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EFFECT OF INJECTION GOATS WITH A, D_3 AND E VITAMINS ON THE QUALITY OF LABNEH PRODUCED FROM ITS MILK.

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ABSTRACT

Three groups of goat (G_1,G_2 andG_3) were selected to study the effect of injection with vitamins A ,D_3 and E on the properties of Labneh produced from their milks . Results showed an increase in milk Titratable acidity and decrease in pH during the second month of lactation, after weaning. Marked increase in yield and Titratable acidity with decrease of pH were noticed in Labneh produced from the milk of injected goats and the highest values were recorded in (G_3) group. A direct relationship was noticed between the injected dose of vitamins and the concentrations of vitamins A, D_3 and E resulted in milk and Labneh. This means that as the injection dose of these vitamins increased, the concentrations of the vitamins in milk were increased. Group (G_3**)** recorded the highest concentrations of these vitamins, being 9.213, 2.987 and 3.33 mg / 100g for vitamins A, D_3 and E, in order. Concerning the lactation period, it was found, that the second month of lactation period recorded the highest values followed by the third period and first period , respectively. The best organoleptic properties was found in Labneh produced in the second month of lactation period .Thus we recommend the vitamins injection in dairy animals to produce milk and milk products that can be used to produce special functional dairy products.

1. INTRODUCTION

Goat is one of the oldest domesticated animals since 8000 BC and use of its milk in dairy products goes back to ancient Egypt, as discovered in Pharaohs burial tombs (**Hussein et al., 2020).** The global dairy goat population was estimated to be 218 million in 2017 **(FAO,2019).** Interest in dairy goats and goat milk products is a part of the recent trend in health food demand and consumption in developed countries as well as a renewed interest in goat milk as a substitute for those who suffer from allergies or intolerance against cow milk **(Park, 2017).**

Goat milk had chemical composition approximately near to cow milk and characterized by higher digestibility, certain nutritional and therapeutic effects

in human nutrition **(Haenlein, 2004)**. It has a distinct goaty flavor which was unacceptable by numerous consumers. Egyptian consumers refused much of the goats' dairy products because of its flavor. When goats' milk processed into Labneh, the goaty flavor was highly reduced through the heat-treatment of milk, fermentation and wheying off the acidic whey.

Labneh, strained yoghurt (also spelled strained yogurt), yoghurt cheese, or Greek yoghurt is yoghurt which has been strained in a cloth or paper bag or filter to remove the whey, giving a consistency between that of yoghurt and cheese, while preserving yoghurt's distinctive sour taste. Like many yoghurts, strained yoghurt is found originally in Middle East area, especially in Lebanon, Syria, Jordan, Morocco and Iraq. **(Basiony et al., 2017).** In Egypt, the conventional method for producing Labneh is to make Zabady and store it overnight under refrigeration to the next day, salt is added, thoroughly mixed, put into cheese cloth bags and hung on racks to drain for about 12-24 hours, packed and stored under refrigeration. **(Abou-Donia, 2008)**.

Goat like other animals require vitamins for optimal performance and health. Each vitamin performs a unique function and cannot be replaced by any other vitamin (**Hafez, 2012)**.

Vitamin A has an effective role in keeping all the body epithelial cells and is playing an important role in the process of vision, spermatogenesis and bone growth **(Tanumihardjo, 2011)**.The classical functions of vitamin D are to regulate calcium-phosphorus homeostasis and control bone metabolism. However, vitamin D deficiency has been reported in several chronic conditions associated with increased inflammation and deregulation of the immune system, such as diabetes, asthma, and rheumatoid arthritis **(Sassi et al., 2018)**. Vitamin E is a fat-soluble nutrient that has potent antioxidant function, which provides protection from oxidative stress **(Jiang, 2014).**

The aim of this work is to produce Labneh from milk obtained from goat injected with A ,D_3 **and** E vitamins mixture, during 3 months of lactation period and determined the effect of the vitamins injection effect on the milk quality produced and the labneh produced from this milk.

2. MATERIALS AND METHODS

2.1. Materials

Goat milk was obtained from El Gemeaza Experimental Station, Animal Production Research Institute, Agriculture Research Center, Egypt. Yoghurt starter (*Streptococcus thermophiles* & *Lactobacillus delbrueckii subsp*. *bulgaricus*) was obtained from Chr. Hansen Laboratories Copenhagen, Denmark. Vitamins A, D_3 **and** E complex (DEVEDRY – MED injection) were manufactured by ARABCOMED, Egypt. High performance liquid chromatography (HPLC) chemicals and standards of vitamins (A, D_3 and E) were purchased from Sigma-Aldrich Chemicals Co., USA through Cornell lab company, Egypt.

