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EFFECT OF FEEDING DIFFERENT LEVELS OF LINSEED MEAL INSTEAD OF SOYBEAN MEAL IN THE DIETS OF BALADY BLACK RABBITS BUCKS:
1- EFFECT ON DIGESTION COEFFICIENTS, SEMEN QUALITY AND SOME BLOOD PARAMETERS.

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ABSTRACT

A total number of 30 bucks Black Balady rabbits was divided into two experiments (15 bucks per experiment) to study the effect of substitution of soybean meal protein (SBMP; 44%) in the diets of Black Balady rabbits by soaked linseed meal protein (SLSMP; 26.26%) at levels of 0.0%, 25%, 50%, 75% and 100%. The digestibility and some blood constituents were studied in experiment 1 while semen quality was tested in the experiment 2.

In the experiment 1 results indicated that the digestibility coefficients for all nutrients did not differ significantly for containing 0, 25 and 50% SLSMP, while increasing the level of SLSMP up to 75 and 100% instead of SBMP decreased digestibility coefficients for all nutrients except ether extract ($P<0.01$ and $P<0.001$ respectively). The best values were recorded for (50% SLSMP). The same trend was observed when feeding values were expressed as TDN, DCP and DE.

Increasing the level of SLSMP did not affect on plasma total protein (g/dl), albumen (g/dl), globulin (g/dl), GOT (IU/L), GPT (IU/L), creatinine (mg/dl), triglyceride (mg/dl) and urea-N (mg/dl) but increased, cholesterol (mg/dl) level significantly ($P<0.01$).

In the experiment 2, motility percent did not differ significantly among the dietary treatment groups, while 50% SLSMP had the best ejaculate volume (ml) and sperm concentration ($x10^6$), also had the lowest dead sperm and abnormal sperm than other treatments ($P<0.001$). Fertility percent increased significantly ($P<0.01$) by increasing the dietary level of SLSMP up to 25%. Also, increasing the age of bulk increased ejaculate volume (ml), motility (%) and abnormal sperm (%) significantly ($P<0.01$ and $P<0.001$).

In conclusion, SLSMP could be inclusion in rabbit diet of black Balady strain at 50% of SBMP or 11% of dietary composition without negative effects on digestibilites of nutrients, nutritive values of the diets, biochemical constituents of blood plasma, semen quality and fertility.

Keywords: Rabbit ; linseed ; digestibility; blood compounds; semen.

INTRODUCTION

The feed is the largest single item in the cost of rabbit production, representing at least 65% (Marai, 1998). Linseed is one of the major oilseed crops, SLSMP is reported to be superior to groundnut protein but because of high level of mucilage (poly saccharide complex formed from sugar and uronic acid units) which ranged from 12.2% (Medhusudhan *et al.*, 1986) to 20% (El-Khimsawy, 1993). This seems to limit its usage in poultry feeds,

while rabbits can utilize it better due to the presence of microfloura in the cecum.

In Egypt, linseed is crushed by expellers and the deoiled remaining meal contains 25-35% protein, and yearly production of linseed meal in Egypt reported to be about 20.000 tons (El-Khimsawy, 1990). The present study aimed to investigate the effects of feeding different levels of SLSMP instead of SBMP on digestibility of nutrients, some blood constituents and semen quality.

MATERIALS AND METHODS

The experimental work of this study was conducted at Sakha Animal Production Research Station, Animal Production Research Institute. Two experiments were conducted to study the effect of substitution of soybean meal protein (44%) in the diets of black Balady rabbits by SLSMP (26.26%) at levels of 0.0%, 25%, 50%, 75% and 100% (as show in Table 1) of SBMP on digestibility of nutrients, some blood constituents and semen quality. Linseed cake was purchased from Tanta company for linseed and oils, it was soaked in water bath at 37°C for 24 hr, it was dried in a sun until air drying until <10% moisture, then grounded to fine particles and used for the experimental diets.

In the experiment 1 fifteen black Balady mature male rabbit of 6 months old were randomly distributed into five similar groups (3 per each). Each group was fed one of the experimental diet. Rabbits were kept in individual metabolic cages, that allow to collect feces separately. The experimental lasted for 14 day–preliminary period followed 7 day as collection period (Cheeke, 1987).

Digestibility coefficients of the experimental diet such as crude protein (CP), crude fiber (CF), ether extract (EE), nitrogen free extract (NFE) and organic matter (OM) were determined, then the digestible crude protein (DCP) and total digestible nutrient (TDN) were calculated. The digestible energy (DE) of experimental diet (kcal DE/ kg diet) was calculated according to the equation described by Church (1977) : DE = TDN x 4.4. The promaite chemical composition of feed, feed residue and feces were determined according to AOAC (1995).

