

EFFECT OF FEEDING RATIONS CONTAINING CANTALOUPE (*CUCUMIS MELO L.*) VINES HAY ON PERFORMANCE OF GROWING LAMBS

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(Received 8/11/2020, accepted 6/12/2020)

SUMMARY

Twenty males Ossimi lambs were chosen after weaned at 3 months of ages and randomly divided into 4 similar groups (5 lambs/ group) according to their initial live body weight (15.250 ± 0.250 kg) and fed the experimental rations for 16 weeks, as an experimental period to evaluate the utilization of cantaloupe vines hay (CLVH) in feeding growing lambs and its effect on growth performance, nutrients digestibilities, ruminal parameters, some blood parameters as well as economic efficiency. Each group was assigned randomly to feeding one of experimental rations where R1 received 60% concentrate feed mixture (CFM) +40% clover hay (CLH) and served as control ration, while the tested rations were formulated as R2: 60% CFM +30% CLH+10% CLVH (i.e. 25% in replacing of CLH), R3: 60% CFM+20% CLH+20% CLVH (i.e. 50% in replacing of CLH) and R4: 60% CFM+40% CLVH (i.e. 100% in replacing of CLH). The feed allowances were calculated according to NRC (2007) for sheep. Four digestibility trials were performed to evaluate the digestibility and feeding values of the experimental rations. Results indicated that the chemical composition of CLVH was contained 12.54, 21.64, 1.82, 41.17 and 22.83% for CP, CF, EE, NFE and ash, respectively. The digestibility of most nutrients of DM, OM, CP, CF, EE and NFE were decreased with increasing the level of CLVH in rations, but such decreases were insignificant between control ration (R1) and both tested rations (R2 and R3) over most nutrients. Feeding values (TDN and DCP) were behaved similar trends to that of digestibility of most nutrients among the experimental rations. The rumen liquor pH and NH₃-N values were decreased over the three sampling times with increasing the level of CLVH up to 100% in replacing of CLH in rations. The vice versa trend was found among dietary treatments respecting TVFA's concentration in the rumen being most changing in rumen liquor parameters did not significant. No significant differences among treatments in respect of all blood metabolites were found. Total body gain and daily gain were similar between control ration (R1) and both tested rations (R2 and R3) which have 25 and 50% CLVH on the expense of CLH, respectively, being the highest values were occurred with R2 and the lowest ones were resulted from (R4) that have 100% CLVH replacing to CLH. Feed intake, TDMI, DCPI and TDNI did not significant affected by dietary treatments, with slightly decreases in feed intake units with increasing the CLVH over the experimental rations on the expense of CLH. Concerning feed conversion measurements, insignificant differences among the dietary treatments being the best value was occurred with R2-ration (25% CLVH in replacing of CLH). Economic efficiency was tangibly improved by feeding ration that contained 25% CLVH in comparison with control one and the other tested rations. It could be concluded that feeding on ration contained 10% cantaloupe vines hay (i.e. 25% in replacing of clover hay) could be recommended for growing lambs with no adverse effects on growth performance and health state as well as being maximize the profitability.

Keywords: *Lambs, cantaloupe vines hay, performance, digestibility, ruminal parameters, blood parameters and economic efficiency.*

INTRODUCTION

Livestock is one of the fastest growing agricultural subsectors and in the meantime the demand for animal products is rapidly increasing in Egypt. However, most producers have been facing many obstacles to continuing in production at the promising level, where the first one is the acute shortage of traditional feed resources. Unconventional alternate feed resources could play an important role to alleviate this deficit. The crop residues and by-products were somewhat rich in essential nutrients and most of them were low in anti-nutritional factors, hence they can be used as alternative feed for ruminant