2.2. Experimental plan

Goats' milk was collected weekly during the three months of lactation period (1ts, 2nd and 3rd month after weaning) from three similar groups (G_1, G_2 and G_3) of lactating goats (each group contained 10 heads). The 1st group G_1 was injected by saline solution, as a control, but G_2 and G_3 groups were injected intramuscularly biweekly by 2 ml. and 4 ml respectively of AD_3E vitamins. Each one ml of vitamins mixture contained (8000 I.U) of vitamin A, (4000 I.U) of vitamin D3 (Cholicalcipherol) and 20 mg of vitamin E (a tocopherol acetate).

2.3. Processing of Labneh:

Eight kilogram of goat milk, monthly, representing experimental groups (G_1, G_2 and G_3) were heat treated up to 85±1 ° C for 5 minutes, then cooled to 44 ± 1°C. Yoghurt starter culture 2% were added to milk of each group, stirred well and incubated at 42±1°C until coagulation. 1 % edible salt was added to each treatment, stirred well and left for 30 min to be sure of salt dissolving. The salted yoghurts were transferred into bags made from tight cloth, bags hanged for whey separation for 12 hours. The curd was got out from the bags, weighted, homogenized well with electric stirrer and kept at refrigerators till analysis. The collected whey of each treatment was weighted, stirred well, for having representative samples and kept at refrigerators till analysis. Labneh was manufactured according to **Tamime and Robinson (1985)** method, as shown in (Fig. 1).

Goats' milk

↓

Heat – treated at 85±°C/ 5 min

↓

Cooling to 44±1°C

↓

Inoculating with 2% yoghurt culture

↓

Incubation at 42±1°C until coagulation

↓

Cooling to 5 ± 1°C and left overnight

↓

The resultant yoghurt filled into cloth bags and hanging for 12 hours in refrigerator

↙ ↘

Labneh whey

1% salt was added and well stirred

$$\text{Yield} = \frac{\text{amount of Labneh}}{\text{weight of milk}}$$

Fig. (1) Flow chart of Labneh making

2.4. Chemical analysis

pH values of milk, Labneh and whey were determined according to **Ling (1963)** by using Greenway pH meter. The Titratable acidity of the same samples was determined by titration following the method described by **AOAC (1990)**.

2.5. Determination of vitamins (A,D_3 and E)

A High Performance Liquid Chromatography (HPLC), Agilent, Germany 1200 system equipped with a variable wavelength detector was used to determine vitamins A, D_3 and E. Samples preparation and chromatographic conditions were similar to those described by **Gąsior and Pieszka, (2007).**

2.6. yield

Amount of Labneh produced from certain amount of milk**.**

$$\text{Yield} = \frac{\text{amount of Labneh}}{\text{weight of milk}}$$

2.7. Organoleptic evaluation

Organoleptic evaluation of Labneh samples was done by 10 judges from Animal Production Research Institute, according to **Nelson and Trout (1957)** method**.** The evaluation included color and appearance, body and texture and flavor. Color and appearance was 10 points, Body and texture was 40 points, and flavor was 50 points.

3. RESULTS AND DISCUSSIONS

3.1. Yield of Labneh

From Table (1) it is clear that injection goat with by vitamins AD_3E caused slightly increment in the yield of Labneh through the lactations periods compared to the control group (G_1). G_1 in the 1st lactation month recorded the lowest yield as compared with groups (G_2 and G_3), being 17.76. G3 in 3rd lactation month scored the highest values of yield, being 24.56. It could be noticed that by increasing injection dose of AD_3E vitamins in all cases, increased the Labneh yield.

Table 1. Yield of goats' Labneh of the tested groups during the lactation months

Lactation Months	Group	Amount of milk/Kg	Labneh Yield	%
1st month	G1	8	17.76	-
	G2	8	20.83	17.28
	G3	8	22.85	28.65
2nd month	G1	8	18.17	-
	G2	8	22.05	21.35
	G3	8	23.33	28.40
3rd month	G1	8	18.09	-
	G2	8	21.27	17.57
	G3	8	24.56	35.77

G1 = Control G2 = 2 ml AD3E /head G3= 4ml AD3E/head

3.2. pH values

pH values of milk, yoghurt, Labneh and whey are present in Table (2). Data indicated that there is an inverse relationship between pH values of milk, yoghurt and Labneh and the dose of injection by vitamins. The lowest values were found in group G_3 followed by Groups 2 and 1, in order.

