EFFECT OF FEEDINGWATER HYACINTH ON CARCASS TRAITS AND SOME BLOOD COMPONENTS OF RABBITS

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SUMMARY

This experiment was carried out at a private rabbit farm under supervision of Benha University Animal Feed Professors, duration time from May to July 2014 on 48 New Zealand White young male rabbits at 6 weeks of age and 696 grams average live body weight. Rabbits were divided into four groups (each group contains 12 NZW rabbits,with three replicates) for the 8 weeks feeding period to investigate the effect of feeding different levels (0, 25, 50 and 75% from Egyptian clover) of sun dried water hyacinth on carcass traits and some blood components. The results showed no significant differences between means of live condition scores, carcass weight and dressing percentage due to the feeding groups effect, carcass cuts and offals weight were not significant except for the fur and legs weight ($P<0.05$). Chemical analysis of meat showed no significant differences between feeding rabbits groupsexcept for the ash% ($P<0.001$). Blood components of feeding rabbits exhibited significant differences ($P<0.001$) for plasma albumin, globulin and total lipids.Present results conclude that, dried water hyacinth leaves and stems may be used as a feed for rabbits to replace 50% of clover hay in concentrate feed mixture without negative effects on carcass and blood components of growing rabbits.

Keywords: *water hyacinth, rabbits, carcass, blood.*

INTRODUCTION

The animal feed stuffs shortage is the most important problem in animal production; therefore, new feed stuffs are required to solve this problem. Water hyacinth (WH) is one of these new feed stuffs, which can replace a part of animal feed to solve this problem. Moreover, animal feed prices are increased yearly,therefore, efforts have been intensified to find more economical feed sources less competitive with human feedstuffs. Using of such non-traditional feeds as WH in animal feeding substantially participates in solving this problem decreases the cost of feeding and hence the marketing price of animal products (Zewil *et al*., 1993). Rabbit is suitable to raise for meat production due to its high feed conversion efficiency, rabbits use protein more efficiently than broilers and up to 20% roughages can be included in their diets(Eleraky and Mohamed, 1996).Water hyacinth completely or partially replaced alfalfa without effects on growth rate and reproductive parameters. The optimum inclusion level of WH will depend on the feedstuff substituted in a complete diet. The replacement of Para-grass with WH up to 60% in rabbit diets improved feed utilization, growth performance and economic returns (Tham, 2015).

The objectives of this study were to investigate the effect of replacing Egyptian clover (*Trifolium alexandriunm*) hay by sun dried water hyacinth leaves and stems at different levels (0, 25, 50 and75%) on carcass traits and some blood components of growing rabbits.

MATERIALS AND METHODS

Preparation of water hyacinth:

Water hyacinth (WH) was collected from EL-Qalag, Qalyubia, Egypt. Leaves and stems were separated from the roots of plants and sun dried for 20 days with flipping the plants every three days.

Dried WH leaves and stems were chopped and used to replace Egyptian clover hay in the concentrate feeding mixture ofa rabbit's diet at different levels (0, 25, 50 and 75 %). Chemical composition of WHand the experimental diets are presented in Table (1).

Table (1). Chemical composition of water hyacinth and the experimental diets.

Items	Composition on DM basis %					
	DM	CP	EE	NFE	CF	Ash
Sun dried water hyacinth	91.4	14.7	2.1	31.6	22.7	28.9
T1 CFM*(Control)	91.1	16.1	4.3	61.0	14.2	4.4
T2 (25% water hyacinth)	91.1	16.3	4.2	60.4	14.5	4.6
T3 (50% water hyacinth)	91.1	16.6	4.2	59.5	14.7	5.0
T4 (75% water hyacinth)	91.0	16.4	4.1	50.1	15.1	5.3

**CFM (Concentrate feeding mixture) consisted of Hay 30 %, Barley 9 %, corn Yellow 15 %, wheat, bran 30 %, soybean meal 14 % and add nitration 2 %.*

Experimental rabbits and feeding groups:

Forty eight New Zealand White young male rabbits, 6 weeks of age and about 675 to 717 g live body weight were divided into four groups (each group contains 12 male rabbits and withthree replicates). The first group (control) was fed on the basal diet formulated according to **NRC (2004**) recommendations. Water hyacinth was used to replace0, 25, 50 and 75% of Egyptian clover hay in the concentrate feeding mixture diet (control). The feeding period extended for 8 weeks.