Blood samples were taken from three males from each treatment of these groups to study the influence of dietary SLSMP on some blood constituents. Blood samples were collected from the marginal care vein of buck from each group into heparinized tube. Plasma were separated by centrifugation at 4000 r.p.m for 15 minutes then frozen at –20°C until analysis. Plasma total protein (g/dl), albumin (g/dl), globulin (g/dl), glutamate oxaloacetate transaminase GOT (IU/L), glutamate pyruvate transaminase GPT (IU/L), triglycerides (mg/dl), cholesterol (mg/dl), urea-N (mg/dl) and creatinine (mg/dl) were determined colorimetrically using Kits according to (total protein, Doumas *et al.* 1981; albumin, Hill and Well 1983; globulin Hill and Well 1983; GOT and GPT, Reitman and Frankel 1957; cholesterol, Siedel et al., 1983; urea-N, Freidman *et al.*, 1980 and creatinine, Ullmann 1976) and the colorimetric determination of plasma triglycerides.

In the experiment 2 Fifteen Black Balady rabbit bucks (3 per diet) were allotted at random to the five diets. After a period of 21 days of

adaptation to each diet, semen was collected individually from the bucks twice weekly for a period of 5 weeks by using an artificial vagina. Ejaculate volume (ml), motility, abnormal sperms (%), sperm concentration (1000,000/ml) and dead spermatozoa (%) were determined.

Table(1): The composition and the chemical & calculated analysis of experimental diets

Ingredients	SLSMP%				
	0	25	50	75	100
Composition of experimental diets					
Clover hay	34.0	31.0	30.5	30.0	29.6
Wheat bran	22.2	23.6	23.0	23.5	25.4
Barley	22.0	22.0	21.6	20.0	17.0
Soybean meal(44%)	16.0	12.0	8.0	4.0	0
Linseed meal	0	5.6	11.2	16.8	22.4
Dicalcium phosphate	1.7	1.7	1.7	1.7	1.7
Methionin	0.2	0.2	0.1	0.1	0.0
Salt	0.3	0.3	0.3	0.3	0.3
Primix*	0.5	0.5	0.5	0.5	0.5
Anticoccidia	0.1	0.1	0.1	0.1	0.1
Molases	3.0	3.0	3.0	3.0	3.0
Total	100	100	100	100	100
Chemical analysis :**					
Crude Protein (CP)	19.15	18.94	18.61	18.59	18.94
Crude Fiber (CF)	16.27	15.74	15.74	15.77	15.87
Ether extract (EE)	2.59	2.66	2.57	2.75	2.89
Calculated analysis :***					
M.E (kcal/kg.)	2653.8	2670	2681.9	2688.4	2688.5
Calcium	1.00	0.97	0.97	0.98	0.98
Total Phosphorous	0.77	0.79	0.80	0.80	0.80
Lysin	0.95	0.90	0.84	0.79	0.75
Methionin	0.480	0.530	0.480	0.530	0.490
Methionin + Cyctin	0.70	0.73	0.73	0.75	0.75

* Vitamins and minerals premix manufactured by Egypt company for chemical & pharmaceuticals (ADWIA) Each 2.5 kg contains: Vit. A 12000000 IU; vit. D3 2000000 IU; vit. E 110000 mg ; vit. B1 1000 mg; vit. B2 4000 mg ; Niacin 20000 mg ; vit. Pantothenic acid 10000 mg; vit. B12 10 mg; vit. K3 2000 mg; Folic acid 1000 mg; vit. B6 1500 mg; Biotin 50 mg; Copper 10 gm; Iron 30 gm; Iodine 1000 mg; Manganese 55 gm; Selenium 100 gm; Zinc 55 gm; Choline chloride 500 gm; Ethoxyquine 3000 mg.

** According to (AOAC 1995) & *** According to (NRC 1994).

Data were analyzed using one-way except for data of semen quality when a factorial experimental analyses was used in the model with treatment and time as the main effect, however data were presented based on the main effect only due to the significant of the interaction according to SAS program (SAS, Institute, Inc., 1985).The application of the least square procedure tests of significance for the differences among the different diets were done according to Duncan (1955).

