USING PEPPER (*CAPSICUM ANNUUM* L) AND EGGPLANT (*SOLANANUM MELONGENA*) VINES IN LACTATING COW DIETS

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SUMMARY

A Total of thirty six lactating Balady cows were selected at 2 month after parturition with average body weight 461.17kg to study the effect of replacing clover hay (CH) by eggplant or pepper vines in cows diets on nutrient digestibilities, feeding value, milk production and some blood constituents. Six similar groups of animals (6 cows/group) were randomly allocated on the dietary treatments of the experiment. Group T1 (control) were given the concentrate feed mixture (CFM) and CH (50:50). While T2 and T3 groups were fed diets included pepper vines (PV) at rate with 12.5 and 25% respectively and at the same previous rate of eggplant vines (EV) was offered to cow groups (T4 and T5), while T6 group was fed on combination of (PV+EV) at 12.5% for each one in replacing to (CH) in control ration, for 3 months as an experimental period. Results revealed that the digestion coefficients of all nutrients and feeding values were significantly ($P<0.05$) higher for T4 followed by T3 ration and then T2 one in comparison with the control group and the other tested rations. The results also indicated that the actual milk yield and 4% FCM were significantly higher in the treatments containing pepper vines at both levels (T2 and T3) as well as the treatment containing the lowest level of eggplant vines (T4) compared to those of control (T1) and the other tested rations (T5 and T6). The same trend was observed with the percentages of fat and protein in milk, where the treatments T2, T3 and T4 were distinguished in their content from the rest of the treatments, although there were no significant differences between all treatments. Also, in most cases, the rest of the milk components ratios (total solids, solids non-fat and lactose) are distinct in the aforementioned treatments compared to the rest of the other experimental treatments. Insignificant differences in feed intake and feed conversion were observed among the dietary treatments, except the value of the T6 respecting feed conversion that proved the poorest one significantly as DM: 4%-FCM. The results also recorded that the economic efficiency was marked improved in treatments T3 and T4 compared to the other groups. The highest concentrations of total protein and albumin in the blood were in the animals fed a low-level diet of eggplant vines (T4) compared to all treatments of the feeding experiment, and there were almost no significant differences between the treatments with regard to these measures. Therefore, the replacement of clover hay with pepper and eggplant vines up to 12.5% in dairy cow rations is highly recommended in the practical feeding of cows.

Keywords: *Cows, eggplant vines, pepper vines, and productive performance*.

INTRODUCTION

Animal production in Egypt is still faced many problems and the most important of which is the lack of most resources of feedstuffs for reasonable production levels of existing livestock. Efforts were undertaken to find the effective solutions for this problem with also lowering feeding costs as well. Potentially, agricultural by-products (vegetable, crops and fruits) which are considering as cheapest source of ruminant feeds and should be researched to be a key ingredients of the livestock rations **(**Mahmoud, 2016). In Egypt, the vegetables and fruits residues were estimated by about 4.80 million tons annually (Agricultural Economics and Statistics, 2007). Despite such huge amount of these wastes till the present time did not use effectively in the animal nutrition. Rather, a significant amounts are burned and cause many problems related to the environmental pollution.

Eggplant (*Solananum melongena*) vines are a kind of vegetable and belonging to *Solanaceae* family and the genus *Solanum* is native to India and Sri Lanka. Of these, about 1,400 species are found in temperate and

tropical regions of the world. Eggplants vines contain glycoalkaloids and its concentration in the leaves of the *Solanum* ssp. was reached from 110 to 890 mg/ 100 g fresh weight (Vaananen, 2007). It also contains a significant amounts of potassium, sodium, iron, copper, magnesium, manganese and vitamins such as B6, thiamin (vitamin B1), folate, niacin, as well as contains other vital phyto-nutrients (Sabo and Dia, 2009).

Pepper (*Capsicum annuum* L) vines are a vegetable that belonging to *Solanaceae* family and the genus *capsicum* and evolutionary considering as a native to the Caribbean and northern South America. The biomass of this plant have been rich in antioxidative compounds (Nakatani, 1994), as well as could be considering a good source of vitamin E and C (Lee *et al*., 2010) and *Capsaicin* (Shahverdi *et al*., 2013). *Capsaicin* is account as the source of spicy-aromatic compounds and also being an active ingredients in *Capsicum oleoresin*, as well as other bioactive components such as phenolic substance, alkaloid, lipophilic and carotenoids, which known for their potentially health-promoting characteristics,

Both pepper and eggplant has proven for its medicinal properties, acting as a healing, antioxidant and bactericidal agent, which aids in the dissolution of blood clots, heart diseases and arteriosclerosis, controls cholesterol, prevents bleeding and influences the release of endorphins (Harish *et al.*, 2008 and Dutra *et al*., 2010). Apart from hazardous chemicals, or anti-nutritional factors (ANFs) in eggplant forges, numerous of these plant metabolites have been demonstrated to have beneficial impacts on nutritional value and animal metabolism (Lewis and Frenwick, 1987). The ANFs in these types of vegetables might be representative by oxalate, saponins, tannins phytate, alkaloid and cyanides (Abara, 2003).