animals (Yusuf *et al.*, 2017), therefore may help in solving the problem of feed shortage and decrease the cost of feeding (Khayyal *et al.*, 2018) and in other cases large quantities of residues currently being disposed either by composting or dumping in the landfills/rivers, causing an environmental pollution. Such unconventional resources can act as an acceptable source of nutrients and help to bridge the gap between demand and supply of feedstuffs for livestock. In addition their use can also reduce the cost of feeding, giving higher profits to farmers. Furthermore, if such huge amounts of plant residues are fully utilized in the diets of ruminants they can support growth and lactation and securing an economical and valuable human edible food (Yusuf *et al.*, 2017). The vegetable wastes are rich sources of energy, protein, minerals and vitamins; and therefore, have great potential as feed for livestock, poultry and fish (Bakshi *et al.*, 2016). Also, such wastes showed a sustainable and potential role in the ruminant feed systemic (Ishraga Ezeldin *et al.*, 2016). Many vegetable crops are grown in Egypt for human consumption and their wastes are available in large amounts without any satisfactory usage in animal feeding. One of the post harvest crops is cantaloupe vine (the percentage of vegetative growth 20% and the proposed percentage of vegetative growth to be exploited 10% according to Desuki and El-Noubi (1990). Annual quantity of cantaloupe vine is about 112.200 tons producing from 561.000 tons of the whole plants that harvested from 49,000 feddan of cantaloupe crop (Agric. Economics, 2017). Cantaloupe (*Cucumis melo* L.) has been considering as a tropical and subtropical crop (Kumar, 2002) and includes nearly all melon and squash species. Due to the high availability and occasional surpluses of melon (*Cucumis melo*), its fruit has been used as an alternative feed source for sheep feeding (Lima *et al.*, 2012) and has become an option for supplementing ruminants during food shortages in semi-arid northeastern Brazil (Lima *et al.*, 2011, Lima *et al.*, 2012 and Oliveira *et al.*, 2015). On the other hand, cantaloupe is rich in biologically active phytoconstituents like essential oils, sterols/triterpenes, carotenoids, pectins and flavonoids (Abou-Ziad, 1998 and Mittal *et al.*, 2010). Several parts of the plants as leaves, fruits, peels have been investigated for their essential oil components, as limonene, citral, 1,8-cineole were identified in *Cucumis melo* fruit, while 6-nonenyl acetate, cinnamyl acetate and nonenol were existed in its peel (Howat and Senter, 1987, Beaulieu and Grimm, 2001 and Nattaporn and Pranee, 2011). So it is highly recommended to give the full attention of the unusable wastes of different plant species for being panting for their economical and medicinal uses (Kamal *et al.*, 2019). The biological value of these residues and the outcome of its phytochemical studies were encouraged the researchers to use it in animal ration formulations. In perspective unconventional resources of feed can act as an excellent source of nutrients and help to bridge the gap between demand and supply of feedstuffs for livestock. The main target of this study was to investigate the effects of replacing 25, 50 or 100% of clover hay by cantaloupe vines hay (CLVH) as nonconventional ingredient in rations of lambs on their growth performance.

MATERIALS AND METHODS

The present study was carried out during the period from October 2018 up to February 2019 at Seds Experimental Station and chemical analysis was conducted at laboratories of Animal Production Research Institute (APRI), Agriculture Research Center, Ministry of Agriculture, Dokki, Giza, Egypt.

Experimental animals and feeding:

Feeding trial was conducted with using twenty male Ossimi lambs with an average live body weight 15.25 ± 0.25 kg and 3 months of age using randomized complete block design and lasted 16 weeks as an experimental period. Lambs were randomly divided into four similar groups (5 lambs for each). The Cantaloupe vines that mainly consisted of leaves and stems (approximately 75% moisture) was collected from Seds area, Beni-Sueif Governorate directly after harvest their fruits and chopped to 2-3 cm in length then left to sun-drying for a period of 7-10 days till reaching a moisture content of ~12%. The concentrate feed mixture (CFM) that used in the experimental rations was consisted of 25% whole dates (residue), 14% date kernel, 25% ajwa biscuit (residue), 5% soybean meal, 10% sunflower meal, 10% nigella sativa meal, 2% rice hulls treated with 0.5% urea, 6% dry malt pomace, 1% salt, 1% limestone and 0.5% mineral premix. Each group was assigned randomly to feeding one of experimental rations where R1 received 60% concentrate feed mixture (CFM) +40% clover hay (CLH), R2: 60% CFM +30% CLH+10% CLVH (i.e. 25% in replacing of CLH), R3: 60% CFM+20% CLH+20% CLVH (i.e. 50% in replacing of CLH) and R4: 60% CFM+40% CLVH (i.e. 100% in replacing of CLH). The amounts of CFM were offered twice daily at 8.00 a.m. and 4.00 p.m. in two equal portions plus the roughage portion. Animals were housed in four shaded yards and they were weighed biweekly. The feed allowances were calculated according to NRC (2007) for sheep. Drinking water was available at all times. The experimental animals were in good health condition and free from external and internal parasites and kept in pens under similar

condition. Samples of the ration ingredients were analyzed for crude protein (CP), crude fiber (CF), ether extract (EE) and ash. The chemical analysis of CFM, CLVH, CLH and the calculated composition of the experimental rations are shown in Table (1).

