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INFLUENCE OF FEEDING NON-CONVENTIONAL ENERGY SOURCES ON PUBERTAL PHASES, BLOOD METABOLITES AND FATTENING OF ZARAIBI MALE KIDS

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ABSTRACT

The aim of this study was to investigate the effect of non-traditional dietary energy as protected fat (PF) and corn steep liquor (CSL) and combination between PF and CSL on upbringing male kids as sires for flock or fattening for marketing. Hence, testis development during pubertal stages, blood metabolites and fattening of Zaraibi male kids were studied. Twenty Zaraibi male kids with an average initial body weight of 15.69 kg and aged 135 days were used. Kids were assigned to four equal groups (N=5 /group) and received non-conventional energy treatments as E1 (control), E2, E3 and E4 contained 10.99, 11.92, 11.63 and 11.96 MJ/kg, respectively. The basal control diet E1 included concentrate feed mixture (CFM) + rice straws (RS). While, E2, E3 and E4 consisted of CFM + RS supplemented with 5% PF, 5% CSL or 2.5% PF + 2.5% CSL, respectively. The stages of age during puberty, changing of body weight, scrotal circumference, testicular volume and testosterone concentration were evaluated during pubertal phases. When kids reached puberty, semen characteristics were investigated. At the end of the experiment, blood samples were collected to assay glucose, triglycerides, total cholesterol, HDL and LDL concentrations. Moreover, fattening performance was estimated for live body weight, average daily weight gain, dry matter intake, feed conversion ratio, water consumption, feed cost and economical efficiency. The results obtained during all pubertal stages, indicated that the kids which received E4 diet had the highest ($P<0.05$) testicular growth measurements (scrotal circumference and volume), testosterone levels and semen characteristics compared to the other energy levels. Plasma glucose, triglycerides, total cholesterol, HDL and LDL concentrations did not significantly differ among all energy diets. Also, E4 diet showed a significantly ($P<0.05$) higher live body weight, average daily weight gain and economical efficiency than kids fed other dietary energy. On the contrary, kids fed E4 achieved lower ($P<0.05$) dry matter intake, feed conversion ratio, water consumption and feed cost than other kids fed different energy diets. Based on results of the present study, it could be safely concluded that supplemented combination between PF and CSL to male kid rations indicated the best testicular development during pubertal stages, semen characteristics at puberty, blood metabolites and feedlot performance.
Keywords: Male kid goats, puberty, growth, non-conventional feed energy.

INTRODUCTION

In Egypt, goat breeding for meat production has emerged as an increasing activity, which can be confirmed by the growing demand for goat meat, followed by the introduction of weaning male kids for flock sires and meat production. Puberty is characterized by the beginning of the reproductive activity and it has great importance for the breeding system. It allows defining management practices such as the separation of lots defined by sex, time of castration, early selection of animals for procreation and permitting greater effectiveness in the improvement of the herd (Pacheco *et al.,* 2009). Otherwise, weaning male kids can be directed to producing males for breeding flock in the farm. Under improved feeding conditions males could be speculated to reflect some potentiality as meat producers and sexual development. Energy is needed for maintenance of body functions such as muscle activity, chemistry work in the circulation of substance in the cell and synthesis-catalyst in the body, such as enzyme and hormones (Bushara and Abu Nikhaila, 2012). The highest cost of energy in the ration components make farmers resort to use the industrial by-products of factory residues such as protected fat (PF) and corn step liquor (CSL) to raise the nutritional value of the diet and provide energy sources with reasonable cost. De Sousa *et al.* (2012) reported that lambs fed a higher energy required less time in the feedlot to reach the slaughtering weight when compared with lambs that received the lower energy. Shivambu *et al.* (2012) found that higher energy diet had the better feed conversion ratio. Also, Adibmoradi *et al.* (2012) suggested that high energy in diets can compensate for an earlier period of a low nutritional plane through increasing feed intake and (or) enhancing efficiency of feed utilization. Hassan *et al.* (2011) found that supplying the right amount of energy has an important impact to the production and reproduction of the livestock, because it has become the most frequent limit to the production of goat livestock. There is also evidence that energy plays a role in the reproductive processes, puberty and testicular evolution of male farm animals (Mellado *et al.,* 2012). Moreover, Khalifa *et al.* (2013) concluded that supplementing non-conventional energy sources as PF and CSL to diet improve productive and reproductive performance of dairy Zaraibi nanny goats.

