

Effect of Diethylstilboesterol Propionate and Disodium Methylarsenate on Milk Yield and Constituents of Friesian Cows

A.B. Hassan and F.M.Fouad

Department of Pharmacology, Faculty of Veterinary Medicine, Cairo University, Egypt.

INTRAMUSCULAR injection of 0.025 mg/kg.b. wt./day diethylstilboesterol for 21 days in Friesian cows, significantly decreased their milk yield by 26.52% and increased fat, total protein, total solids and solids not-fat percentages by 24.9, 29.01, 0.2 and 0.17% above their levels prior to drug injection. While that of chloride, lactose and casein were unchanged.

Stopping the administration of this hormone was accompanied by a significant decrease in milk yield, fat, protein, total solids and solids not-fat percentages till they became 50.97, 11.8, 2.4, 20.4 and 22.7% respectively after 21 days from the stopping of Diethylstilboesterol injection.

Whereas, subcutaneous injection of disodium methylarsenate in a dose of 2 mg/kg b wt in Friesian cows insignificantly increased milk yield but did not alter the various milk constituents either during or after the administration.

Numerous investigations were carried out, for increasing production and keeping quality of milk to fulfill its human requirements. The nutritive value of milk is depending mainly on its components (fat, lactose, chloride, protein, casein, total solids and solids not-fat) which vary according to specie of dairy animals (Pilla and Melossini, 1964), time of lactation (Bayoumi, 1959 and Wease *et al.*, 1967), season of calving (Herman, 1938 and Waite *et al.*, 1956), management system (Karasek and Samerha, 1962, Afanas and Syshev, 1970 and Korcdts and Gravert, 1972) and number of lactation (Rook, 1961 and Iofe, 1967). Quantitative and qualitative alteration in milk components makes it unfit for human consumption and indicates illness of dairy animals.

Moreover, therapeutic applications of some drugs dairy animals during their lactation period, may subject their milk to certain alterations, as it is considered as one of the excretory routes of drugs.

Therefore, the alterations in milk yield and constituents in Friesian cows, during and after the administration of diethylstilboesterol propionate and disodium methylarsenate, were investigated.

Material and Methods

Quantitative and qualitative changes which may occur in Friesian cows milk is going to be studied, during and after administration of diethylstilboesterol and disodium methylarsenate.

1. *Diethylstilboesterol dipropionate (Diprostyl).*

It is one of Ein-Shams Company products prepared in oily solution in 25 ml bottles, each 1 ml contains 5 mg stilboesterol dipropionate in olive oil.

2. *Disodium methylarsenate*

It is one of Rhone Roulanc, Paris-France products, it is present in a white powder form packed in dark bottle, each of 1 kg disodium methylarsenate is highly soluble in distilled water and prepared in 10% solution for subcutaneous injection.

Animals

15 Friesian cows of 4 years old, 435.0 kg.b.wt. and 8 weeks after calving were used, from March to July 1978. They were bred in an open sheds in Sakha Station of Animal Production Research Institute, Ministry of Agriculture. These dairy cows were fed on a ration containing 45% cakes, 26% bran, 7% rice bran, 14% corn, 3% rice germ cakes, 3% in molas, 0.1% calcium carbonate and 1% sodium chloride, in addition to rice straw as a roughage and water.

Grouping of animals

Animals were grouped into 3 equal groups of 5 cows each. The first one was served as a control, while the second and the third groups were used for studying the effect of intramuscular injection of diethylstilboesterol (0.025 g/kg.b.wt./day) and subcutaneous injection of disodium methylarsenate (2 mg/kg.b.wt./day) respectively. Drugs were repeatedly injected for a period of 21 days.

Cows were hand milked in morning and evening for 21 days prior, during and after drug administration. The daily milk yield of each cow was weighed, a representative sample from each was taken for determination of its different constituents.

Procedure

Fat percentages of the obtained milk samples were determined using Gerber's method whereas that of chloride, protein and casein were estimated by the direct titration method described by Ling (1963). Lactase percent of milk samples was determined using the rapid method of John *et al.* (1957). The total solids and solids not-fat were determined using the oven drying method (British Standards Institution, 1951).

The data were statistically analysed using "F" test (Snedecor, 1961).

Results

The results are given in Tables 1, 2 and shown in Fig. 1 and 2.

Intramuscular injection of diethylstilboesterol (0.025 Ug./kg b.wt./day) in Friesian cows every 3 days for 21 days, significantly decreased their milk yield by 26.52%, but increased its fat percent by 24.09% compared with the control group. Moreover, this hormone had no effect on chloride and lactose percentages of milk. The total protein, total solids and solids not-fat percentages were significantly increased by 29.01, 2.43 and 20.26% more than the control group. Casein percent of of milk of treated cows was insignificantly increased.

Stopping the administration of diethylstilboesterol was followed by significant decrease in milk yield, gradual decrease in fat percent till it became 0.1%, no change in chloride and lactose percentages, sudden drop in total protein percent till it became 2.4% corresponding to 2.9% in the control group. Although the solids not-fat percent of treated cows milk remained on its level during hormone administration, those of casein and total solids were gradually decreased.