So, eggplant forage as untraditional feed can be used to feed Yankasa rams during the critical period of forage scarcity without any adversely effects (Okereke, 2012). Recently, Zhigao *et al*. (2022) found that the addition of *Capsicum oleoresin* in cow diets was increased milk fat percent linearly ($p<0.05$), but had no effect on milk protein percent. *Capsaicin* supplementation into the ration of cows may improve milk production due to improved fat metabolism according to the findings that obtained by Oh *et al*. (2021). It also contains medicinal, preventive and curative substances where each of which makes functional feeds beneficial to animal and human health. Comparable results could be detecting with peppers, onion, garlic, grape and lemon (Bontempo, 2007). Generally, Angulo *et al*. (2012) mentioned that nutritional value of fruit and vegetable waste demonstrated that this by-product could be considered as a potential alternative feedstuffs for animal feeding. Also, Stobiecka *et al*. (2022) investigated that seeds, herbal mixtures and waste from the fruit and vegetable industries can being used most commonly and properly. It is worth emphasizing that regular consumption of natural antioxidants could be minimizes the risk of development of civilization diseases e.g., cardiovascular disease, cancer or diabetes.

The aim of this work was to investigate the effect of partially replacing clover hay by eggplant or pepper vines in cow's' diets on nutrient digestibilities, productive performance and some blood constituent parameters of dairy cows.

MATERIALS AND METHODS

This work was carried out at Seds Animal Production Research Station which belongs to Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt.

Animals and feeding trials:

A total of 36 dairy Baladi cows were chosen at 2 month after parturition with an average body weight 461.17kg. The experimental cows were housed and randomly distributed into identical 6 groups (6 cows for each one) using the randomized complete block design during feeding period. Cows of control group (T1) were fed ration consisted of concentrate feed mixture (CFM) and clover hay (CH) at rate of (50:50) on dry matter basis to covering the nutritional requirements according to NRC (1989). While groups T2 and T3 were fed their diets include pepper vines (PV) at rate of 12.5 and 25%, respectively in replacing of CH in control ration. The same previous rates of eggplant vines (EV) were offered to cow groups T4 and T5, while the last group was fed on combination of 12.5% of each PV and EV in replacing to clover hay. The CFM used in this experiment was consisted of 24% undecorticated cottonseed meal, 30% yellow corn, 40.0% wheat bran, 1.5% limestone, 1.0% salt, 0.5% minerals and 3% molasses. The daily amount of CFM was offered in two equal portions at 8 am and 6 pm, in addition to clover hay which was offered in order to covering the nutritional requirements for cows according to NRC (1989). Fresh water was freely available at all times. The experimental period of feeding trial was extended up to 3 months postpartum.

Digestibility trials:

Six digestibility trials were carried out simultaneously on the same cows of the feeding trial where three animals from each experimental group were used during the post-partum period to determine nutrient digestibilities and feeding values of the control and the tested rations using the same feeding and the other practices that would taken on feeding trial. Acid insoluble ash (AIA) method was applied as an internal marker for determining the digestion coefficients and feeding values according to the procedure that described by Van Keulen and Young (1977). Cows were fed individually where the daily feed intake was recorded and faecal samples were taken from the rectum during the period of collecting samples for 7-consecutive days. Daily faecal samples for each animal were frozen at −20 °C immediately until the end of the collection phase where the composite sample of each animal was prepared for analysis. Chemical analysis of feed and feces was determined according to the method of AOAC (2007).

Milk production:

Cows were housed under shaded area and hand milked twice a day 6.0 am and 6.0 pm and milk yield was recorded individually during the trial period weekly. Milk samples were taken proportionally from the two successive milking daily, and the composite sample was prepared and stored for later analysis. Total milk production was calculated and recorded during the entire experimental period. Milk was sampled for analysis of milk protein, fat, total solids and lactose contents by scanning device (Foss 120Milko-scan, Foss Electric, Hillerod, Denmark). Feed conversion was estimated as intake of DM, TDN and DCP per kg of FCM.

4% fat corrected milk = 0.4 M + 15.0 F, Where, M = milk yield and F = fat yield.

Blood parameters:

Eighteen blood samples were collected from the jugular vein of animals post-feeding in the morning (8 am) in a dry clean sterile tubes containing few drops of heparin solution (anticoagulant agent). Blood plasma was separated soon after collection by centrifuged at 3000 r.p.m for 20 min. The supernatant was transferred into a clean dried glass vials and then frozen and stored (at -20 °C) until subsequent specific chemical analysis. Concentration of total protein was estimated by the Biuret method according to Henry *et al*. (1974); albumin was assayed according to Doumas *et al*. (1971); globulin concentration was computed by subtracting the albumin from total protein concentrations. Also, aspartate (AST) and alanine (ALT) aminotransferase activities were assessed as described by Reitman and Frankel (1957) and creatinine was determined according to Henry *et al*. (1974). All blood biochemical constituents were determined using spectrophotometer (Spectronic 21 DUSA) and commercial diagnostic kits (Combination, Pasteur Lap.)