The objective of this research was to study the effect of supplementing non-conventional energy as PF, CSL or their combination to rations in order to breeding male kids as sires for herd or using them for marketing when fattened. Accordingly, testis development during pubertal phases, blood metabolites and feedlot performance of Zaraibi male kids were investigated.

MATERIALS AND METHODS

The study was conducted in El-Serw Experimental Research Station belongs to Animal Production Research Institute (APRI), Agriculture Research Center, Ministry of Agriculture, Egypt. The experiment was carried out from March to July 2013.

Experimental energy rations

The chemical composition of the ingredients and the experimental four rations are presented in Tables, 1 and 2, respectively. The basal control energy (E1) included concentrate feed mixture (CFM) and rice straws (RS) to generate 10.99 MJ/kg metabolizable energy. While, three other energy levels E2, E3 and E4 contained basal control energy diet supplemented with 5% PF, 5% CSL or 2.5% PF + 2.5% CSL to contain 11.92, 11.63 and 11.96 MJ/kg, respectively. The chemical analysis of E1, E2, E3 and E4 were determined using standard procedures of AOAC (2007).

Table 1: Chemical composition of CFM and RS (% as fed).

Items	Chemical composition %						
	DM	OM	CP	EE	CF	NFE	Ash
CFM	87.85	89.25	14.42	3.45	12.16	59.22	10.75
RS	92.83	80.23	3.08	1.49	36.88	38.78	19.77

Table 2: Chemical composition of the experimental rations (% as fed).

Chemical analysis	Experimental energy rations			
	E1	E2	E3	E4
OM	87.08	90.20	88.63	90.53
CP	14.46	14.65	15.13	14.58
CF	15.59	12.57	12.31	12.74
EE	2.85	4.15	3.65	4.26
NFE	54.18	58.83	57.54	58.95
Ash	12.92	9.80	11.37	9.47
*ME (MJ/Kg)	10.99	11.92	11.63	11.96

*** ME= Metabolizable energy (MJ/Kg//DM) calculated according to MAFF (1976).**

Experimental animals

Twenty male kids of Zaraibi goats were used at 135days of age and 15.69 kg of average body weight. The kids were housed in separated pens under the same environmental condition and placed in an open shaded barn, the ceiling of barn covered with asbestos. The male kids were allocated into 1^{st}, 2^{nd}, 3^{rd} and 4^{th} groups (N=5 per group) according to body weight and randomly received E1, E2, E3 and E4 energy, respectively. The kids were allowed 7 days as adaptation period for different energy levels. During this trial, non-conventional energy sources were supplemented immediately to basal control diet. All energy levels were adjusted every fifteen days according to NRC (2007) recommended allowances for kids. Fresh water and mineral licking salt blocks were available *ad libitum* throughout the experimental period.

Experimental procedures

Puberty phases

Pubertal phases were observed for all kids within 25 minutes using an estrus nanny goat, considering three pubertal following criteria phases: 1^{st} pubertal phase; kids induced mounting within desire trembling without penis exposure. In the 2^{nd} pubertal phase; kids displayed mounting with penis exposure. In the 3^{rd} pubertal phase; kids produced first ejaculate semen containing motile sperm. The kids' age, scrotal circumference, testes volume and testosterone levels were determined at each phase of puberty. The Scrotal circumference (SC) was obtained using a cloth tape and measured in centimeters (cm) as the largest diameter of scrotum after pushing the testes firmly into the scrotum. The testes volume (cm^3) = $0.015409 \times SC^3$ was determined according to Entwistle (1992). The testosterone level (ng/ml) was determined by kit produced by Germany IBL Company; with catalogs number RE52151 and the ELISA Plate Reader (Biotek ELX808, made in USA).

Semen collection and evaluation

Semen collection with an artificial vagina, from each group, was started immediately after kids reached puberty using an estrus nanny goat. Semen characteristics such as volume, progressive motility, live sperm, normal sperm and sperm cell concentration were evaluated by method described by Roca *et al.* (1992).