Table 2. pH values of goats' milk, yoghurt and whey of the tested groups during the lactation months .

Lactation Months	Group	Milk		Yoghurt		Labneh		Whey	
		pH	%	pH	%	pH	%	pH	%
	G1	6.70	-	4.81	-	4.81	-	4.88	-
1st month	G2	6.60	1.49	4.76	1.04	4.68	2.70	4.86	2.70
	G3	6.54	2.39	4.71	2.08	4.66	3.12	5.38	3.12
	G1	6.65	-	4.83	-	3.80		4.86	
2nd month	G2	6.51	2.11	4.65	3.73	3.88	2.11	4.78	2.11
	G3	6.48	2.56	4.60	4.76	3 .60	5.26	4.76	5.26
	G1	6.75	-	4.84	-	4.78		4.82	-
3rd month	G2	6.63	1.78	4.73	2.27	4.63	3.14	4.80	3.14
	G3	6.56	2.81	4.69	3.10	4.61	3.56	4.88	3.56

G1 = Control G2 = 2 ml AD3E /head G3= 4ml AD3E/head

3.3. Titratable acidity values

Titratable acidity values of milk, yoghurt, Labneh and whey are present in Table (3). Data indicated that there is a close relationship between Titratable acidity of milk, yoghurt and Labneh and the dose of injection by vitamins. The highest values were found in group G_3 followed by Groups 2 and 1, in order. Concerning the effect of lactation period it was noticed that the Titratable acidity values of milk, yoghurt and Labneh were increased up to the second period of lactation then decreased thereafter .The variations in total solids among the former products may be the main reason for that. Moreover, secretion of some AD_3E vitamins into milk may activate the starter bacteria to convert more lactose into lactic acid. pH values of the previous products behaved reverse trends to Titratable acidity in all groups and lactation periods .Injection by the former vitamins may has a vital effect on the constituents of the resultant milk as noticed by **Ali et al., (2013)** who studied the effect of using AD3E vitamins or vitamin E-Selenium complex (E-Se) on some productivity traits.

Table 3. Rate of increase (%) in Titratable acidity in goats' milk, yoghurt, Labneh and whey of the tested groups during the lactation months.

Lactation Months	Group	Milk		Yoghurt		Labneh		Whey	
		Acidity	%	Acidity	%	Acidity	%	Acidity	%
1st month	G1	0.15	-	0.76	-	2.12	-	0.72	-
	G2	0.17	13.33	0.78	2.6	2.24	5.66	0.81	12.5
	G3	0.18	20.00	0.81	6.6	2.26	6.60	0.85	18.0
2nd month	G1	0.16	-	0.81	-	2.15	-	0.79	-
	G2	0.19	18.75	0.85	4.9	2.32	7.91	0.86	8.86
	G3	0.20	25.00	0.89	9.9	2.36	9.77	0.89	12.66
3rd month	G1	0.15	-	0.74	-	2.16	-	0.75	-
	G2	0.17	13.33	0.78	5.4	2.31	6.94	0.77	2.70
	G3	0.18	20.00	0.80	8.1	2.33	7.87	0.80	6.66

G1 = Control G2 = 2 ml AD3E /head G3= 4ml AD3E/head

of local black Iraqi does and found that colostrum yield and fat % in AD_3E and E-Se groups was Significantly increased compared with control, also significant increase in Protein% in E-Se group compared with control group, while the lactose % and solid-non fat (SNF) % did not affect with the former treatments.

In addition, data presented in Table (3) demonstrate that the rate of increase in Titratable acidity and yield took placed in goats' milk, yoghurt and Labneh as affected by injection by A, D_3 **and** E vitamins during three months of lactation period. Results showed that as the dose of vitamins increased the former values were increased. Concerning the lactation period, it was found, generally, that the second month of lactation period recorded the highest values followed by the third period and first period, in order. The rates of increase in the second period of lactation were 18.7 and 25.0 % for milk; 4.9 and 9.9 for yoghurt and 7.91 and 9.77 for Labneh comparing to control group of this period.

3.4. Concentration of AD3E vitamins in goats' milk, Labneh and whey

Table (4) showed the relationship between the dose of injected vitamins (A, D_3 and E) and the concentrations of those in milk, Labneh and whey. It was clear that as the injection dose of these vitamins increased, the concentrations of the previous vitamins increased. In case

of milk, treatment G_3 recorded the highest concentrations being 9.21, 2.98 and 3.33 mg / 100g for vitamins A, D_3 and E, respectively compared with G1 and G2. Also, the same treatment (G3) has the highest levels of studied vitamins in case of Labneh 18.64, 3.45 and 1.64 mg/100g, respectively compared with the other two treatments. On the other hand, **(Bouwstra et al., 2008)** reported that supplementation with vitamin E had no effect on its concentration in milk and blood

Table 4. Concentrations of AD_3E vitamins (mg/100g) goats' milk, Labneh and whey.