Economic efficiency:

Economic efficiency was calculated as the ratio between incomes price of weight gain and the cost of feed consumed over 5-15 weeks of age.

Statistical analysis:

The obtained data were statistically analyzed using one-way analysis of variance procedure (SAS, 2000) computer program using the following fixed model:

$$Y_i = \mu + T_i + ie$$

Where Yi = The individual observation; μ = Overall mean; Ti = Effect of treatments. (i = 1, 2, 3, 4, 5 and 6) and ie = Random error component assumed to be normally distributed. Significant differences between treatment means were determined at $P<0.05$ by Duncan's multiple-range test (Duncan, 1955).

RESULTS AND DISCUSSIONS

Chemical composition:

Chemical composition of CFM, CH, PV and EV and the calculated composition of the experimental rations are presented in Table (1). Based on CH, the contents of CP, NFE and ash were somewhat lower in PV and EV than those of CH, while CF content had the vice versa trend. Pepper and eggplant vines are very rich in many vital biochemical compounds, as documented in the literature. Vines of eggplant had relatively better contents of

CP, CF, NFE and ash than those of pepper vines. The present values of CF and CP contents for PV and EV vegetables are comparable to those reported by Ndemanisho *et al*. (1998). The chemical composition of both CFM and CH are closely matched with the corresponding values in the literature.

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

Item	Composition of DM,%						
	DM	OM	CP	EE	CF	NFE	Ash
CFM	89.09	84.48	18.28	3.94	7.73	65.99	4.06
CH	89.87	86.18	11.40	1.80	29.16	43.82	13.82
PV	96.20	89.41	9.96	1.95	39.40	38.13	10.59
EV	88.70	86.75	10.86	1.68	32.13	42.08	13.25
Control (T1)	89.48	90.49	15.16	2.72	20.57	52.05	9.51
T2	90.26	90.80	14.90	2.71	22.00	51.18	9.20
T3	91.06	91.30	14.79	2.75	23.13	50.62	8.70
T4	89.20	90.75	15.14	2.71	21.00	51.89	9.26
T5	89.34	90.62	15.15	2.72	20.78	51.98	9.38
T6	90.13	91.03	14.97	2.74	22.05	51.27	8.97

Concentrate feed mixture (CFM); Clover hay (CH); Pepper vines (PV); Eggplant vines (EV)
Control T1 (50 % CFM+ 50 % CH) *T2 (50 % CFM+ 37.5 CH + 12.5 % PV)*
T3 (50 % CFM+ 25 % CH + 25 % PV) *T4 (50 % CFM+ 37.5 % CH + 12.5 % EV)*
T5 (50 % CFM+ 25 % CH + 25 % EV) *T6 (50 % CFM+25 % CH+12.5% PV+12.5* % EV)

***Digestibility and feeding values*:**

Nutrients digestibility and feeding values of the experimental diets are shown in Table (2). Most dietary treatments that have the high level PV (T3) and also that have the low level EV (T4) showed the highest (P<0.05) digestibility coefficients of DM, OM, EE and NFE, amongst all experimental treatments, followed by T2 while, the lowest ones were due to T5 and T6 rations. Meanwhile, CP digestibility was the highest (P<0.05) for cows received the low level of EV (T4) being 75.08 %, followed by those fed the low and high levels of PV in their rations, being (74.31) for T2 and (71.20%) for T3. Otherwise, the combination of PV and EV in (T6) didn't adding any positive effect on the digestibility of all nutrients. These findings may be related to some synergistic or antagonistic actions among the different ingredients of the rations.

The best nutritional value of T2 and T4 (12.5% PV or EV), respectively might be due to the favorable synergistic interaction of the released nutrients of the appropriate levels of both types of supplemented vines. It is also well known from a nutritional point of view as specific type of positive associated effect that is likely affect feed utilization and thus increasing the productive performance of ruminants (Huhtanen, 1991). Related to this point, in many circumstances two feeds may be of similar nutritive value but of differing feeding value, because of their effects on feed intake or their antagonistic or synergistic interaction with other feeds in the diet (Thomas, 1990). On the other hands, Zhigao *et al*. (2022) found that *Capsicum oleoresin* additive for lactating cows had no significant effect on the digestibility coefficient of CP. According to El-Waziry and Kamel (2001) who showed that lower CP digestibility may be due to lower protein degradability because of the higher condensed tannins content in eggplant vines, which in turn leads to the precipitation of certain proteins and the formation of tannins protein complexes'. Likely the higher levels of flavonoids and phenolic compound, as well as photochemical compounds in pepper vines could be somewhat affected negatively on the CP digestibility. However, these compounds have been identified as powerful antioxidants in food and positively affected on human health, as well as the compounds of carotenoids and vitamins C and E had outperforming effect on the product quality (Dia and Mumper, 2010). On the other hand, Abara (2003) showed that anti-nutritional compounds such as tannins may interfere with metabolic processes and bind to digestive enzymes, rendering them to be an inactive for digestion. Also, the results of the present work revealed that, digestibility of CF was higher (P<0.05) with rations T1 up to T4 with the highest one (T2), than that of rations T5 and T6 where the difference didn't significant between them (P>0.05). Otherwise, Zhigao *et al*. (2022) found that *Capsicum oleoresin* additive for lactating cows had no effect on the digestibility coefficients of DM, OM, NDF and ADF.