Blood metabolites

At the end of the trial, blood samples were collected in the morning before feeding for each energy group from jugular vein by sterile syringe. The collected blood was poured into clean test tubes containing sodium heparin then stored immediately in an ice box. Plasma samples were harvested by centrifuging at 3000 for 15 min and were stored at -20°C until analysis. Blood samples were analyzed for concentrations of glucose, triglyceride, cholesterol, low-density lipoprotein cholesterol (LDL) and high density lipoprotein cholesterol (HDL) using enzymatic method and appropriate kits (Pars-azmon Co.) and Clima Plus Analyzer (RAL, Madrid, Spain).

Live body weight during experimental period

The live body weight was recorded in the morning before offered energy diets at regular fortnightly intervals from 135 days post-weaning to marketing weight at 255 days of age. The live body weight was used to calculate the average daily weight gain as the difference between marketing body weight and initial body weight divided by the feedlot period.

Feed intake

In the day of evaluation, feed intake from either CFM or RS was estimated every fortnightly as interval period. The feed intake was calculated by weighing the refusal, collected in the next morning at 07:00 a.m. and subtracted from the daily offered amount to calculate the actual feed intake.

Feed conversion ratio

The feed conversion ratio was calculated as feed intake divided by the average body weight gain during feedlot period.

Water consumption

The clean water intake was evaluated monthly by quantifying the offer. Determination of the water intake began at 07:00 a.m. when 7.5 Litters of water offered in 10 Litters plastic containers. After 24 hours the remaining water was evaluated /ml to estimate daily intake, and this process was repeated for an additional 24 hours.

Statistical analysis

Results were expressed as the mean ± SE. Means were analyzed by analysis of variance (ANOVA), followed by Duncan test (1955) to determine significant differences in all the parameters between groups using the SPSS/ PC computer program (version 20, SPSS, Chicago, IL, 2011). Differences with values of $P<0.05$ were considered to be significant.

RESULTS AND DISCUSSION

Puberty phases

The age, scrotal circumference, testes volume and testosterone levels of male kids fed different energy diets from 135 days post-weaning to the end of puberty stage are presented in Table 3. In the 1st phase of puberty, kids received E2 or E4 reached to mating age earlier than E1 or E3. Furthermore, the testes volume and testosterone level increased (P<0.05) with kids fed E2 and E4 than E1 and E3. These results are in agreement with Salam (2009) who noticed that high energy in the ration of animal increased the activity of the endocrine gland, particularly the pituitary gland. It has been indicated that there are direct relationships between plane of nutrition and gonadotropin secretion in male ruminants. These findings are consistent with Mohamed and Abdelatif (2010) who reported that males which received higher plane of nutrition chiefly energy results in increased sexual hormones. In the 2nd stage of puberty, kids nourished E4 showed quicker (P<0.05) age to exposure the penis (175.42 days) compared to other energy diets E1 (213.80 days), E2 (190.20 days) and E3 (199.41days).

Table 3: Puberty phases of male kids nourished different energy rations.

Puberty phases	Different energy rations			
	E1	**E2**	**E3**	**E4**
1st mating within desire trembling without penis exposure				
Age, days	188.40±1.03[d]	168.80±1.65[b]	178.40±1.32[c]	151.41±2.46[a]
Scrotal circumference, Cm	13.48±0.40[b]	16.68±0.32[a]	15.18±0.42[a]	18.04±0.49[a]
Testicular volume, Cm^3	38.14±3.39[d]	71.83±4.22[b]	54.40±4.48[c]	91.24±7.66[a]
Testosterone concentration, ng/ml	0.45±0.01[c]	0.83±0.02[a]	0.69±.02[b]	0.95±0.03[a]
1st mating within penis exposure				
Age, days	213.80±1.15[a]	190.20±0.97[b]	199.41±1.28[b]	175.42±1.21[c]
Scrotal circumference, Cm	16.84±0.43[b]	19.40±0.30[a]	18.26±0.48[a]	20.86±0.75[a]
Testicular volume, Cm^3	74.15±5.62[d]	112.82±5.15[b]	94.59±7.36[c]	142.03±14.77[a]
Testosterone concentration, ng/ml	0.61±0.02[c]	1.23±0.12[a]	0.91±0.02[b]	1.37±0.04[a]
1st mating within first semen collected containing motile sperm				
Age, days	245.22±1.35[a]	228.21±0.86[c]	238.61±1.77[b]	216.82±1.85[d]
Scrotal circumference, Cm	19.88±0.42	21.90±0.34	20.52±0.79	23.68±0.57
Testicular volume, Cm^3	121.71±7.68[d]	162.33±7.57[b]	135.51±15.43[c]	206.05±15.31[a]
Testosterone concentration, ng/ml	1.46±0.14[d]	2.06±0.05[b]	1.80±0.04[c]	2.38±0.05[a]

a, b, c, d means within the same row with different superscripts are significantly different at (P<0.05).