Item	Group	Vitamin concentrations (mg/100g)		
		Vitamin A	Vitamin D	Vitamin E
Milk	G1	7.28	0.73	0.82
	G2	8.47	1.42	1.41
	G3	9.21	2.98	3.33
Labneh	G1	9.09	1.07	1.11
	G2	12.66	3.09	1.14
	G3	18.64	3.45	1.64
Whey	G1	2.66	0.04	0.14
	G2	4.05	0.04	0.29
	G3	4.20	0.04	0.37

G1 = Control **G2 = 2 ml AD3E /head** **G3= 4ml AD3E/head**

3.5. Organoleptic evaluation

Samples of fresh Labneh were donated to ten judges as unknown samples. The average scoring points were summarized and tabulated in (Table 5). Judges highly accepted Labneh from 2nd lactation month, than the others. The AD_3E vitamin injection had marked effect on the body and texture and flavor of Labneh. Luckily, the goaty flavor wasn't highly detected because of the heat – treatment of milk, fermentation process, the clean sour flavor of Labneh, as well as the addition of salt. The bright white color of Labneh attracted the ten judges, since Egyptian consumers prefer the bright white color of dairy products than the yellow color of counterparts of cow milk. The highest scoring points 91 and 94 out of 100 were recorded for G_2 and G_3 groups of the 2nd month of lactation. Labneh of the control group G_1 gained 80, 88 and 81 for 1st, ^{2}nd and ^{3}rd month of lactation, respectively. **El-Samargy and Zall (1988)** reported that Labneh has a consistency resembles cultured cream and It should be soft, smooth, spreadable, not dry or grainy and had no sign of wheying off. The flavor must be clean acidic and the color is milky. The chemical composition may vary within fat 9-11% , carbohydrate 3.5-4% , protein 8.5-9% , total solids 22-26% , lactic acid 1.6-2.5% and salt 1% .

Table 5. Organoleptic properties of Labneh

Item	Lactation months								
	1st month			2nd month			3rd month		
	G1	G2	G3	G1	G2	G3	G1	G2	G3
Color and appearance	8	9	8	8	8	8	8	8	9
Body and texture	30	32	34	33	35	37	29	30	33
Flavor	42	45	48	47	48	49	44	46	45
Total (100)	80	86	90	88	91	94	81	84	87

G1 = Control G2 = 2 ml AD3E /head G3= 4ml AD3E/head
Color and appearance (10 points) Body and texture (40 points) Flavor 50 points

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خواص اللبنة المصنعة من لبن المعز المحقون بخليط فيتاميتات أ ودz وهـ خلال ثلاثة اشهر من موسم الحليب

حاتم حلمى عمر ، هالة على ثابت ، عماد صلاح الجوهرى

تم تقسيم قطيع من المعز الى ثلاث مجموعات متشابهة لدراسة تاثير الحقن بخليط فيتاميتات ا ود3 وهـ بجرعات 2 او 4 مل من خليط الفيتامينات ودراسة خواص كل من اللبن واللبنه المصنعة من البانها على مدار ثلاثة اشهر من الحلابة التالية لفطام الخالى (صغار الماعز) .ولقد اظهرت النتائج زيادة الحموضة وتناقص ال pH خلال الشهر الثانى للحلابة مع زيادة الريع بتقدم موسم الحلابة كما قد حدثت زيادة ملحوظة فى ريع اللبنة والحموضة وانخاض ال pH للبن الناتج من المعز المحقونة. و كان اعلاها فى ا لمجموعة (G3) المحقونة ب 4 مل من مخلوط الفيتامينات . كما وجدت علاقة طردية بين الجرعة المعطاة من خليط الفيتامينات وبين تركيز هذة الفيتامينات الناتجة فى اللبن و (جبن اللبنة) . كان اعلى تقييم حسى للبنة الناتجة من مجموعة المعز فى الشهر الثانى من الحلابة .

لذلك توصى الدراسة بحقن حيوانات اللبن ومنها المعز لانتاج البان ومنتجات عالية القيمة التغذوية لإستخدامها في اعداد منتجات لبنية وظيفية خاصة تفيد الإنسان.