Digestibility trials and rumen liquor parameters:

Digestibility trials were carried out at the end of the feeding trial to determine the nutrient digestibility and the feeding values of the experimental rations using twelve Ossimi rams (3 for each treatment) with an average live body weight 50.83 ± 0.17 kg. Animals were placed in individual metabolic cages for 21 days (14 days as a preliminary period, followed by 7 days as collection period). Animals in each group were fed on one of experimental rations which offered twice daily at 8.00 a.m. and 4.00 p.m., while water was offered freely along the day. Sub samples (10%) of feces were taken once daily in the morning then stored at -18°C . At the end of the collection period composite fecal samples for each ram were dried at 60°C for 72 hrs. Feed and fecal samples were ground till passing through 1 mm screen on a Wiley mill grinder and representative samples of feed and feces were analyzed for dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE) and ash according to A.O.A.C. (2007). At the end of collection period of the digestibility trial, rumen liquor (RL) samples and blood samples were taken from three animals of each group. Rumen liquor samples were collected by stomach tube before and after the morning feeding 0, 3 and 6 hrs of the animals. The ruminal pH values were measured immediately using Orian 680 digital pH meter. Samples were strained through four layers of cheese cloth, and then ammonia nitrogen ($\text{NH}_3\text{-N}$) was determined according to Conway and O'Malley (1957). Total volatile fatty acids (TVFA's) concentration was estimated by using steam distillation methods (Warner, 1964).

Blood parameters:

At the end of collection period of the digestibility trial before feeding, blood samples were withdrawn from jugular vein in heparinized tubes and centrifuged for 20 min. at 3000 r.p.m. Plasma was frozen and stored at -18°C until the time of analysis. Various chemical parameters were colorimetrically determined using commercial kits; following the same steps as described by manufactures. Total protein (TP) was measured as described by the Biuret method according to Henry and Davidsohn (1974); albumin (A) was assayed according to Dumas *et al.* (1971); globulin was calculated by subtracting the albumin value from total protein value; liver functions were assessed by measuring the activities of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) according to Reitman and Frankel (1957); uric acid was detected according to Barham and Trinder (1972); creatinine was measured according to Faulkner and King (1976).

Statistical analyses:

Data were analyzed using the general linear models procedure of SAS (2004). The difference between means was tested by Duncan's Multiple Range Test (Duncan, 1955). The used model was: $Y_{ij} = \mu + T_i + e_{ij}$ where: Y_{ij} = the observation of ij , μ = overall mean of Y_{ij} . T_i = effect of i (treatments). e_{ij} = the experimental random error.

RESULTS AND DISCUSSION

Chemical composition:

Chemical analysis of rations, ingredients and calculated chemical composition of experimental rations are presented in Table (1). The chemical composition of CFM was closely comparable to those using commonly in practical field of sheep feeding. Also, the nutrient content values of CLH are within the normal range that widely recorded in the literature. The chemical analysis of CLVH was contained 12.54, 21.64, 1.82, 41.17 and 22.83% for CP, CF, EE, NFE and ash, respectively. The corresponding values that obtained by Hussien (2009) for cantaloupe vines were 12.58, 30.85, 1.12, 29.11 and 26.34%, in addition, he was recorded 1.27% Ca and 0.52% glutamic acid on DM basis. While squash residues and watermelon vine hay which belonging to the same family of *cucurbitaceae* were chemically analysed by Desuki and El-Noubi (1990) who reported that squash residues (leaves and stems) were contained 21.15, 13.27, 11.75, 25.63 and 28.20 for CP, CF, EE, NFE and ash, respectively. Also Magouze *et al.* (1998) showed that the chemical analysis of squash leaves was 22.00, 10.19, 2.47, 41.10 and 24.24% for CP, CF, EE, NFE and ash, respectively. Generally, CLVH is rich in most nutrients and its CP value is much closer to that of clover hay (12.54 vs. 15.15%), therefore, it could be used as an effective ingredient or as a beneficial feed supplement in the rations of lambs. Experimental rations appeared slightly differences in

its chemical composition as a result of increasing the level of CLVH from 25 to 100% in replacing of CLH in tested rations. More recently, Magouz *et al.* (2008) showed that comparable values to that mentioned above for the same for chemical analysis of squash leaves being 21.11, 9.92, 3.17, 46.74 and 23.35% for CP, CF, EE, NFE and ash, respectively. Likewise, Fayed *et al.* (2019a) found that watermelon vine hay (WMVH) had higher nutritive value and contained 8.63, 28.62, 1.36, 52.84 and 8.55 for CP, CF, EE, NFE and ash, respectively, as well as had 4.66 mg/100g total phenols. Ultimately, nutrient concentrations, particularly CP, in all experimental rations appeared to be closely suitable for growing lambs and are matched with the values that recorded in (NRC, 2007). This is mainly owing to the potential use of acceptable nutritional values of either CLH or CLVH in those rations. On the other hand, plant breeder and animal nutritionists showed jointly strive for increasing the output from the whole farm by improving grain, fruit and crop residues either yield or quality (Ørskov *et al.*, 1990).