Also, in this phase, buckling testes volume and testosterone concentration increased (P<0.05) in E2 and E4 ration compared to E1 and E3 ration. The testes volume was 74.15, 112.82, 94.59 and 142.03 cm^3 while, testosterone concentration 0.61, 1.23, 0.91 and 1.37ng/ml for E1, E2, E3 and E4 rations, respectively. Similarly, Adam et al. (2010) reported that results of pubertal characteristics of goat male kids reached to earlier growth and directly correlated to scrotal circumference. The full sequence of puberty behavior of kids in the 3rd stage was significantly (P<0.05) higher for E2 and E4 diet than E1 and E3 diets. At the same phase of puberty, kids had suitable scrotal circumference which is an indicative for testicular size and testosterone levels (Almeida *et al.,* 2007). Also, Bezerra *et al.* (2009) recorded that puberty could happen between 4 and 17 months of age in young Boer goat male kids. The quality of rations offered to kids after weaning had changed the puberty age. This is defined by Zarazaga *et al.* (2009) who found that puberty in kids and onset of sexual activity are influenced by feeding good energy levels. Superiority of E4 kids in earlier puberty stages than other energy diets may be related to the high energy level. Blache *et al.* (2008) concluded that reproductive functions such as puberty and sexual maturity require more nutrients of high quality especially energy. On the other hands, Okere *et al.,* (2011) revealed that scrotal circumference of young Boer goat male is directly correlated to testosterone concentration. Furthermore, Machado *et al.* (2011) concluded that goats with superior scrotal bipartition have a great capacity to produce reproductive cells that is reflected in reproductive potential. Likewise, Nasir *et al.* (2013) reported that growth rate; age at complete separation of prepuce from the penis and scrotal circumference at puberty should be capable to express normal sexual behaviors that enable to successfully complete the puberty. Also, these authors reported that the age of male pure Nubian × pure Saanen kids to reach puberty ranged between 29 and 31 weeks in.

Semen collection and evaluation

Statistical analysis indicates that the average semen parameters of the Zaraibi male kids significantly ($P < 0.05$) increased when kids were given E2, E3 and E4 compared to those kids fed E1(Table 4). Semen evaluation is used to predict the breeding value of a sire used in natural service or artificial insemination (Atta, *et al.,* 2011). The results of the current study indicated that energy intake is one of the most important factors influencing reproductive performance. The results of Robinson *et al.,* (2006) have documented the interrelationship between energy intake and reproductive performance in adult rams such as testicular size, semen quality, testosterone secretion or sexual activity. Also, Tufarelli *el al.* (2011) suggested that supplementary dietary energy resulted in improved body weight gain, feed intake, sperm production, and semen quality. Selvaraju *et al.* (2012) concluded that increasing dietary energy improves semen quality especially volume and concentration as important factors in semen evaluation and scrotal circumference as a direct indicator of sperm production. Also, Castellano *et al.* (2010) indicated that there was a clear influence of dietary lipids on spermatozoa fatty acid profile, the fatty acid composition of sperm and male germ cells. On the other hand, low dietary energy causes poor polyunsaturated fatty acids (PUFA); which makes it susceptible to oxidative damage because of the low concentration of PUFA present in the spermatozoa plasma membrane. This result confirms those of Yan *et al.* (2013) who suggested that sperm cells containing very high proportions of PUFA maintain of an adequate reactive oxygen species (ROS) in semen.

Table 4: semen characteristics of male kids nourished different energy rations.