RESULTS AND DISCUSSION

Digestibility and nutritive value:

The results in Table (2) indicated significant difference among the experimental groups for digestibility of CP, CF, EE, NFE and OM and the nutritive value e.g. DCP and TDN. It was observed that digestibility coefficients of nutrients for diets containing 0, 25 and 50% SLSMP did not differ significantly, while increasing the level of SLSMP to 75 and 100% instead of SBMP decreased digestibility coefficients of all nutrients except for digested EE which showed stepwise increase with increasing the level of SLSMP ($P<0.01$ and $P<0.001$). Also, there was no significant difference DCP, TDN and DE due to inclusion of SLSMP up to 50%, however increasing the level of linseed meal to 75 and 100% decreased DCP, TDN and DE significantly ($P<0.01$ and $P<0.001$). A mixture of 50% SLSMP and 50% SBMP resulted in the best DCP, TDN and DE while the lowest values were recorded by group fed100% SLSMP. Similar trends were recorded by (El-Husseiny *et al.*, 1997; Morsy, 2001; Amber *et al.*, 2002; Amber, 2002 and Attia, 2003). Also, Raya *et al.* (1991) related this worse nutrient metabolizability and digestibility observed with linseed meal diet due to its ability to absorb large quantities of water and tends to form a somewhat bulky, mucilaginous mass which aids in the passage of feed more rapidly throughout the intestine, allowing shorter time for digestion.

Table (2) Effect of feeding different levels of SLSMP on digestibility coefficient and nutritive values

Nutrients	Experimental SLSMP, %					SEM	Sig.
	0	25	50	75	100		
Digestibility coefficients (%) :							
Organic matter (OM%)	64.59^{ab}	63.11^{ab}	68.48^{a}	58.53^{bc}	52.33^{c}	1.71	**
Crude protein (CP%)	79.60^{a}	78.02^{ab}	82.10^{a}	74.18^{b}	69.04^{c}	1.35	***
Ether extract (EE%)	76.63^{d}	79.03^{cd}	81.51^{bc}	84.93^{ab}	85.83^{a}	1.03	***
Crude fiber (CF%)	43.72^{a}	37.06^{a}	45.25^{a}	24.81^{b}	23.41^{b}	2.86	**
N-free extract (NFE%)	65.00^{ab}	64.75^{ab}	69.96^{a}	61.73^{b}	53.20^{c}	1.72	**
Nutritive values % on dry matter basis :							
DCP %	15.24^{a}	14.78^{a}	15.28^{a}	13.79^{b}	13.08^{b}	0.256	***
TDN %	60.36^{ab}	59.08^{ab}	64.44^{a}	55.45^{bc}	50.31^{c}	1.49	**
DE (Kcal/kg)	2661^{ab}	2605^{ab}	2841^{a}	2445^{bc}	2218^{c}	65.84	**

a, b, c,.... Means values with in the same raw with different superscript were significantly. *(P<0.05) , ** (P<0.01) , *(P<0.001) and NS not significant.**
SEM = the standard error means, Sig. = Significant

Data in Table (3) show the effect of feeding different levels of SLSMP on some blood parameters. It was clear that increasing the level of SLSMP did not affect plasma total protein (g/dl), albumen (g/dl), globulin (g/dl), GOT (IU/L), GPT (IU/L), triglyceride (mg/dl), creatinine (mg/dl) and urea-N (mg/dl) however there was significantly ($P<0.01$) increased cholesterol (mg/dl) values with increasing the level of SLSMP steadily. Similar trends were recorded by

Attia, (2003) observed that the nutrimental value of soaked linseed cake (SLSC) and the possibility to include it at the rate of 0,5,10 and 15% in finishing diet for broilers as a source of protein and n-3 fatty acids, the plasma total protein was not significantly affected by including SLSC up to 15% in the diet for broiler males during the period from 30 to 45 days of age, however including 15% SLSC in the diet for broiler significantly (P<0.01) increased plasma triglyceride and cholesterol.

Table (3) Effect of feeding different levels of SLSMP on some blood parameters

Parameters	Experimental SLSMP%					SEM	Sig.
	0	25	50	75	100		
Total protein (g/dl)	7.02	7.86	6.92	6.48	6.56	0.112	NS
Albumen (g/dl)	4.48	4.65	4.22	4.32	4.29	0.137	NS
Globulin (g/dl)	2.54	3.21	2.70	2.16	2.27	0.142	NS
GOT (IU/L)	36.3	35.6	36.2	37.1	34.2	0.346	NS
GPT (IU/L)	21.3	20.4	19.3	20.1	20.8	0.289	NS
Triglyceride(mg/dl)	98.2	96.0	97.2	99.9	101.6	0.715	NS
Cholesterol (mg/dl)	72.4^{d}	73.9^{d}	77.4^{c}	79.4^{b}	82.3^{a}	0.505	**
Urea-N (mg/dl)	54.2	54.8	55.3	55.7	56.2	0.201	NS
Creatinine (mg/dl)	0.81	0.85	0.84	0.87	0.88	0.003	NS

a, b, c,.... Means values with in the same raw with different superscript were significantly.
***(P<0.05) , ** (P<0.01) , ***(P<0.001) and NS not significant.**
SEM = the standard error means, Sig. = Significant