Similar trend of changes in digestibility coefficients of experimented treatments was observed with the feeding value parameters that expressed as TDN and DCP percentages, where the highest value was associated

with the T4 followed by T3 ration for TDN% (65.79 and 65.03%, respectively), while the highest value respecting DCP was occurred with the ration T4 followed by T2 ration (11.37 and 11.07%, respectively). On some related study, Salama (2011) showed that the digestion coefficients and feeding values were significantly (P<0.05) higher for rabbits fed diet contained 50% eggplant shoots treated with *T. viride, L. acidophilus* or *T. viride + L. acidophilus* as a biological treatments compared to those of control diet. Physiologically, Frankic *et al*. (2009) demonstrated that some herbs and spices like pepper, curcuma, cayenne, ginger, anise, mint, onions, fenugreek and cumin and their extracts can promote the synthesis of bile acids in the liver and their excretion in bile, thereby benefiting the digestion and absorption of lipids. Most of the previously listed spices stimulate pancreatic enzymes (amylase, protease and lipase) and some of them can also increase the activity of digestive enzymes in the gastric mucosa. Apart from effects on bile synthesis and enzyme activity, herbal and spice extracts accelerate digested and shortened the passage of food through the digestive tract. In addition, activation of digestive secretions, immunological stimulation, antibacterial, coccidiostatic, anthelmintic, antiviral or anti-inflammatory activity and antioxidant qualities may all contribute to the beneficial effects of herbs or botanicals in farm animals (Kumar *et al*., 2014). Importantly, after antibiotics were banned, more herbs were used as feed additives to improve growth conditions. Due to the variety of active ingredients, different herbs and spices have different effects on the digestive process and some of them stimulate of saliva secretion.

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

Item	Experimental rations						±SE
	T1	T2	T3	T4	T5	T6	
Digestibility %							
DM	56.54 ^{c}	58.54 ^{b}	61.32 ^{a}	60.93 ^{a}	53.24 ^{d}	54.71 ^{d}	± 0.757
OM	63.69 ^{c}	66.58 ^{b}	68.16 ^{ab}	69.44 ^{a}	60.95 ^{d}	62.35 ^{cd}	± 0.777
CP	68.35 ^{c}	74.31 ^{b}	71.20 ^{b}	75.08 ^{a}	67.75 ^{c}	67.05 ^{c}	± 1.135
CF	63.22 ^{a}	65.00 ^{a}	61.21 ^{a}	61.86 ^{a}	51.25 ^{b}	53.22 ^{b}	± 1.660
EE	78.81 ^{b}	80.31 ^{ab}	81.70 ^{a}	81.83 ^{a}	78.36 ^{b}	78.17 ^{b}	±0.451
NFE	61.73 ^{b}	64.29 ^{b}	69.71 ^{a}	70.22 ^{a}	61.93 ^{b}	64.05 ^{b}	± 0.990
Feeding values %							
TDN	60.31 ^{c}	63.18 ^{b}	65.03 ^{ab}	65.79 ^{a}	57.89 ^{d}	59.43 ^{cd}	± 0.744
DCP	10.36 ^{ab}	11.07 ^{ab}	10.53 ^{ab}	11.37 ^{a}	10.26 ^{ab}	10.04 ^{b}	± 0.169

a, b, c and d: Means in the same row with different superscripts are significantly (P≤0. 05) different. SE=Standard error.

***Milk yield and composition*:**

Milk yield and its composition of cows fed the experimental rations are presented in Table (3). Results showed that cows fed tested rations T2, T3 and R4 were produced significantly higher either daily actual milk yield or 4%-FCM yield compared with those of control T1 and the other tested rations (T5 and T6). Improving the digestion coefficients of nutrients and feeding values with the tested rations (T2 up to T4) resulted in higher actual milk and 4-FCM yields. The incorporated PV or EV in rations T5 and T6 had gave the lowest actual milk yield and 4%-FCM among the whole dietary treatments. Certainly, the presence of anti-nutritional factors or phytonutrient components in plants is one of the major barriers to reaping the full nutritional benefits of many sources of plant foods and vegetables (Oluremi *et al*., 2007). Furthermore, phytonutrients have a significant negative impact on livestock production, including decreased palatability and milk production. Recently, results obtained by Zhigao *et al*. (2022) indicated that cows fed diets supplemented with 20 mg/kg DM of *Capsicum oleoresin* (CAP) had a significantly higher (P<0.05) milk yield and a quadratically higher (P>0.05) 4%-FCM than those fed the control ration during the feeding trial, where an increases in milk yield was recorded as the percentage of CAP increased in the diets.