Table (1): Chemical analysis of ration ingredients and calculated chemical composition of experimental rations (on DM basis, %).

Item	DM	OM	CP	CF	EE	NFE	Ash
Ration ingredients:							
Concentrate feed mixture (CFM)	84.58	87.19	14.15	18.45	5.08	49.51	12.81
Clover hay (CLH)	85.44	82.51	15.15	28.48	2.24	36.64	17.49
Cantaloupe vines hay (CLVH)	88.69	77.17	12.54	21.64	1.82	41.17	22.83
Experimental rations:							
R1	84.93	85.30	14.56	22.51	3.93	44.30	14.71
R2	85.28	84.70	14.28	21.82	3.87	44.73	15.30
R3	85.63	84.11	14.00	21.13	3.81	45.16	15.90
R4	86.32	82.95	13.47	19.80	3.70	45.98	17.05

R1: 60% CFM + 40% CLH (control ration), R2, R3 and R4 graded levels of CLVH were used to replace 25, 50 and 100% from CLH, respectively.

Nutrients digestibilities and feeding values:

Digestion coefficients and feeding values of experimental rations are given in Table (2). Results revealed that the digestibility of most nutrients did not significant affected with increasing the level of CLVH up to 50% in rations. Only the fully replacement of CLH by CLVH (R4) led to significant decreases in the digestibilities of all nutrients in comparison with those of control one (R1). This might be due to the negative effect of pesticides residues and anti-nutritional factors in vines. The vegetable seeds and vines crops usually have to be contain some anti-nutritional factors as total phenols, saponin, total tannins, nitrite and nitrate (Ilelaboye and Pikudea, 2009, Fayed *et al.*, 2012 and Fayed *et al.*, 2019a). Polyphenolic compound like tannins are known to potentially interfere with digestion and absorption of protein in the gastrointestinal tract of animals (Eggum *et al.*, 1983 and Back *et al.*, 1988). In relation to this point, Huisman and Tolman (1992) reported that polyphenolic compounds considered as an anti-nutritional factors that have a depressive effect on protein digestion and utilization, in addition of carbohydrates that similarly affected by these compounds. Furthermore, Makled *et al.* (2003) reported that decreased all digestibility coefficients of nutrients and nutritive values of the diets included 0.25 or

Table (2): Digestion coefficients and feeding values of the experimental rations.

Item	R1	R2	R3	R4	±SE
Digestibility coefficients, %					
DM	60.68 ^a	59.90 ^a	53.61 ^{ab}	50.38 ^b	±2.12
OM	67.78 ^a	68.11 ^a	62.02 ^b	59.30 ^b	±1.36
CP	63.08 ^a	64.44 ^a	55.25 ^b	54.77 ^b	±2.38
CF	65.99 ^a	63.27 ^a	60.88 ^a	54.28 ^b	±1.64
EE	74.72 ^a	73.34 ^a	67.06 ^{ab}	62.82 ^b	±2.76
NFE	70.89	75.21	72.40	71.63	±1.75
Feeding values, %					
TDN	62.05 ^a	63.04 ^a	59.05 ^{ab}	56.29 ^b	±1.37
DCP	9.18 ^a	9.20 ^a	7.74 ^b	7.38 ^b	±0.353

a and b means in the same row with different superscripts are significantly (P≤0.05) different. SE=standard error.

0.50% tannic acid. No significant differences were observed among experimental groups in the digestibility of NFE. The same trend was approximately resulted for feeding values among the dietary treatments in which R1 and R2 recoded higher ($P < 0.05$) values for TDN and DCP than those of the other experimental rations (R3 & R4). The obtained results are in agreement with the findings obtained by Hussien (2009) who reported that digestibility of most nutrients of DM, OM, CP, CF, EE, NFE and feeding values were significantly decreased with including the cantaloupe and squash vines in diets of rabbits compared with clover hay. Also, the same trends were found by Fayed *et al.* (2019a) who reported that digestibility of most nutrients were significantly decreased with increasing the level of dried watermelon vines in rations of growing lambs. Likewise, Soliman *et al.* (2020) found that digestibility of most nutrients were improved with cows fed rations containing 25 and 50 % watermelon vines, while those animals fed rations of higher levels of watermelon vines (75 and 100%) were recorded the lowest values ($P < 0.05$).