All rabbits in each group were individually weighed to the nearest gram at the start of the feeding period and then weekly in the morning before feeding and drinking till the end of the feeding period. Diets were offered twice daily in equal quantities at the 8 am and 4 pm and estimated for each of the four groups every day. Both of consumed diets and refusals (if any) were recorded daily.Ingredients of the experimental diets are presented in Table (2).

Table (2). Feed ingredients of the experimental diets.

Ingredients%	Experimental diets			
	T1(Control)	T2	T3	T4
Egyptian clover hay	30	22.5	15	7.5
Water hyacinth	0	7.5	15	22.5
Yellow corn	15	15	15	15
Wheat bran	30	30	30	30
Soybean meal (48% protein)	14	14	14	14
Barley	9	9	9	9
Common salt	0.5	0.5	0.5	0.5
Limestone	0.78	0.78	0.78	0.78
Mineral premix	0.6	0.6	0.6	0.6
Antitoxins and fungi	0.12	0.12	0.12	0.12
Total	100	100	100	100

Carcasstraits:

At the end of the feeding period, 16 male rabbits (four rabbits from each group) were randomly chosen for slaughter test. Rabbits were 14 weeks of age and had nearly similar average live body weight. Live condition scores (LCS) of rabbits (1weak, 2acceptable, 3good, 4very good and 5excellent) were recorded (Armero and Blasco 1992).

Rabbits were slaughtered to determine the performance of carcass characteristics. They were fasted for approximately 16 hours, according to El-Sayaad and Abd EL-Rahman (1990).Rabbits were weighted individually to obtain pre-slaughter weight (fasted weight) and slaughtered by severing the neck with a sharp knife according to Islamic Religion. The slaughter weight was recorded after complete bleeding.

The head was separated and the body was skinned. Skinning was carried out by removing the skin, including the tail and feet, then after the carcass was opened down and all entrails were removed.Also, lungs, liver, kidneys and heart were weighed.

The weights of the carcass, fur, head and legs were recorded. The carcass for each rabbit was separated into front quarter, chest, loin and hindquarters and their weights were also recorded according to Cheeke (1987). All weights were taken to the nearest gram and related to the fasted weight.

Dressing percentage was calculated using the following equation:

$$\text{Dressing percentage} = \frac{\text{Dressed weight (g)}}{\text{Fasted weight (g)}} \times 100$$

Meat of *Longissimus dorsi* muscle for each carcass was separated from the bones and weighted, minced, dried, re-weighed, ground and stored at 10◦ C for chemical analysis according to **AOAC (2004)**.

Blood sampling:

Individual blood samples were collected at slaughter time from four male rabbits within each group.The blood samples were collected after the addition of EDTA into dry clean tubes. The blood plasma was obtained by centrifuging the blood samples soon after collection at 3000 RPM for 15 minutes.Blood plasma was transferred into vials and stored in a deep freezer at -20◦C for subsequent specific chemical analysis,total protein according to Henry (1964), albumin according to Doumas *etal.*(1971), total lipids according to Frings *etal.*(1972). Also, calcium, phosphate and potassium were determined according to American Association for Clinical Chemistry (1977).The concentration of total globulin in each sample was obtained by subtracting albumin concentrates from the total protein concentration and albumin globulin (A/G) ration was calculated by dividing albumin by total globulin.

Statistical analysis:

Statistical analysis was carried out by using the least squares procedure for analyzing the data with unequal subclass number as described by SAS (2004).

The statistical model was used as follows:

$$Yij = \mu + Ti + eij$$

Where:

Yijk = the observation of carcass traits, meat chemical analysis and blood plasma component for rabbits;
μ = general mean, common element to all observations;
Ti = the fixed effect of ith treatment;
eij = random error associated with the individual observation and assumed (NI D)□□□(0, □□2e).