Concerning milk composition, including fat, protein, lactose, total solids (TS), solids not fat (SNF) and ash percentages (Table 3), results showed that supplementation of PV, EV or their combination had no significant differences with respect to protein and fat ratios among the experimental dietary treatments, being the higher values with T2 and T4-rations (3.33 and 3.30 %) for protein content and 3.43 and 3.37% of the fat content, respectively as a result given in Table (2) for the CP digestibility coefficient. While, the lowest values were

obtained with T5 and T6 rations for protein and fat%. In consistent with these results, Salem and Abd El-Galil (2014) showed that the higher fat content with servings of dairy cows can be attributed to the high fermentation of their high-quality fiber content to volatile fatty acids in the rumen, which are naturally converted into fats in the milk. While, the results observed by Zhigao *et al*. (2022) demonstrated that the addition of *Capsicum oleoresin* cow diets was increased milk fat percent linearly (P<0.05), but had no effect on milk protein percent. *Capsaicin* supplementation may improve milk production in dairy cows due to improved fat metabolism according to Oh *et al*. (2021). Feeding T2 and T4 scored the highest (P < 0.05) total solids (TS), Solid not fat (SNF), lactose and ash%. These findings, were reflected on the measurements of yields of milk components (Kg/h/d) that behaved the same direction to that of milk yield and composition among the dietary treatments over the whole period of the trial, where the highest value was recorded with T2 and T4-rations followed by T3 ration. Otherwise, Zhigao *et al*. (2022) estimated that there was no significant difference in milk protein yield for cow fed diets with different levels of *Capsicum oleoresin* supplementation. In practice, nutritional strategies that improve rumen function can significantly increase milk production and composition; therefore producers can use varieties of strategies to improve rumen function and thus maximize milk yeild and milk components. An adequate level of forage NDF and also degradable rumen protein in the diet, particularly at an early lactation phase could be considered as one of the most nutritional strategy that positively affect milk components (Varga and Ishler, 2007). In this regard, Varga and Isher (2007) demonstrated that milk fat concentration can vary by about 3% units due to dietary manipulations, however, milk constituents of minerals, lactose and other solid contents were unaffected; while protein content could be vary around 0.6 units. Therefore, replacing CH in the ration of lactating cows by pepper and eggplant vines at 12.5% could led to an improvement of digestibility and productive performance of cows significantly.

Table (3): Milk yield and milk composition of cows fed the experimental rations.

Item	Experimental rations						±SE
	T1	T2	T3	T4	T5	T6	
Body weight (kg)	460.0	465.0	458.33	463.3	461.67	460.0	±6.990
Milk yield (kg/h/ d)	7.0 ^{c}	7.94 ^{a}	7.90 ^{a}	7.98 ^{a}	7.24 ^{b}	7.20 ^{b}	±7.553
4% FCM, yield, (kg/h/d)	6.09 ^{b}	7.27 ^{a}	7.17 ^{a}	7.22 ^{a}	6.15 ^{b}	6.10 ^{b}	±6.66
Milk composition %:							
Fat%	3.13	3.43	3.38	3.37	3.0	2.98	± 0.073
Total solids (TS) %	11.99 ^{ab}	12.60 ^{a}	11.95 ^{ab}	12.40 ^{a}	11.56 ^{b}	11.64 ^{b}	± 0.116
Solid not fat (SNF) %	8.86 ^{ab}	9.16 ^{a}	8.57 ^{b}	9.05 ^{a}	8.57 ^{b}	8.66 ^{ab}	± 0.078
Protein%	3.23	3.33	3.13	3.30	3.07	3.07	± 0.039
Lactose%	4.90 ^{ab}	5.03 ^{a}	4.73 ^{b}	4.93 ^{ab}	4.80 ^{ab}	4.90 ^{ab}	± 0.036
Ash%	0.70 ^{b}	0.80 ^{a}	0.71 ^{b}	0.80 ^{a}	0.70 ^{b}	0.69 ^{b}	±0.011
Yield of milk components (kg/h/d):							
Fat	0.22 ^{b}	0.27 ^{a}	0.27 ^{a}	0.27 ^{a}	0.22 ^{b}	0.21 ^{b}	± 0.243
Total solids (TS)	0.84 ^{c}	1.00 ^{ab}	0.94 ^{b}	0.99 ^{a}	0.84 ^{c}	0.84 ^{c}	± 0.908
Protein	0.23 ^{b}	0.26 ^{a}	0.25 ^{a}	0.26 ^{a}	0.22 ^{b}	0.22 ^{b}	± 0.241
Lactose	0.34 ^{c}	0.40 ^{a}	0.37 ^{b}	0.39 ^{a}	0.35 ^{c}	0.35 ^{c}	± 0.369

a, b and c Means with different superscripts within the same row are significantly different (P<0.05).
4% FCM yield = 0.4× milk yield + 15 × fat yield.