Semen characteristics	Different energy rations			
	E1	E2	E3	E4
Semen volume, ml	0.28±0.04 [d]	0.42±0.03 [b]	0.34±0.04 [c]	0.54±0.02 [a]
Progressive motility, %	25.00±2.24 [d]	37.00±2.25 [b]	30.00±3.16 [c]	42.00±2.00 [a]
Live sperm, %	28.20±1.59 [d]	42.40±1.21 [b]	36.80±1.43 [c]	47.80±2.99 [a]
Normal sperm, %	49.40±1.91 [d]	64.60±1.63 [b]	58.41±0.98 [c]	72.20±1.83 [a]
sperm concentration, 10^9/ml	0.27±0.02[d]	0.57±0.01[b]	0.41±0.01[c]	0.61±0.02[a]

a, b, c, d means within the same row with different superscripts are significantly different at (P<0.05).

Blood metabolites

Plasma glucose, triglycerides, total cholesterol, HDL and LDL concentrations did not significantly differ among energy treatments (Table 5). This study identify that the different of dietary energy had no significant effect on the blood plasma metabolites. It is of interest to note that kids fed E2, E3 and E4 had slightly higher blood metabolites as triglycerides, total cholesterol and HDL concentration compared to E1. Conversely, kids fed E1 had slightly higher LDL than kids fed other energy levels. In general, these results are in agreement with Adibmoradi *et al.* (2012) who defined that blood plasma glucose, triglycerides, total cholesterol, HDL and LDL did not significantly differ among goat kids fed rations containing different levels of energy. Moreover, these results are supported with the conclusions of Agazzi *et al.* (2010) who reported that different dietary fatty acids supplementation to goat rations did not affect blood plasma parameters. In contrast to these findings, Miguel *et al.* (2012) found that serum concentrations of cholesterol was higher in group fed ration contained high energy than fed low energy. On the other hand, Hayat *et al.* (2012) recorded that calcium soap of fatty acids supplement to diets produced significant changes in blood lipid composition and modified the metabolism of fatty acids.

Table 5: Blood metabolites of male kids nourished different energy rations.

Blood metabolites	Different energy rations			
	E1	E2	E3	E4
Glucose, mg/ dl	84.54±0.84	85.61±0.50	84.88±0.99	85.82±0.68
Triglyceride, mg/ dl	9.16±0.42	9.58±0.25	9.37±0.19	9.73±0.15
Cholesterol, mg/ dl	110.98±0.71	112.45±0.66	111.57±1.36	113.55±0.78
LDL, mg/ dl	44.28±0.46	42.57±0.40	43.60±.087	42.77±0.41
HDL, mg/dl	70.17±0.42	73.38±1.31	71.96±0.66	73.80±0.41

Live body weight changes during the experimental period

The live body weight (LBW/kg) changes of male kids consumed E1, E2, E3 and E4 rations from 135 days post-weaning to 255 days are illustrated in Table 6. During the first few weeks of feeding, the LBW of the kids subjected to the E1, E2 and E3 diet had nearly similar LBW compared to the kids subjected to the E4 diet. With advancing of feeding, groups receiving E2 and E3 started to gain weight faster than the group receiving E1 diet. The faster LBW of E1, E2 and E3 may be attributed to the digestive disorders experienced by the group receiving the highest energy diet E4. These previous results are in accord with those of Silva *et al.* (2007) who found that covering energy requirement of animals is very important and it is chiefly derived from energy ingested and secondly from the mobilization and catabolism of body reserves. Also, it is demonstrated that LBW of kids received E2 and E4 diets tended to be slightly higher compared to those kids fed E1 and E3 at all times. Furthermore, the results showed that the average LBW of kids receiving different energy levels tended to be gradually increased with progressive ages. The energy diets as E1, E2, E3 and E4 revealed that average LBW reached at 120 days of feedlot period were 24.08, 25.36, 24.92 and 26.08 kg, respectively. The lowest LBW with E1 energy may be attributed to the greater concentration of fibrous carbohydrates in diets of low energy, which are less digestible. These are supported with the conclusions of Araújo *et al.* (2009) who reported that the increase in dietary energy value improved non-fibrous carbohydrate apparent digestibility which improve body growth. The variation in LBW of kids may be related to levels energy intake. This observation is consistent with Hosseini *et al.* (2008) who found that energy is the major dietary element that is responsible for the different utilization of nutrients and thereby the productivity and body gain of an animal. Also, energy ration is the main factors affecting growth performance and body gain promoters. This trend is in harmony with Canbolat and Karabulut (2010) who showed that average body growth, daily weight gain and feed efficiency increased with increasing level of energy in diets. Generally, increasing the energy level may allow the production of more fermentable metabolic energy (ME) for rumen microorganisms which result in a rise in the synthesis of microbial protein and the amount of protein available to the animal let to refinement body weight (Bhatt *et al.,* 2013).