Tests of significance for differences between means were carried out according to Duncan (1955).

RESULTS AND DISCUSSION

Carcass traits:

Least square means and standard errors of live condition scores (1-5), carcass weight (g) and dressing percentage are shown in Table (3). Rabbits fed the T1 (control) and T3 diet, recorded the highest LCS (4.25) and carcass weight (1301 g). While, rabbits fed diet containing 50% water hyacinth (T3) recorded the highest dressing percent (63.38%).

The differences between means of live condition scores (1-5), carcass weight (grams) and dressing percentage (%), due to feeding groups effect, were insignificant (Table 3).These results disagree with those ofZewil *et al.* (1993) who showed that the dressing percentage was significantly ($P<0.05$) depressed when the diet contained 30% water hyacinth. Eleraky and Mohamed (1996) recorded that dressed weight and dressing percent of NZW rabbits fed on 0, 15 and 30% water hyacinth were 1123.2, 1165.4 and 1094.3 g; 53.7, 54.2 and 52.3%, respectively, differences between feeding groups were significant

(P<0.05). EL-Adawy and Borhami (1999)observed a significant (P< 0.01 or P<0.05) effect of water hyacinth levels in the rabbit's diet on hot carcass weight and dressing percent. El–Adawy *et al.* (2000) showed that levels of water hyacinth decreased significantly (P<0.05 or P<0.01) hot carcass weight and dressing percentage, respectively.

Table (3). Least-squares means and standard errors (LSM±SE) of rabbits carcass andoffal's weight.

Items	No.	T1 (Control)	T2 (25%WH)	T3 (50%WH)	T4 (75%WH)	Sign.
Live condition score (1-5)	4	4.25±0.47	3.75±0.47	4.25±0.47	3.75±0.47	ns
Carcass weight (g)	4	1301.25±41.35	1218.75±41.35	1300.00±41.35	1170.00±41.35	ns
Dressing%	4	61.83±0.71	62.98±0.71	63.38±0.71	63.04±0.71	ns
Offals weight (grams):						
Fur	4	317.50±8.94^{a}	285.00±8.94^{bc}	310.00±8.94^{ab}	271.25±8.94^{c}	*
Legs	4	80.00±4.60^{a}	72.50±4.60^{ab}	62.50±4.60^{b}	61.25±4.60^{b}	*
Head	4	132.500±4.06	125.00±4.06	130.00±4.06	123.75±4.06	ns
Digestive tract	4	341.25±16.55	315.00±16.55	321.25±16.55	292.50±16.55	ns
Lungs and trachea	4	11.25±1.69	10.00±1.69	13.75±1.69	15.00±1.69	ns
Liver	4	53.75±3.64	57.50±3.64	57.50±3.64	46.25±3.64	ns
Kidneys	4	12.50±1.14	11.25±1.14	11.25±1.14	10.00±1.14	ns

*a, b, c Means within any classification, followed by different letters are significantly different (p<0.05); ns= p>0.05 and *=p<0.05*

Data of head, legs and body of offal's weight for rabbits fed diets containing different levels of WH are shown in Table (3). The differences due to treatments were not significant except T1 (control) recorded thesignificant (P<0.05) highest weight of fur and legs whereas T4 showed the lowest ones (Table 3).

In this respect, EL-Adawy and Borhami (1999) reported that offal's weight percent in growing rabbits fed on 0, 50 and 100% water hyacinth were not significant except liver percent.Moreover,El–Adawy *et al.* (2000) found that total offal's weight percent of carcass for growing NZW rabbits fed on 0, 18 and 36 % water hyacinth were not significant except of fur and leg. Also, Zewil *et al.* (1993) indicated that water hyacinth fed to rabbits with levels of 0, 10, 20 and 30% did not affect the relative weight of offal's liver, heart and kidney. Eleraky and Mohamed (1996) stated that experimental diets contain 0, 15 and 30% water hyacinth did not affect relative weight of liver, heart and kidney.