Rumen fermentation:

Data of ruminal fermentation activities of animals fed the experimental rations are presented in Table (3). Results revealed that rumen liquor pH values were insignificantly decreased with increasing the level of CLVH up to 100% in replacing of CLH in ration (R4) at all sampling times. In fact, the main source of fiber and its type and content can affect markedly on fermentative microbial activities and consequently on rumen pH. Decreasing in pH value was generally due to the production of TVFA's (Odetokun, 2000) that largely depending on protein-based fermentation (Adenik *et al.*, 2007). These results are coincided with those obtained by Khayyal *et al.* (2018) who observed that no significant difference in pH value between the green bean vines diets of growing rabbits and that of control one that free from vines. The concentrations of ruminal NH₃-N at 3 hrs and 6 hrs sampling times were significant lower only with R4 than that of control one, while the other tested rations (R2 and R3) did not differ significantly than that of control in this item. Also, at zero sampling time, there were no significant differences among the dietary treatments respecting NH₃-N value. Decreases in concentration of ruminal NH₃-N with increasing CLVH level may be due to the lower degradability of the CLVH ingredient that consequently decreased ammonia releasing in the rumen. The production of ammonia and amines is quite common end products that released during ruminal fermentation processes as a result of protein hydrolysis. Greatly, the interaction of feed ingredients in ruminants rations can affect positively or negatively on the whole fermentative processes in the rumen and its end products, as well as effect on feed intake or synergistic as antagonistic interactions among diet ingredients (Thomas, 1990). Related to this point, Huhtanen (1991) added that the utilization of dietary energy depends not only on the profile of nutrients made available from a particular feed but also from nutrients made available from other feeds that incorporated in a rations. Respecting the TVFA's concentration, there were non-significant differences among different dietary treatments were observed over the three sampling times, thus the favorable trends and values of ruminal measurements (pH, NH₃-N and TVFA's) might be due to the well balanced all dietary nutrients required for sheep and ruminal organisms as well. Such slightly increases of TVFA's concentration may be due the effects of DM digestibility, rate of absorption, rumen pH and microbial population in the rumen and their activities (Allam *et al.*, 1984). The obtained results are in agreement with those recorded by Fayed *et al.* (2019a) who showed that rumen liquor pH values did not significantly differ among treatments, while contrariwise, NH₃-N and TVFA's concentrations were significantly ($P < 0.05$) decreases with increasing the level of watermelon vines hay up to 100% replacement of berseem hay in

Table (3): Ruminal parameters of lambs fed the experimental rations.

Item	pH			NH ₃ -N (mg/100 ml RL)			TVFA's (meq/ 100 ml RL)		
	0 hrs	3 hrs	6 hrs	0 hrs	3 hrs	6 hrs	0 hrs	3 hrs	6 hrs
R1	6.28	5.98	6.01	13.85	44.70 ^a	43.78 ^a	9.07	12.17	11.69
R2	6.26	5.92	6.00	13.39	43.78 ^a	42.71 ^a	9.56	13.09	12.43
R3	6.24	5.77	5.94	13.01	39.42 ^{ab}	38.65 ^{ab}	9.80	13.49	12.97
R4	6.23	5.74	5.90	13.62	37.27 ^b	36.66 ^b	9.23	13.61	13.06
±SE	±0.053	±0.094	±0.033	±1.80	±1.90	±1.70	±0.593	±0.749	±1.05

a and b means in the same column with different superscripts are significantly ($P \leq 0.05$) different. SE=standard error.

ration of sheep. Ultimately, the progress made in the representation and quantification of the rumen fermentation process in models stimulating whole rumen function has been significant, although important gaps in knowledge and representation still remain. An extensive evaluation of whole rumen function models has earlier been done (Dijkstra and France, 1996).

Blood parameters:

Results of blood parameters of lambs fed the experimental rations are presented in Table (4). Data revealed that all the levels of CLVH had no significant effects on the concentrations of all blood parameters (total protein, globulin, A/G ratio, AST, ALT, uric acid and creatinine). The blood parameters are intimately related to metabolism and influenced by the external environment including feeding, climate and management. The concentration of total protein was slightly decreased with increasing the level of CLVH up to 100% in replacing of CLH in rations. These slightly decreases in plasma total protein and albumin concentrations may be due to indirect response to protein quality, protein intake of CLVH and antinutritional factor. The AST and ALT values were insignificantly increased with increasing the level of CLVH up to 100% in replacing of CLH in the tested rations. The obtained results are in agreement with those recorded by Abo Egla *et al.* (2013) who showed that no significant effect on blood plasma constituents (total proteins, albumin, globulin, AST, ALT and creatinine) with rabbits fed up to 22.5% level of cucumber vines straw (75% of clover hay). On earlier study, Hussien (2009) reported that the AST and ALT values were increased with increasing the level of squash vines hay up to 100% in replacing of clover hay compared with control diets of rabbits. Comparable results were recently detected by Khayyal *et al.* (2017) who showed that dried taro waste had slightly changes on blood constituents when incorporated by reasonable levels in rabbit diets. Otherwise, Fayed *et al.* (2019b) reported that the values AST, ALT, urea and creatinine were significantly higher while the serum total protein, albumin and globulin concentrations were significantly decreased with rations contained 25 and 50% watermelon vines hay untreated with fungi (in replacing of clover hay) than those of corresponding ration that have watermelon vines hay treated with fungi and control one that haven't the vines hay of lactating goats.