Feed consumption and feed conversion:

Data of feed intake of cows fed the experimental rations are summarized in Table (4). The effect of dietary treatments on the total dry matter intake (TDMI) values did not significantly affected, being the highest value was noticed with T6, and while those fed T4 had the lowest one. Unmistakably, variances in feed intake can be ascribed to changes depending on the palatability of various feedstuffs, as well as the feeding technique used. However, the more TDMI for such rations could be explained by increasing the palatability of this ration after inclusion of EV and PV. These means that the mixture of PV and EV had more acceptability than if only one of them was inclusion. These might be due to the less anti-nutritional factors intake in the mixture than those in PV or EV alone. In accordance with the present results El-Menniawy *et al*. (2020) showed that the incorporation of 25% pepper and eggplant vines mixture led to the highest (P<0.05) TDMI in comparison with those of control and the other tested diets. Otherwise, Zhigao *et al*. (2022) reported that cows fed diets supplemented with only 20 mg/kg of DM of *Capsicum oleoresin* (CAP) led to an increased (P<0.05) significantly DMI comparing with

those fed the control and the other tested rations during the trial period. They added that high levels of CAP decreased the DMI. Salama (2011) indicated that feed intake was significantly (P<0.05) lower for rabbits fed diet contained 50% eggplant shrubs treated with *T. viride, L. acidophilus* or *T. viride + L. acidophilus* as a biological treatments compared with that in the control diet ranging from ages 6-14 weeks. Dietary energy utilization is influenced not only by the profile of nutrients available from a specific feed, but also by nutrients available from other feeds in the ration. Associative effects of feeds in ruminants are the name given to this type of nutritional interaction between the various constituents of ruminant rations (Huhtanen, 1991). Similarly, Mahmoud *et al.* (2020) reported that dry matter intake was insignificantly (P<0.05) higher for lactating goats received diet containing dry bean vines as a non- traditional vegetables by-products at rate of 0, 50, 75 and 100% levels in replacing to clover hay in their diets. The same authors confirmed that the majority of non-traditional vegetable by-products could be used to replace good quality fodder (clover hay). However, increasing the replacement (up to 100 percent) could be markedly reduced the feed utilization significantly. It is also well known nutritionally as a kind of positive associated effect that potentially affect positively on feed utilization and consequently on productive performance of ruminant animals (Huhtanen, 1991). Pysiologically, *Capsaicin* ingestion can be increased feed intake by directly affecting on neurons Zafra *et al.* (2003). Pepper has introduced itself as a natural alternative as growth stimulants used in animal production (Valverde, 2011). Also, results showed that TDNI and DCPI were not significantly affected (P > 0.05) by all tested servings compared with those of the control one that free from the vines, being highest with T4 (10.45 and 1.81 kg/h/day, respectively).

In perspective, results of feed conversion trait that expressed as DMI:FCM, TDNI:FCM and DCPI:FCM showed that there were no significant effect mostly due to incorporation of EV or PV at different levels in the diet of cows from T2 up to T5 rations based on those of control one. All feed conversion parameters of tested ration (T6) which included both PV plus EV, were appeared to be the poorest one, respecting to such measurements, among all dietary treatments of the present trial. These results were coincided with those obtained by Grazziotin *et al*. (2020) who mentioned that the intake of *capsaicin* improved feed efficiency in dairy cows. Generally many factors being influence the optimal feed conversion in sheep, including feed intake, nutritional components, fiber content, digestive coefficiency of feed nutrients, as well as the roughage-to-concentrate ratio (Tolera and Sundstol, 2000 and Shem *et al*., 2003). Finally, Salama (2011) mentioned that feed conversion were improved (P<0.05) significantly for diet of rabbits consumed 50% eggplant treated with *T. viride, L. acidophilus* or (*T. viride + L. acidophilus*) as a biological treatments compared with those of control one.

According to the economic evaluation, it could be seen that inclusion of 25% pepper or 12.5% eggplant in the diets will be economically better than any other percentage used in this study.

Table (4): Feed intake, feed conversion and economical evaluation of cows fed the experimental rations.

Item	Experimental rations						
	T1	T2	T3	T4	T5	T6	±SE
Feed intake (kg):							
TDMI	16.10	16.22	16.04	15.88	16.16	17.28	± 0.301
TDNI	9.69	10.25	10.43	10.45	9.34	10.26	± 0.189
DCPI	1.66	1.79	1.69	1.81	1.66	1.74	±0.040
Feed conversion:							
Kg DMI / Kg 4%-FCM	2.65 ^{ab}	2.23 ^{b}	2.25 ^{b}	2.20 ^{b}	2.64 ^{ab}	2.83 ^{a}	±2.466
Kg TDNI / Kg 4%-FCM	1.60	1.41	1.46	1.45	1.52	1.68	±1.520
Kg DCPI/ Kg 4%-FCM	0.27	0.25	0.24	0.25	0.27	0.29	±0.262
Economic evaluation:							
Daily feed cost, L.E	60.0	58.0	52	52	56	56	-
Price of daily milk yield, L.E	63	71	71	72	65	65	-
Economic return L.E	3	13	19	20	9	9	-

a and b: Mmeans in the same row with different superscripts are significantly (P ≤ 0. 05) different.
Calculation based on the following price in Egyptian pound (L.E.) per ton at 2019, concentrate feed mixture (CFM)=5000 L.E/ton, clover hay=2500 L.E/ton, pepper vines=450 L.E/ton, eggplant vines=350 L.E/ton and one kg of raw milk=9 L.E.