Table 6: Live body weight of male kids nourished different energy levels.

Different energy levels	Weighing days post-weaning								
	135	**150**	**165**	**180**	**195**	**210**	**225**	**240**	**255**
E1	15.80 ±0.62	18.98 ±0.84	17.12 ±0.19	18.40 ±0.54	19.68 ±0.61	20.08 ±0.46	21.88 ±0.61	22.56 ±0.57	24.08 ±0.62
E2	15.72 ±0.58	16.18 ±0.64	17.36 ±0.73	18.86 ±0.84	20.16 ±0.81	21.00 ±0.80	22.28 ±0.80	23.36 ±0.44	25.92 ±0.37
E3	15.48 ±0.17	16.20 ±0.28	17.44 ±0.54	18.25 ±0.63	19.96 ±0.52	20.84 ±0.44	22.16 ±0.50	23.16 ±0.44	24.92 ±0.68
E4	15.76 ±0.57	17.04 ±0.58	18.12 ±0.59	19.64 ±0.51	21.28 ±0.59	22.20 ±0.58	23.00 ±0.75	24.92 ±0.74	26.08 ±0.72

Feedlot performance

As shown in Table 7, there were significant (P<0.05) differences among the four energy groups in average daily weight gain (DWG), total dry matter intake (TDMI), feed conversion ratio, water consumption and feed cost. However, other feedlot parameters did not show differences (P > 0.05) among E1, E2, E3 and E4 kids. Concerning DWG, the values showed similar trend to that reported by El-Gallad *et al.* (1988) who found that feeding high energy resulted in relatively better DWG (55 to 61 g/day) than Zaraibi kids fed low energy rations. Kids fed E2, E3 and E4 recorded higher DWG than those fed E1. This finding agree with those reported by Hossain *et al.* (2003) and Johnson *et al.* (2010)who found that average daily gain was highest in goat kids fed high energy diet and lowest in goats fed low energy diet. Moreover, DWG increase when dietary energy level increased, it accomplished 69.00, 80.33, 78.67 and 86.00 g/day for E1, E2, E3 and E4, respectively. This trend agree with the findings of Hassan *et al.* (2011) who concluded that daily weight gains were 60, 70 and 80 g/day in treatments contained 0, 15 and 25% of energy source as sunflower cake, respectively. In general, the diet with the highest concentration of energy has a better proportion of volatile fatty acids, mainly ruminal propionate, after being absorbed by the rumen wall. These fatty acids become the main substrate of hepatic gluconeogenesis, resulting in a greater availability of energy and consequently greater daily average weight gain (Sousa *et al.,* 2012). In connection with voluntary feed intake, the kids fed E1 and E3 consumed more total DM than those fed E2 and E4. Increasing dietary energy resulted in a decrease in voluntary feed intake. This may be attributed to lower neutral detergent fibre content in the low energy diet, because this diet needed smaller quantities of dry matter to meet the nutritional requirements. This result is in agreement with the findings of Atay *et al.* (2011) who reported that the highest voluntary feed intake was found for goats fed with diet without energy sources. Moreover, Park *et al.* (2013) mentioned that the amounts of feed intake is affected by adding fat to diets of ruminants and depends not only on the type of fat but also on the amount added. Concerning feed conversion ratio (FCR), the values of FCR in this study were 16.97, 13.64, 14.39 and 12.30 DMI/kg gain for kids fed E1, E2, E3 and E4, respectively. This finding is in line with Shahjalal *et al.* (1992) who reported feed conversion ratios of 7.19 and 10.1 kg/DMI gain for high and low energy fed to Angora goats, respectively. Similarly, Mahgoub *et al.* (2000) found that feed conversion improved as the dietary energy level increased, when lambs were fed 2.08, 2.38 and 2.68 Mcal/kg the FCR values were 10.16, 9.76 and 7.34 kg/DMI, respectively. The FCR is considered important parameter in meat production, it determines the unit of feed consumed for unit of weight gain and energy had a positive effect on the FCR (Yagoub and Talha 2009). In addition, Sousa *et al.* (2012) concluded that lambs had better feed conversion when fed a diet with 2.90 Mcal/kg DM when compared with a diet with 2.40 Mcal/kg DM. Also, these authors indicated that a diet with a greater concentration of energy is necessary to obtain a preferable utilization of diet. Moreover, Rahman *et al.* (2013) showed that the supplementation of energy had a positive effect on daily body weight gain and feed conversion ratio. Regarding water consumption, the diet with the lower energy density resulted in a greater amount of water intake when related to units of metabolic body weight and percentage of body weight. Sheridan *et al.* (2000) recorded that the daily water intake /head was 2.44 L and 1.97 L and the efficiency of water intake was 1.82 L/kg DM and 1.71 L/kg DM for low and high energy diets, respectively. These authors found also that diets that contained a greater amount of concentrated nutrients do not promote greater rumination and require greater water intake. Furthermore, Barreto *et al.* (2012) emphasized that goats fed a diet of high energy density displayed significantly decreased consumption of water and dry matter when compared to those fed a diet of low energy density. Ultimately, the lowest ($P<0.05$) feed cost recorded with

