0.025 ^{c}
Daily gain (gm/day)	207.20	277.33	148.33
Feed intake (gm/day/head)	1490.0±30.50 ^{b}	1670.0±35.8^{a}	1300.0± 25.50c
Feed conversion kg D M/kg gain	7.19 ^{b}	6.02 ^{c}	8.8 ^{a}

- Means within raws differ (P<0.01) when superscripts differ.

This may be due to high protein content and low ash in helia nodule diet than other groups. Feed conversion showed a beneficial effects of helia nodule for group 2 and this may be due to higher ADG as well as feed intake of this group (El - Ghamry and Badawi ,1965) .Likewise group 1 which fed helia trunk,was higher for daily gain and feed intake but lower for feed conversion than control group . The beneficial effect of helia for daily gain, intake and feed conversion may be due to its high crude protein especially in nodule and high palatability (El - Ghamry and Badawi ,1965 and Abou'l Ella *et al.*, 2003).

Some physiological parameters

It is well known that animals have complex physiological mechanisms which enable them to interact with their environment. The effect of summer on respiration rate, rectal temperature and skin temperature are shown in Table (3). Results showed that , the lowest values for RR, RT and ST were found in group 2 which fed helia nodule. The highest values for RR, RT and ST were recorded in control group. Results may indicated that feeding helia nodule to animals may improved heat tolerance in sheep. The rectal temperature ,skin temperature and respiration rate (Table, 3) are a normal physiological response to the ambient temperature (AT) and /or the relative humidity (Kobeisy,1994; Shafie *et al.*, 1994 and Solouma ,1999). Generally , changing in skin temperature with season depend to large extent on

thickness of body cover and skin and subcutaneous fat and to the degree of ambient temperature (Hafez *et al.*, 1956) . Generally , respiration rate is the most one which could be affected greatly by feeding level or feed components (Kabak, 2003). So, helia nodule can diminish RR in studied rams and increased their heat tolerance.

The results obtained may disagreement with those of Bunting *et al.*, (1992). Abd - El-Hafez (1997), Solouma (1999) and Kobeisy *et al.*, (2001). The previous authors showed no significant effect of protein intake level on the above physiological parameters with sheep .

Table(3): Values of least square means (LSM) and SE of some physiological parameters for rams fed tested diets.

Item	Dietary treatments		
	Helia trunk.G_1	Helia nodule, G_2	Control,G_3
Respiration rate(RR,Br./min.)	44.4810.116 ^{b}	42.38 ±0.084 ^{c}	45.62±0.146 ^{a}
Rectal temperature (RT.C°)	39.75±0.020 ^{ab}	39.50±0.020 ^{b}	40.19±0.021 ^{a}
Skin temperature (ST.C°)	38.63±0.017 ^{ab}	38.33± 0.018 ^{b}	38.98+0.019r ^{a}
Ambient temperature (AT.C°)	34.36±0.095 ^{a}	34.34±0.081 ^{a}	34.35±0.068 ^{a}
Relative humidity (RH.%)	69.14±0.061 ^{a}	70.02±0.074 ^{a}	69.84±0.065 ^{a}

- Means within raws differ (P<0.01) when superscripts are differ.

Generally, rectal temperature runs around relatively constant levels because of the balance between heat production and dissipation (Folk, 1974). However factors affect RT are muscular activity, feeding, water consumption, breed, sex, age and fleece length , diurnal rhythm and other rhythmic cycles such as seasons ambient temperature(AT) and solar radiation (Bianca ,1968). Also , Singh *et al.*, 1980 reported that ,the increase ST with the increase of ambient temperature' is indicative to the direct effect of the environment. This may be explain the high ST in all groups obtained herein than the summer normal values reported by Abd - El – Bary (1982); Shalaby (1985); Khalil (1990) ;Ibrahim; (1994); Gomaa, (1996); Shalaby *et al.*, (1996) and Abd El -Hafez., (1997) in Upper E gypt .

On the other hand , the heat stress imposed to animals by the high AT requires a considerable heat dissipation to maintain a thermal balance. Sheep was found to rely primarily on respiratory activity as a principle mechanism for heat dissipation to control body temperature under heat condition (Schmidt - Nielsen, 1979 and Aboul – Ela *et al.*, 1987). Higher RR in all groups in present study than the normal values agreed Singh *et al.*, 2(1980); Shalaby (1985), Khalil *et al.*, (1991), Ibrahim (1994), and Shafie *et al.*, (1994). They found that increasing AT significantly increased RR than the normal value.

The previous results indicated that feeding helia nodules to sheep can diminish the critical values of RR and may improve their heat tolerance .

Some biood serum constituents

Serum total protein, albumin and globulin concentrations

The influence of feeding helia to rams on serum total protein ,albumin and globulin are shown in Table (4). The lowest serum total protein (TP) concentration (p<0.01) was recorded in group 1 and control group, while the

highest concentration was found in group 2 which fed helia nodules. However, the lowest values ($p<0.01$) for albumin and the highest values for globulin were found in groups 1 and 2 which fed helia trunk and nodule, respectively. The highest value ($p<0.01$) for albumin and the lowest value for globulin were found in control group .

These results indicated that feeding helia can rise serum total protein and globulin in blood, consequently enhance the immunity and general health of lambs under Upper Egypt conditions with severe heat stress (Awad-Allah ,2002).

Serum testosterone , triiodothyronine (T_3) and thyroxin (T_4)

The influence of feeding helia to rams on serum testosterone , T_3 and T_4 concentrations are shown in Table (4). Results showed that testosterone concentration in blood of group, 2 which fed nodules was higher ($p<0.01$) than other groups, whereas the control group achieved the lowest ($p<0.01$) value. These events indicated that feeding helia nodules to rams may have a beneficial effect on testosterone concentration, consequently may be have enhancement effect on their reproduction performance (Megahed and Etman, 2003).The enhancement of testosterone concentration can activates the secretary function of the accessory glands (Salisbury *et al.*, 1978) which ,in turn may increase seminal volume and reproduction performance (Kabak, 2003).