***Blood physiological characteristics*:**

Blood constituent's analysis data of cows fed the different experimental rations are shown in Table (6). Results revealed that tangible increasing trend respecting concentrations of total protein, albumin and globulin with all tested rations compared with those of control one, being the highest values almost occurred with T3 and T4 tested rations. Cows in T4 showed the highest total protein and albumin (9.05 and 5.97, respectively), but control T1 had the lowest total protein (7.66) and T3 had the lowest albumin (5.11). Increasing total protein and albumin in tested groups might be due to the increases digestibilities of crude protein and organic matter in these rations. Albumin is one of the proteins that help to maintain a constant osmotic pressure in the blood (Craig, 1999). Findings that obtained by El-Menniawy *et al*. (2020) showed that concentrations of blood total protein and albumin was insignificantly (P>0.05) increased with sheep fed diet containing 50% pepper vines or their mixture with eggplant vines at equal proportions in other diet, in comparisons with those of control one. Similarly, Salama (2011) revealed that total protein and albumin concentrations in blood were significantly (P<0.05) higher for diet of rabbits consumed 50% eggplant treated with *L. acidophilus* or *T. viride + L. acidophilus* as a biological treatments compared to those of control one. In general, the concentrations of total protein and albumin in blood plasma are closely proportionate to the quality and quantity of protein in the ration (Onifade and Abu, 1998). Plasma globulin concentration was significantly (P<0.05) higher with T3 than that of control (T1) and insignificantly (P>0.05) higher than that of the other tested rations. On line with these points, it's worth demonstrating that supplementing cow diets with suitable amount of various of natural feed additives had a good impact on their immunological state, as evidenced by increased globulin levels. Similarly, in comparison to control diet for sheep, blood plasma globulin concentration was significantly (P<0.05) higher in tested diets which included PV, EV or their mixture (25 %) as concluded by El-Menniawy *et al*. (2020). On the other hand, Salama (2011) showed non-significant differences in globulin concentration among the tested rations of rabbits that fed diets containing eggplant untreated or treated with *T. viride, L. acidophilus* or *T. viride + L. acidophilus* as a biological treatments. The ability of animals for store the reserved proteins even after their bodies have achieved their maximal capacity of deposition tissues is being a reflection of both albumin and globulin status as suggested by Stroev (1989). As a result, an increase in globulin production by the liver may suggest strong hepatic function in these animals and is highly correlated with their high immune level (Griminger, 1986). Regarding the liver enzymes, activities of AST and ALT enzymes were significantly (P<0.05) decreased due to all tested rations as compared to those of control one. Regarding the results of blood creatinine concentration, its values were significantly (P<0.05) decreased by incorporation of PV, EV or their combination in all tested rations. While, Salama (2011) showed that activities of AST and ALT enzymes in blood were significantly (P<0.05) decreased, while, creatinine concentration was insignificantly (P>0.05) increased for diet of rabbits consumed 50% eggplant treated with *L. acidophilus* or *T. viride + L. acidophilus* as a biological treatments compared to control diet. These results are similar to the findings that obtained by El-Menniawy *et al*. (2020). In general, Stobiecka *et al*. (2022) investigated that seeds herbal mixtures and waste from the fruit and vegetable industry are used most commonly. It is worth to emphasizing that regular consumption of natural dairy antioxidants minimizes the risk of development of civilization diseases e.g., cardiovascular disease, cancer or diabetes. It also slows down the aging process in the organism.

Table (5): Effect of experimental rations on blood parameters of cows.

Item	Experimental rations						
	T1	T2	T3	T4	T5	T6	± SE
Total protein (g/dl)	7.66 ^{b}	8.39 ^{ab}	8.77 ^{a}	9.05 ^{a}	8.29 ^{ab}	8.42 ^{ab}	±0.142
Albumin (g/dl)	5.21 ^{ab}	5.30 ^{ab}	5.11 ^{b}	5.97 ^{a}	5.21 ^{ab}	5.62 ^{ab}	±0.109
Globulin (g/dl)	2.45 ^{b}	3.09 ^{ab}	3.66 ^{a}	3.08 ^{ab}	3.08 ^{ab}	2.80 ^{ab}	±0.132
AST (U/I)	57.20 ^{a}	53.47 ^{ab}	47.0 ^{bc}	43.93 ^{c}	45.53 ^{c}	40.67 ^{c}	±1.61
ALT (U/I)	53.05 ^{a}	47.28 ^{b}	40.50 ^{c}	35.94 ^{cd}	39.61 ^{c}	33.61^{d}	±1.72
Creatinine (mg/dl)	3.19 ^{b}	3.05 ^{a}	2.76 ^{b}	3.11 ^{a}	3.01 ^{a}	2.99 ^{b}	±0.058

a, b, c, and d: Means in the same row with different superscripts are significantly (P≤0. 05) different. SE=Standard error.