E4 which had the lowest (best) feed conversion and the highest daily body weight gain. While, the highest feed cost was recorded with E1 kids but those of E2 and E3 were intermediate. This finding indicated that E4 energy was more profitable than the other energy groups. Economical efficiency of E4 gave the highest economical efficiency value (92.33%) followed by E 2 (83.38%) and E3 (79.25%) compared to E1 (67.79%). Similar results were reported by Abd El-Rahman *et al.* (2012) who found that energy supplementation to diet decreased the feed intake required for 1 kg daily weight gain but increased the feed efficiency.

Table 7: Feedlot performance of male kids nourished different energy rations.

Items of feedlot	Different energy rations			
	E1	**E2**	**E3**	**E4**
No. of feedlot kids	5	5	5	5
Duration of feedlot (days)	120	120	120	120
Initial body weight (kg)	15.80±0.62	15.48±0.17	15.72±0.59	15.76±0.57
Marketing body weight (kg)	24.08±0.61	25.36±0.37	24.92±0.68	26.08±0.72
Total body gain (kg)	8.28±0.28	9.88±.0.85	9.20±0.76	10.32±0.27
Average daily gain (g /h)	69.00±2.45[b]	80. 33±3.64[a]	78.67±2.13[b]	86.00±2.37[a]
Feed intake				
CFM (g/day)	646	611	627	595
Roughage as RS (g/day)	525	485	505	465
Total DM intake (g/day)	1171[a]	1096[b]	1132[a]	1058[b]
Feed conversion ratio	16.97[a]	13.64[b]	14.39[b]	12.30[c]
Water consumption				
Water volume ml/day	3152.80[a]	2468.6[c]	2654.6[b]	2326.8[d]
Water consumption ml/ kg DM intake	2.69[a]	2.25[b]	2.35[b]	2.20[c]
Economical efficiency				
Price of CFM, pounds	2.26	2.14	2.19	2.08
Price of RS (kg/day), pounds	1.31	1.21	1.26	1.16
Price of energy, pounds	-	0.02	0.02	0.02
Total price of feed cost consumed	3.57	3.37	3.47	3.26
Price of weight gain	2.42	2.81	2.75	3.01
Feed cost	51.74[a]	41.95[b]	44.11[b]	37.91[c]
*Economical efficiency %	67.79[d]	83.38[b]	79.25[c]	92.33[a]

a, b, c and d . Means within same rows with different superscripts are significantly different ($P < 0.05$).
Price of kg LBW is 35 EGP.
Price in year 2013 for CFM, RS bales and non- conventional energy =3500, 250 and 600 EGP/ton, respectively.
***Economical efficiency (%) = money out put (price of weight gain) ÷ money input (total price of feed consumed) ×100.**

CONCLUSION

It is evident from this study that the non-conventional energy had positive effect on growth rates, body weight and average daily gain. Moreover, they decreased the cumulative feed intake, water consumption and improved feed conversion ratio. Furthermore, the current results show that non-conventional energy diet reflected acceptable blood parameters and positively testes development and earlier puberty in Zaraibi male kids.