One the other hand, results showed that group 2 , achieved the lowest concentration ($p<0.01$) for T_3 and the highest concentration ($p<0.01$) for T_4. However the control group showed the highest value ($p<0.01$) for T_3 and the lowest value ($p<0.01$) for T_4 .Rams fed helia trunk have serum T_3 and T_4 concentration within the values of control group and group 1 which fed helia nodules. These events indicated that rams fed helia nodules in summer ,when the animal was gaining heat from the environment tended to reduce heat production by reducing the conversion of T_4 to T_3, thus showing higher level of T_4 in summer. This result confirms the previous findings of El - Sherbiny *et al.*, (1981) and El-sherbiny ,(1983).

Table (4): Effect of feeding tested diets on some blood plasma constituents in Osimi rams.

Item	Dietary treatments		
	Helia trunk,G1	Helia noduleG2	Control group,G3
Total protin(gm/dl)	7.21±0.031 ^{c}	7.29±0.022 ^{a}	7.18±0.020 ^{b}
Albumin (gm/dl)	2.78±0.006 ^{b}	2.71±0.004 ^{b}	2.92±0.002 ^{a}
Globulin (gm/dl)	4.43±0.025 ^{b}	4.58±0.018 ^{a}	4.26±0.018 ^{b}
Testosterone (ng/ml)	2.57±0.091 ^{b}	2.95±0.077 ^{a}	2.05±0.086 ^{c}
Triiodothyronirre (T_3,ng/100ml)	61.2±6.380 ^{b}	56.1±5.89 ^{c}	75.8±7.72 ^{a}
Thyroxine (T_4,ug/100ml)	4.7±.0.741 ^{b}	5.4±8.22 ^{a}	4.2±0.635 ^{c}

Means in the same row with the same superscript letters (a, b& c) are significant different ($p<0.01$).

CONCLUSION

From the foregoing results , it could be concluded that feeding rams on helia plant (nodule or trunk) showed beneficial effects on some productive performance as well as blood serum testosterone concentration which may be enhancement the reproductive performance. Moreover, feeding this plant to rams enhanced their immunity system and helped the animals to tolerate heat and preserve the heat balance during summer season.

Generally, rams tended to reduce their endogenous heat production by reducing the functional activity of the thyroid, i.e. T_3 secration rate, and this function helped the rams to tolerate heat and preserve the heat balance by reducing its endogenous heat production.

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دراسة بعض الصفات الفسيولوجية علي ذكور الأغنام الأوسيمي المغذاه علي نبات الطرطوفة تحت ظروف الصيف بأسيوط

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أجريت هذه الدراسة في مزرعة قسم الإنتاج الحيواني بكلية الزراعة – جامعة الأزهر – فرع أسيوط في الفترة من شهر مايو حتي نهاية شهر سبتمبر عام ٢٠٠٤ لمدة خمس شهور والتي يتخللها فصل الصيف حيث كان متوسط درجة الحرارة ٣٤,٣٦ م ودرجة الرطوبة النسبية ٦٦,١٤%

تم إختيار عدد ٣٠ كبش من ذكور الأغنام الأوسيمي (بمتوسط وزن ٣٠,١٩ كجم) الخالية من الأمراض وفي حالة صحية جيدة وقسمت الي ثلاثة مجاميع هي :

المجموعة الأولي كانت تتغذي علي سيقان الطرطوفة مع تبن القمح والعلف المركز **والمجموعة الثانية** كانت تتغذي علي درنات الطرطوفة مع تبن القمح والعلف المركز **والمجموعة الثالثة والأخيرة** كانت مجموعة مقارنة تتغذي علي تبن القمح فقط مع العلف المركز وكانت كمية العلف المركز المضافة لكل حيوان من المجموعات الثلاثة هي ٦٠٠ جرام يوميا .

أوضحت النتائج أن المجموعة التي غذيت علي درنات الطرطوفة (المجموعة الثانية) حققت زيادة معنوية في وزن الجسم وكمية الغذاء المأكول اليومي والكفاءة الغذائية للحيوان . بينما سجلت مجموعة الكنترول أقلهم معنوياً في تلك الصفات . وأيضا حققت المجموعة الثانية أعلي مقاومة للظروف البيئية (صيف أسيوط) حيث سجلت أقل قيمة معنوية للقياسات الفسيولوجية التي تمت الدراسة عليها وهي معدل التنفس ودرجات حرارة كل من المستقيم والجلد عن باقي المجموعات وكانت المجموعة الأولي وسطية في كل القياسات السابقة بين المجموعة الثانية والمجموعة الثالثة .

بالنسبة لقياسات الدم فقد سجلت المجموعة الثانية أعلي قيمة معنوية في كل من نسبة البروتين الكلي والجلوبيولين وهرمون الذكورة التستسترون وهرمون الغدة الدرقية الثيروكسين وهذا يدل علي حالة الحيوان الصحية والمناعة العالية عند تغذيته علي درنات الطرطوفة وكذلك إرتفاع خصوبته التناسلية ومقاومته العالية للتغيرات البيئية الحرارية وقد سجلت المجموعة الأولي المرحلة الوسطية بين الكنترول والمجموعة الثانية في كل الصفات المدروسة .

وبذلك بينت الدراسة بأنه يمكن تحسين حالة الحيوان الفسيولوجية والتناسلية والمناعية خلال الصيف بإضافة درنات الطرطوفة للغذاء المقدم لها .