Table (4): Blood parameters of lambs fed the experimental rations.

Item	R1	R2	R3	R4	±SE
Total protein, g/dl	6.58	6.33	6.20	5.70	±0.263
Albumin, g/dl	3.28	3.23	3.20	3.13	±0.160
Globulin, g/dl	3.30	3.10	3.00	2.57	±0.293
A/G ratio, g/dl	1.04	1.08	1.08	1.23	±0.143
AST, U/L	33.33	34.67	35.67	36.33	±1.13
ALT, U/L	21.00	23.00	24.33	25.00	±1.62
Uric acid, mg/dl	3.43	3.50	3.57	3.43	±0.144
Creatinine, mg/dl	0.700	0.767	0.767	0.667	±0.050

Differences within the same row were not significant. SE=standard error.

Growth performance, feed intake and economic efficiency:

The measurements of growth performance, daily feed intake, feed conversion and economic efficiency are presented in Table (5). Final live body weight, total body weight gain and daily body weight gain were significantly decreased only with the higher level of CLVH in tested ration (R4) in comparison with control one (R1), while the other tested rations (R2 and R3) those have low and middle levels of CLVH did not differ significantly with control one (R1) respecting to the mentioned growth performance items. The improvements of growth performance for lambs fed the lower level of CLVH in ration (R2) might be due to the very suitable level of replacement (25%) of CLH by CLVH that consequently being a potential positive associative effect among the different ingredients of this ration R2 (CFM, CLH and CLVH). The rumen microbes could play a key role on detoxification mechanism for some pesticides to which ruminant animals might be exposed (Abou Akkada *et al.*, 1973). In relation with this point, Hussien (2009) showed that the possibility of using squash vines and cantaloupe vines as suitable non-conventional wastes in replacement for clover hay at suitable levels in growing rabbit's diets, whereas the final body weight of rabbits fed 50% squash levels (as 17.5% from diets) replacement for clover hay was markedly improved. Also, Abo Egla *et al.* (2013) concluded that cucumber vines straw can be successfully used till 22.5% level (75% in replacing of clover hay) for feeding growing NZW rabbits without any healthy troubles or adverse effects on their productive performance. Likewise, Fayed *et al.* (2019b) showed that biologically treated watermelon vines hay with fungus could safely recommend for formulated the rations of lactating

goats up to 25% (replaced 50% of berseem hay) to improve milk yield and composition without any adverse effect on productive performance of does, as well as the growth performance of their kids. Concerning feed intake, the quantity of TDMI, DCPI and TDNI were markedly higher in both R1 and R2 than those of R3, and R4 groups, where R2 ration that had 25% CLVH was represent the best one among the three tested rations. Considerably, this trend of feed intake (TDMI, TDNI and DCPI) among the dietary treatments could be attributed to the clear differentiation in palatability between CLH and CLVH, where the clover hay potentially unparalleled among different wide range of roughage sources worldwide. Concerning feed conversion measurements, its values did not significantly affected by the dietary treatments, being the best values in respect of DM : gain or TDN : gain were occurred with R2-ration (25% CLVH in replacing of CLH) while the worst one was associated with ration R4 that included the higher level of CLVH. Likewise, results obtained by Phillip *et al.* (2017) showed that the best values of feed conversion and economic efficiency were observed with lambs fed ration that contained 17.5% dried taro waste in ration (low level) with dried yeast than those of ration that contained 35% dried taro waste (high level) with or without yeast. Data of economic efficiency that presented in Table (5) showed that average daily feed cost (L.E.) was decreased with increasing CLVH level in rations (R2, R3 and R4) compared with that of R1-ration. While both items of feed cost per kg gain and the price of daily weight gain were considerably the best with ration (R2) that have 25% of CLVH replacing of CLH compared with those of R1, R3 and R4 rations. The favorable economic values were occurred with R2, followed by R3 in comparison with the poorest one (R4). Ultimately the whole outcomes were obviously reflected on economic efficiency, where the highest profitability being associated with R2 and the moderate one are placed with the R3-ration while the lowest values were outputted by R4 ration. In turn the highest daily profit and relative daily profit (LE) were resulted by the low level of CLVH in ration (R2) compared with the other ones. The present results are in harmony with those recorded by Soliman *et al.* (2020) who

Table (5): Growth performance, daily feed intake, feed conversion and economic efficiency of lambs fed the experimental rations.