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تـأثير تغذيـة مصـادرطاقة غيـر تقليديـة علـى مراحـل البلـوغ الجنسـي وأيـض الـدم وتسمين جداء الماعز الزرايبى

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الهدف من هذه الدراسة هو قياس تأثير تغذية مصادر طاقة غير تقليدية (الدهن المحمى ومياه منقوع الذرة والخلط بينهما)على تنشئة الجداء كطلائق للقطيع أو للتسمين للتسويق. من هنا تم دراسة مراحل تطور الخصية خلال مراحل البلوغ الجنسي وبعض قياسات أيض الدم والتسمين لجداء الماعز الزرايبى . أستخدم فى الدراسة ٢٠ من جداء الماعز الزرايبى متوسط وزنها في بداية التجربة ١٥,٦٩ كجم وعمر ١٣٥ يوم قد قسمت إلى أربعة مجاميع متساوية (٥ جداء بكل مجموعة) وغذيت الجداء على أربعة مستويات من الطاقة المستوى ١٠,٩٩ . ١١,٩٢ , ١١,٦٣ , ١١,٩٦ ميجا جول/كجم. وكانت مصادر الطاقة للعلائق : للمج١ مخلوط العلف المركز و قش الأرز (كنترول) بينما علائق مج٢، مج٣، مج٤ إحتوت على ٥% دهن محمى, ٥% مياه منقوع الذرة، ٢,٥% دهن محمى +٢,٥% مياه منقوع الذرة على التوالى. وتم حساب التقدم فى العمر اثناء البلوغ وقياس التغير في والوزن ومحيط كيس الصفن وحجم الخصية و تركيز هرمون التستيرون خلال مراحل البلوغ الجنسي . وعند وصول الجداء إلى البلوغ الجنسي تم تقييم صفات السائل المنوي. وفى نهاية التجربة تم أخذ عينات الدم وذلك لتقدير بعض القياسات البيوكيميائية مثل الجلوكوز - الجليسريدات الثلاثية - الكوليستيرول الكلي - وتركيز اللبيدات العالية الكثافة والمنخفضة الكثافة. وكذلك قد تم تقدير الزيادة الوزنية , معدلات النمو اليومية ,المأكول اليومي , كفاءة التحويل الغذائي , المستهلك من المياه , الكفاءة الغذائية ،الكفاءة الأقتصادية أثناء تسمين الجداء.

وأوضحت النتائج أن جداء مج٤ أنه خلال مراحل البلوغ الجنسى كانت أفضل زيادة معنوية عند مستوى معنوية (٠,٠٥%) لقياسات حجم الخصية ومستوى هرمون التستيرون وكذلك صفات السائل المنوي مقارنة بالجداء المغذاه على مصادر الطاقة الأخرى. وبالنسبة لأيض الدم تبين من التجربة أن مستوى تركيز سكر الجلوكوز، الجليسريدات الثلاثية , الكوليستيرول الكلى وتركيز اللبيدات العالية الكثافة والمنخفضة الكثافة لم تتأثر معنويا فيما بين العلائق المختبرة . وقد أظهرت عليقة مج ٤ أفضل زيادة معنوية عند مستوى(٠,٠٥%) في معدل النمو اليومي والكفاءة الغذائية بالمقارنة بجداء باقي المجاميع المختبرة .وكذلك إنخفضت كمية المأكول من المادة الجافة ,معدل التحويل الغذائي ,المستهلك من مياه الشرب و التكلفة الغذائية والكفائة الأقتصادية لجداء مج٤ مقارنة بجداء المجاميع الأخرى.

ومن هنا توصى هذة الدراسة أن الخلط لمواد الطاقة الغير تقليدية (الدهن المحمى ومنقوع الذرة) تحقق الآمان الغذائى مع المحافظة على أفضل تطور للنمو خلال مراحل البلوغ الجنسي ,وكذلك الحصول على أفضل صفات للسائل المنوي بعد البلوغ , وأفضل إستفاده غذائية من هذه المصادر للطاقة الغير تقليدية خلال التسمين.

قام بتحكيم البحث

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