CONCLUSION

It could be concluded that pepper vines or eggplant vines are favorably used as partially replacement of clover hay at 12.5% in the diet for good productive lactating cows.

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إستخدام عروش الفلفل والباذنجان فى تغذية الأبقار الحلابة

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أجريت هذه التجربة بمحطة بحوث الإنتاج الحيوانى بسدس بهدف دراسة مدى تأثير إستبدال دريس البرسيم بعروش الفلفل أوالباذنجان أو مخلوطهما على معاملات الهضم والقيمة الغذائية وكذلك تأثير ذلك على تركيب وإنتاج اللبن وأيضاَ على بعض الخصائص الفسيولوجية فى الدم للأبقار. تم استخدام 36 بقرة بلدى حلابة، بمتوسط وزن 461.17 كجم بعد الولادة بشهرين . تم تقسيم الأبقار إلى 6 مجاميع متماثلة عشوائيا بكل منها 6 أبقار لكل/ مجموعة. تم إعداد مجاميع التغذية بحيث تكون إحداها ضابطة تستخدم للمقارنة (ت1) تحتوى على العلف المركز ودريس البرسيم بنسب 50:50% بينما العلائق المختبرة كانت كالآتى: (ت2 ، ت3) علائق محتوية على 12.5 و 25% من عروش الفلفل على التوالى، و (ت4 ، ت5) علائق محتوية على 12.5 و 25% من عروش الباذنجان على التوالى، بينما (ت6) عليقة محتوية على خليط من عروش الفلفل والباذنجان بنسبة 12.5% لكل منهما كإستبدال من دريس البرسيم فى العليقة المقارنة. دلت النتائج أن المعاملات التجريبية المختبرة عند مستوى 12.5% من عروش الباذنجان و 25% من عروش الفلفل وتلتها المجموعة الثانية المحتوية على 12.5% من عروش الفلفل أدت إلى زيادة معنوية ($P<0.05$) فى نسب معاملات الهضم وأيضاً فى قيم مجموع المركبات الغذائية المهضومة بالمقارنة مع المجموعة الضابطة والمعاملات التجريبية المختبرة الأخرى. كما أشارت النتائج إلى أن محصول اللبن الفعلى والمعدل لنسبة ٤% دهن هو الأعلى معنوياً فى المعاملات المحتوية على عروش الفلفل بمستوييه (ت2 وت3) وأيضاً المعاملة المحتوية على المستوى الأقل من عروش الباذنجان (ت4) مقارنة بمعاملة الضابطة (ت1) والمعاملات المختبرة الأخرى (ت5 وت6). ولوحظ نفس الإتجاه مع نسب الدهن والبروتين فى اللبن حيث تميزت المعاملات ت2، ت3،ت4 فى محتواهما عن باقى المعاملات بالرغم من عدم وجود فروق معنوية بين جميع المعاملات. وأيضاً فى الغالب كانت باقى نسب مكونات اللبن (الجوامد الكلية والجوامد الكلية غير الدهنية واللاكتوز) متميزة فى المعاملات المذكورة سابقاً مقارنة بباقى المعاملات التجريبية الأخرى. وأظهرت النتائج أنه لم يكن هناك اختلافات ($P>0.05$) معنوية فى كميات المأكول اليومي وأيضاً فى معدل الكفاءة التحويلية بين مجموعات الأبقار المغذاة على المستويات المختلفة من عروش الفلفل والباذنجان والمجموعة الضابطة. باستثناء قيمة ت6 فيما يتعلق بمعدل الكفاءة التحويلية للأعلاف التي أثبتت أنها الأكثر فقراً معنويا مثل DM: 4٪-FCM. كما سجلت النتائج أن الكفاءة الإقتصادية كانت الأعلي في المعاملة ت3 وت4 مقارنة بالمجموعات الأخرى. وكانت قيم تركيزات البروتين الكلى والألبيومين فى الدم هى الأعلى فى الحيوانات التى تغذت على عليقة المستوى المنخفض من عروش الباذنجان (T4) مقارنة ببافى معاملات التجربة الغذائية وبشكل عام لاتوجد فروق معنوية بين المعاملات فيما يخص هذه القياسات.

وتخلص النتائج إلى أن إستبدال دريس البرسيم بعروش الفلفل والباذنجان حتي نسبة 12.5% فى علائق الأبقار أدي إلي تحسن فى معاملات الهضم وإنتاج اللبن وبعض نسب مكوناته وأيضاً فى الكفاءة الإقتصادية.