Rabbits of the T1 (control) recorded the highest weight for hind quarter, loin, chest and front quarter, respectively, being 430.00, 243.75, 227.75 and 185.00 g, respectively (Table 4).However, differences between means of rabbits carcass cuts weight, due to feeding groups effect, were not significant (Table 4).

Table (4). Least-squares means and standard errors (LSM±SE) of factors affecting rabbits carcass cuts weight and meat chemical analysis.

Items	No.	T1 (Control)	T2 (25%WH)	T3 (50%WH)	T4 (75%WH)	Significant
Carcass cuts weight (grams):						
Hindquarter	4	430.00±15.60	420.00±15.60	418.75±15.60	368.75±15.60	ns
Loin	4	243.75±15.72	220.00±15.72	267.50±15.72	243.75±15.72	ns
Chest	4	227.50±16.20	193.75±16.20	230.00±16.20	188.75±16.20	ns
Front quarter	4	185.00±8.54	176.25±8.54	166.25±8.54	168.75±8.54	ns
Meat chemical analysis (%):						
Moisture	4	74.87±0.21	74.64±0.21	74.48±0.21	75.01±0.21	ns
Protein	4	20.89±0.19	20.93±0.19	21.00±0.19	20.67±0.19	ns
Fat	4	1.68±0.04	1.68±0.04	1.60±0.04	1.52±0.04	ns
Ash	4	1.37±0.03c	1.51±0.03b	1.74±0.03a	1.60±0.03b	***

*a, b, c Means within any classification, followed by different letters are significantly different (p<0.05); ns= p>0.05 and ***=p<0.001*

Meat of rabbits of T4 group had the higher moisture percentage (75.01 %) compared with other treatments being 74.87, 74.64 and 74.48 % for T1 (control), T2 andT3 group, respectively. Protein percentage was the highest in meat of T3 group (21.00 %) followed by that of T1 (control), T2 and then T4 group (20.89, 20.93 and 20.67 %) respectively. Otherwise, fat percentage was the highest in T1 (control) and T2 groups (1.68 % for both treatments) followed by 1.60 and then 1.52% for meat of rabbits of T3 and T4 groups, respectively. While, the highest ash percentage (1.74%) was recorded in T3 group followed by T4, T2 groups and then T1 (control), being (1.60, 1.51 and 1.37%), respectively, statistical analysis showed differences between treatment for only ash element (Table 4). The present results nearly agree with those reported by El- Adawy *et al. (*2000) who found that moisture in meat of growing NZW rabbits was 72.83, 73.07 and 72.67%; CP was 19.23, 19.2 and 19.18 %. But EE was 4.25, 4.13 and 3.97%; ash was 2.48, 2.61 and 2.79%, for rabbits fed 0, 18 and 36% water hyacinth, respectively. They stated that there were no significant differences between means of chemical meat composition, due to rabbits fed on different levels of water hyacinth except for ether extract (P<0.05).

Generally, the values obtained in the present study are within the range reported by El-Sayaad and Abd-Rahman (1990) and Abdel-Rahim *et al.* (1994) using different rabbit breeds, ages at slaughter and different diets.

Blood components:

Means of blood plasma components (total protein, A/G ratio, calcium, phosphorus and potassium) for rabbits fed the different levels of water hyacinth were almost similar. However, rabbits of T3 group(50% WH) achieved the highest values of albumin, globulin and total lipids concentrates 2.4, 2.27 g/dl and 376.67mg/dl, respectively, followed by those of the T2 group (25% WH); while the correspond lowest values were recorded for the T1(control) as shown in Table (5). Statistical analysis of the rabbits blood plasma components fed at different levels of water hyacinth was highly significant (P<0.001) for albumin, globulin and total lipids, but the reverse was true for other rates (Table 7).These results almost agree with those of Eleraky and Mohamed (1996) who found that blood serum components of growing rabbits were 8, 8.32 and 8.18 g/dl, for total protein; 339.0, 340.0 and 337.0 mg/dl, for total lipids; 3.34, 3.61 and 3.35 g/dl, for albumin; 4.66, 4.71 and 4.83 g/dl, for globulin of rabbits fed 0, 15 and 30 % water hyacinth, respectively. However,differences betweenrabbits blood component levels due to feeding groups on different levels of water hyacinth (0, 15 and 30%) were not significant.