The effect of feeding different levels of SLSMP and weeks of age on semen quality of buck rabbits are shown in Table (4), motility percent did not differ significantly among the dietary treatment groups, however ejaculate volume (ml) of semen was significantly (P<0.01) higher of the buck fed 50% SLSMP compared with those fed 0 and 25% SLSMP however increasing the levels of SLSMP to 75 and 100% decreased the ejaculate volume (ml). Increasing the levels of SLSMP only to 25% increased significantly (P<0.01) sperm concentration ($x10^6$). However dead sperm % was higher at only 75 and 100% of SLSMP compared to the other treatment mean while 25 and 50% of SLSMP was significantly decreased compared to the control group. It was observed that abnormal sperms 50% SLSMP was the lowest compared to other treatments, while the best fertility% was 96.3 % of group fed 25% SLSMP than the others which showed no significant difference among them. Amber (2002) and Amber *et al.*, (2002) observed that replacing linseed meal for soybean meal in rabbit diets caused the highest fertility rate and semen characteristics which were found for bucks fed diet with 14% LSM. The improvement of semen characteristics of group fed 50% SLSMP may be due to increasing feed consumption, where Papadominchelakis *et al.*, (2000) observed that semen characteristics was improved as the level of protein and energy increased.

Age of bucks affected significantly (P<0.01 and P<0.001) ejaculate volume (ml), motility percent and abnormal sperms% where increasing the age of buck increased these parameters, but decreased dead sperm % significantly (P<0.001).

Table (4): Effect of feeding different levels of SLSMP & age and interaction on semen quality of bucks

Week	Level of linseed meal SLSMP %					SEM	Mean
	0	25	50	75	100		
Ejaculate volume (ml)							
1	0.40	0.52	0.67	0.50	0.67	0.037	0.55^{b}
2	0.50	0.42	0.50	0.63	0.75	0.039	0.56^{b}
3	0.60	0.42	0.70	0.53	0.47	0.031	0.54^{b}
4	0.57	0.75	0.90	0.50	0.60	0.042	0.66^{a}
5	0.67	0.67	0.85	0.60	0.63	0.030	0.68^{a}
Mean	0.55^{c}	0.56^{bc}	0.72^{a}	0.55^{bc}	0.62^{b}	0.017***	0.036***
Sperm concentration (x10⁶)							
1	205	248	217	222	214	4.54	221^{b}
2	255	246	221	227	243	4.73	239^{a}
3	212	247	241	218	243	4.84	232^{a}
4	214	254	222	204	215	5.13	222^{b}
5	256	260	214	224	211	6.29	233^{a}
Mean	228^{b}	251^{a}	223^{b}	219^{b}	225^{b}	2.37***	5.11***
Motility%							
1	55.0	51.7	60.0	75.0	71.7	2.71	62.7^{c}
2	81.7	80.0	71.7	81.7	78.3	1.24	78.6^{b}
3	71.7	80.0	85.0	80.0	81.7	1.86	79.6^{b}
4	88.3	93.3	90.0	60.0	68.3	3.81	80.0^{b}
5	85.0	91.7	86.7	85.0	78.3	1.65	85.3^{a}
Mean	76.3	79.3	78.7	76.3	75.7	1.38^{NS}	2.25***
Dead sperm							
1	15.0	8.3	9.0	11.7	13.3	0.76	11.5^{a}
2	9.0	8.6	10.0	9.0	11.0	0.40	9.5^{b}
3	10.7	7.0	5.0	9.3	11.7	0.71	8.7^{b}
4	5.0	6.0	5.0	13.0	16.3	1.32	9.1^{b}
5	7.0	5.7	9.0	14.3	13.0	1.02	9.8^{b}
Mean	9.3^{c}	7.1^{d}	7.6^{d}	11.5^{b}	13.1^{a}	0.41***	0.84***
Abnormal sperm							
1	7.0	2.0	5.0	5.7	9.3	0.75	5.8^{bc}
2	2.0	5.3	4.0	7.0	8.0	0.62	5.3^{c}
3	9.0	7.7	7.0	7.3	6.0	0.59	7.4^{a}
4	12.0	9.7	7.0	6.0	6.7	0.70	8.3^{a}
5	5.0	9.0	2.0	10.0	9.0	0.86	7.0^{ab}
Mean	7.0^{a}	6.7^{a}	5.0^{b}	7.2^{a}	7.8^{a}	0.33***	0.71***
Fertility %							
%	74.4^{b}	96.3^{a}	76.5^{b}	77.3^{b}	77.5^{b}	2.22	**