Item	R1	R2	R3	R4	±SE
Growth performance:					
Initial body weight, kg	15.50	15.25	15.00	15.00	±0.311
Final live body weight, kg	34.00 ^a	35.20 ^a	32.20 ^{ab}	30.00 ^b	±1.022
Total body weight gain, kg	18.50 ^a	19.95 ^a	17.20 ^{ab}	15.00 ^b	±0.893
Daily body weight gain, kg	0.165 ^a	0.178 ^a	0.154 ^{ab}	0.134 ^b	±0.009
Relative daily body weight gain, %	100	107.88	93.33	81.21	
Daily feed intake (as fed):					
CFMI, kg	0.793	0.783	0.740	0.747	
CLH, kg	0.529	0.394	0.247	-	
CLVH, kg	-	0.129	0.247	0.498	
TDMI, kg	1.321	1.306	1.234	1.245	
TDNI, kg	0.820	0.823	0.729	0.701	
DCPI, kg	0.121	0.120	0.096	0.092	
Feed conversion:					
DM, kg/ gain, kg	8.01	7.34	8.01	9.29	
TDN, kg/ gain, kg	4.97	4.62	4.73	5.23	
DCP, kg/ gain, kg	0.733	0.674	0.623	0.687	
Economic efficiency, L.E/h/d:					
Price of daily gain, L.E.	8.91	9.61	8.32	7.24	
Average daily feed cost, L.E.	4.84	4.52	4.02	3.56	
Relative feed cost, %	100	93.44	83.12	73.60	
Feed cost / kg gain, L.E.	29.32	25.40	26.11	26.57	
Daily profit, L.E.	4.07	5.09	4.29	3.68	
Relative daily profit, %	100	125.04	105.46	90.26	
* Economic efficiency, L.E.	1.84	2.13	2.07	2.03	
Relative economic efficiency, %	100	115.45	112.28	110.35	

a and b means in the same row with different superscripts are significantly (P≤0.05) different. SE=standard error.

Based on prices of the Egyptian market during the experimental period (2018/2019). The price of one ton of CFM, clover hay, cantaloupe vines hay and live body weight were 4500, 2400, 400 and 54 L.E., respectively.

** Economic efficiency, L.E. = Price of daily gain / Average daily feed cost*

found that replacing 25% of berseem hay by watermelon vine (WMV) had the highest economic efficiencies followed by R3 (50% WMV), while those fed either 75% or 100% WMV in replacing berseem hay cow rations had the lowest values. Generally, including local agricultural by-products into ruminant diets could potentially reduce the feed cost and improve the economic efficiency of animal production (Borhami and Yacout, 2001). Lastly, in perspective the relationships between important forage quality factors may then be used by more aggregated whole-farm models that start to employing in the practical field to more accurately evaluate the importance of forage quality on profitability.

CONCLUSION

In conclusion, cantaloupe vines hay could be used as a beneficial ingredient in formulation of rations of growing lambs with positive effect on nutrient digestibility, some blood parameters, growth performance and economic efficiency up to 20% level of CLVH (50% in replacing of clover hay), while the ration included 10% cantaloupe vines hay (25 % of replaced clover hay) could be performed the best compared with the other experimental rations. There are a few results in literature on using cantaloupe vines in feeding small ruminants; thereby we are urgently need more studies on using this waste in feeding farm animals. It was concluded that most of the tested vegetable wastes (cantaloupe vines) could serve as an excellent alternative feed resources for small ruminants.

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تأثير التغذية على العلائق المحتوية على دريس عرش الكنتالوب علي أداء الحملان النامية

أماني أمين خيال ، يوسف لطفي فيليب ، أدولف عبدالملاك خير ، عبد المنعم علي محجوب و أسامة عبد السلام