Table (5). Least-squares means and standard errors (LSM±SE) of factors affecting rabbits bloodplasmacomponents.

Items	No.	T1 (Control)	T2 (25%WH)	T3 (50%WH)	T4 (75%WH)	Significant
Total protein	4	4.60±0.09	4.69±0.09	4.75±0.09	4.61±0.09	ns
Albumin	4	2.32±0.01b	2.37±0.01a	2.40±0.01a	2.33±0.01b	***
Globulin	4	2.19±0.007c	2.24±0.007b	2.27±0.007a	2.20±0.007c	***
A/G ratio	4	1.05±0.005	1.06±0.005	1.05±0.005	1.05±0.005	ns
Total lipids	4	366.45±0.65c	372.18±0.65b	376.67±0.65a	3.66.68±0.65c	***
Calcium	4	16.31±0.16	16.40±0.16	16.57±0.16	16.40±0.16	ns
Phosphor	4	3.81±0.09	3.76±0.09	3.87±0.09	3.85±0.09	ns
Potassium	4	5.52±0.09	5.41±0.09	5.54±0.09	5.46±0.09	ns

*a, b, c Means within any classification, followed by different letters are significantly different (p<0.05); ns=p>0.05and ***=p<0.001*

CONCLUSION

Present results conclude that, sun dried water hyacinth leaves and stems may be used as a feed for rabbits to replace 50% of clover hay in concentrate feed mixture without negativeeffects onrabbit's carcass traitsand blood components.

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تأثير التغذية بورد النيل على صفات الذبيحة وبعض مكونات الدم فى الارانب

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قسم الإنتاج الحيوانى- كلية الزراعة بمشتهر– جامعة بنها- جمهورية مصر العربية

أجريت هذه الدراسة فى مزرعة أرانب خاصة تحت إشراف أساتذة تغذية الحيوان بقسم الإنتاج الحيوانى– كلية الزراعة-جامعة بنها خلال الفترة ما بين مايو إلى يوليو 2014 على 48 من ذكور الأرانب الصغيرة من سلالة النيوزيلندي الأبيض عمر 6 أسابيع ومتوسط وزن حى 696 جم حيث تم تقسيمها إلى أربع مجاميع (كل مجموعة تحتوى على 12 ذكر من الأرانب والمجموعة مقسمة إلى ثلاث مكررات) للتغذية على أوراق وسيقان ورد النيل المجفف شمسيا بنسب مختلفة (صفر و 25 و 50 و 75%)بديلا عن دريس البرسيم الموجود بالعلف المركز خلال فترة تغذية 8 أسابيع. فى نهاية التجربة تم ذبح 4 أرانب من كل مجموعة لقياس تأثير التغذية على صفات الذبيحة وأخذت عينات من الدم لتقدير بعض مكونات بلازما الدم. وأظهرت النتائج عدم وجود فروق معنوية بين متوسطات حالة الجسم قبل الذبح ووزن الذبيحة و نسبة التصافى للذبيحة ناتجةعن تأثير التغذية بورد النيل كذلك صفات وزن قطعيات الذبيحة والأعضاء الملحقة بالذبيحة فيما عدا وزن الفراء ووزن الأرجل ($P<0.05$). أظهرالتحليل الكيماوى للحم الأرانب عدم وجود فروق معنوية بين مجموعات التغذية فيما عدا نسبة الرماد ($P<0.05$). أظهر تقدير مكونات بلازما الدم أختلافات معنوية ($P<0.001$) فى قيمة الألبيومين والجلوبيولين والليبيدات الكلية. ومن خلال النتائج السابقة نوصى باستخدام أوراق وسيقان ورد النيل المجفف شمسيا كغذاء للأرانب بنسبة 50% بديلا عن دريس البرسيم الموجود بالعلف المركز بدون تأثير سلبي علىصفات الذبيحة و التركيب الكيماوى للحم ومكونات الدم فى الأرانب.