a, b, c,.... Means values with in the same raw with different superscript were significantly.
**** (P<0.01) , ***(P<0.001) and NS not significant.**
SEM = the standard error means.

In conclusion, SLSMP could be inclusion in rabbit diet of black Balady strain at 50% of SBMP or 11% of dietary composition without negative effects on digestibilites of nutrients, nutritive values of the diets, biochemical constituents of blood plasma, semen quality and fertility.

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تأثير التغذية على مستويات مختلفة من كسب بذرة الكتان لتحل محل كسب فول الصويا فى علائق أرانب البلدى الأسود :

دراسة التأثير على معاملات الهضم وبعض قياسات الدم وصفات السائل المنوى للذكور.

فؤاد عبدالواحد متولى عجور*، سلوى بخيت عبدالهادى، المغازى السيد على المغازى* و نيفين عرفه يوسف سعد حنيش***

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تم إستخدام عدد ٣٠ ذكر أرنب بلدى أسود وذلك لدراسة تأثير إستبدال المصدر البروتينى فى العليقة (كسب فول الصويا ٤٤%) بمصدر بروتينى آخر (كسب بذرة الكتان المنقوع) وذلك بالنسب الآتية ٠%، ٢٥%، ٥٠%، ٧٥% و ١٠٠% ومعرفة تأثير ذلك على معاملات الهضم و بعض القياسات على الدم وصفات السائل المنوى.

وكانت النتائج كالأتى :

- لم تتأثرمعاملات الهضم لكل المركبات معنويا وذلك مع نسب الإحلال ٠ ، ٢٥ ، ٥٠% كسب كتان منقوع ولكن زيادة مستوى بروتين كسب الكتان المنقوع حتى ٧٥ ، ١٠٠% أدى إلى إنخفاض معاملات الهضم عند كل المستويات (٠,٠١ ، ٠,٠٠١) فيما عدا معامل الدهن، وكانت أحسن معاملات هضم مع نسبة إحلال ٥٠% ، وأيضا كانت المركبات الكلية المهضومة والبروتين الطاقة المهضومة تسير على نفس المنوال تقريبا.
- لم تؤثر معنويا نسب إحلال كسب الكتان المنقوع حتى ١٠٠% على نسبة بروتينات الدم والألبيومين والجلوبيولين وإنزيمات الكبد (GOT , GPT) ونيتروجين اليوريا والدهون الثلاثية والكرياتينين ولكن أدت زيادة بروتين كسب الكتان المنقوع إلى زيادة الكوليستيرول معنويا عند ٠,٠١.
- لم تؤثر معنويا نسب إحلال بروتين كسب الكتان المنقوع حتى ١٠٠% على حركة الحيونات المنوية بينما أدى مستوى ٥٠% إحلال بروتين كسب الكتان المنقوع إلى تحسن معنوى (٠,٠٠١) فى حجم القذفة وتركيز الإسبرمات وكانت أقل نسبة إسبرمات ميتة من هذه المجموعة(٥٠% إحلال).
- تحسنت نسبة الخصوبة بزيادة نسب إحلال كسب الكتان حتى مستوى٢٥% ثم تساوت فى باقى المعاملات ، كما أوضحت النتائج أن تقدم عمر الذكور أدى إلى تحسن معنوى (٠,٠١ ، ٠,٠٠١) فى حجم القذفة (سم) وزيادة الحركة وتركيز الإسبرمات كما إنخفضت نسبة الإسبرمات الميتة.

وخلاصة القول من هذه النتائج أنه يمكن إستخدام بروتين كسب الكتان المنقوع حتى مستوى ٥٠% من بروتين كسب فول الصويا أو حوالى ١١% من مكونات العليقة لذكور أرانب البلدى الأسود بدون تأثيرات ضارة على معاملات الهضم والقيمة الغذائية والمكونات البيوكيميائية لبلازما الدم وصفات السائل المنوى ونسبة الخصوبة.