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تم إختيار ٢٠ ذكر من حملان الأوسيمي عمر ٣ أشهر بعد الفطام وقسمت عشوائياً إلى ٤ مجموعات متشابهة (٥ حملان/ مجموعة) وفقاً لوزن الجسم الحي (٢٥٠ ± ٢٥٠ كجم) وتم تغذيتها علي العلائق التجريبية لمدة ١٦ أسبوعاً كفترة تجريبية لتقييم إستخدام دريس عروش الكنتالوب في تغذية الحملان النامية وتأثيرها علي أداء النمو، ومعاملات الهضم، وقياس نشاط الكرش، وبعض قياسات الدم وكذلك الكفاءة الاقتصادية. تم توزيع كل مجموعة عشوائياً لتغذيتها علي إحدى العلائق التجريبية وهي ١: ٦٠٪ عليقة مركزة + ٤٠٪ دريس برسيم (عليقة كمنترول)، بينما العلائق المختبرة ٢: ٦٠٪ عليقة مركزة + ٣٠٪ دريس برسيم + ١٠٪ دريس عروش الكنتالوب (٢٥٪ إستبدال من دريس البرسيم)، ٣: ٦٠٪ عليقة مركزة + ٢٠٪ دريس برسيم + ٢٠٪ دريس عروش الكنتالوب (٥٠٪ إستبدال من دريس البرسيم)، ٤: ٦٠٪ عليقة مركزة + ٤٠٪ دريس عروش الكنتالوب (١٠٠٪ إستبدال من دريس البرسيم). تم حساب العلائق وفقاً NRC (2007) للأغنام. تم إجراء ٤ تجارب هضم لتقييم مدي قابلية الهضم وقيم التغذية للعلائق التجريبية. أشارت نتائج التحليل الكيماوي إلى احتواء دريس عروش الكنتالوب علي ١٢,٥٤، ٢١,٦٤، ١,٨٢، ٤١,١٧، ٢٢,٨٣٪ لكل من البروتين الخام والألياف الخام ومستخلص الإثير والكربوهيدرات الذائبة والرماد علي التوالي. إنخفاض نتائج معاملات هضم معظم العناصر الغذائية من المادة الجافة والمادة العضوية و البروتين الخام و الألياف الخام ومستخلص الإثير والكربوهيدرات الذائبة مع زيادة مستوى دريس عروش الكنتالوب في العلائق ولكن هذا الإنخفاض كان غير معنوي بين العليقة الكمنترول (١) وكلا من العلائق المختبرة ٢، ٣ علي معظم العناصر الغذائية. كانت قيم التغذية (مجموع المركبات الكلية المهضومة والبروتين الخام المهضوم) متشابهة مع معاملات الهضم بين العلائق التجريبية. انخفضت قيم درجة الحموضة و الأمونيا في سائل الكرش خلال فترات أخذ العينات الثلاثة مع زيادة مستوى دريس عروش الكنتالوب حتى ١٠٠٪ إستبدال من دريس البرسيم في العلائق بينما العكس في تركيز الأحماض الدهنية الطيارة الكلية. لم يوجد اي فروق معنوية بين المعاملات في معظم خصائص الدم. كان معدل الزيادة الكلية واليومية لوزن الجسم متشابهين بين العليقة الكمنترول (١) وكلا من العلائق المختبرة ٢، ٣ التي تحتوي علي ٢٥٪ و ٥٠٪ دريس عروش الكنتالوب إستبدال من دريس البرسيم، علي التوالي، حيث كانت أعلى القيم مع ٢ والأقل مع ٤ التي تحتوي علي ١٠٠٪ دريس عروش الكنتالوب إستبدال من دريس البرسيم. لم يتأثر الغذاء المأكول وكمية المادة الجافة المأكولة و البروتين الخام المأكول ومجموع المركبات الغذائية الكلية المهضومة المأكولة بشكل كبير بالمعاملات الغذائية، مع إنخفاض طفيف في قيم الغذاء المأكول مع زيادة دريس عروش الكنتالوب في العلائق التجريبية علي حساب دريس البرسيم ذات تأثير أعلى بشكل ملحوظ في كل من معاملات ١، ٢، ٣، ٤، حيث كانت نسبة ٢ التي تحتوي علي ٢٥٪ دريس عروش الكنتالوب هي الأفضل. فيما يتعلق بقياسات الكفاءة التحويلية، كان هناك فروق معنوية بين المعاملات الغذائية، حيث تم الحصول علي أفضل قيمة مع عليقة ٢ (٢٥٪ دريس عروش الكنتالوب إستبدال من دريس البرسيم). بينما تحسنت الكفاءة الاقتصادية بشكل ملحوظ مع العليقة التي تحتوي علي ٢٥٪ دريس عروش الكنتالوب مقارنة مع الكمنترول والعلائق التجريبية الأخرى. يمكن الاستنتاج أن التغذية علي عليقة تحتوي علي ١٠٪ من دريس عروش الكنتالوب (أي ٢٥٪ إستبدال من دريس البرسيم) يمكن التوصية بها لتغذية الحملان مع عدم وجود اثار سلبية علي أداء النمو والحالة الصحية بالإضافة إلي زيادة الربحية.