Subcutaneous injection of disodium methylarsenate in a dose of 2 mg/Kg . b. wt./ day for 21 days in Friesian cows caused insignificant increase in milk yield because it exceeds the control group with 8.12 dg/week. Whereas fat, chloride, lactose, total protein, casein, total solids and solids not-fat percentages showed no significant changes. These parameters remained constant for another 21 days after topping of drug injection.

Discussion

Great consumption of milk and milk products for their high nutritive value encouraged the search for increasing their production and keeping quality to fulfill human requirements. Therefore, revealing the changes in milk yield and components of dairy animals during or even after the administration of drugs is highly indicated. Milk yield and its constituents are influenced by several factors which consequently affect its nutritive value. Dairy animals are always subjected to the effect of some therapeutic agents during lactation period either for prophylaxis or curing purposes, hence their milk may be quantitatively or qualitatively changed.

In this investigation, intramuscular injection of 0.025 Ug/kg. b. wt/day diethylstilboesterol propionate for 21 day in Friesian cows significantly decreased their milk yield either during or after its administration. This finding is in accordance with that obtained by Folley *et al.* (1991) and Spielman *et al.* (1941), whereas fat percent of milk was significantly increased and this correlated with the results of Hutton (1957), Fulkerson and Mc Dowell (1974) and Haenlein *et al.* (1974) but disagreed with that of Browning *et al.* (1957).

It is clear that there is a reverse correlation between milk yield and its fat content, *i.e.* the decrease in milk yield was accompanied by an increase in the fat content.

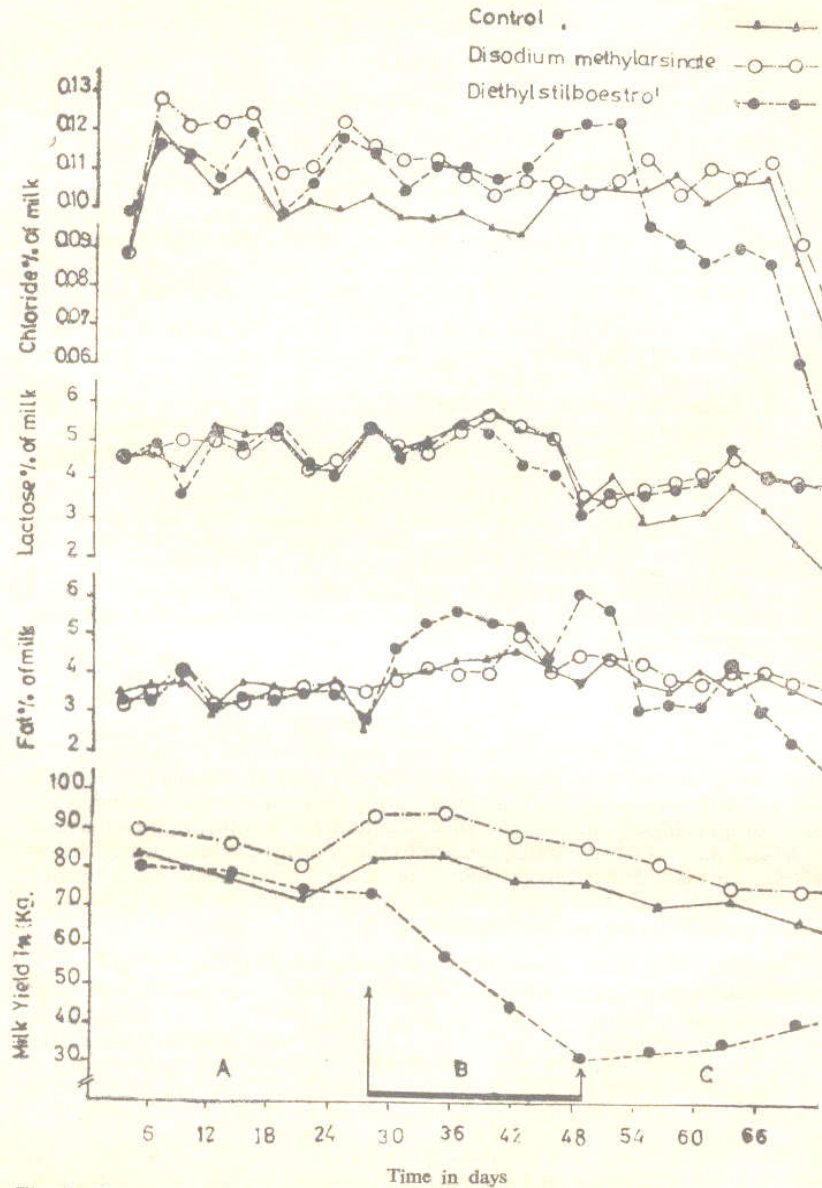


Fig. 1. Changes in milk yield, fat, lactose and chloride percentages of Friesian cows' milk before, during and after parenteral administration of diethylstilboestrol (0.025 ug/kg. b. wt/day) and disodium methylarsinate (2mg/kg. b. wt/day).

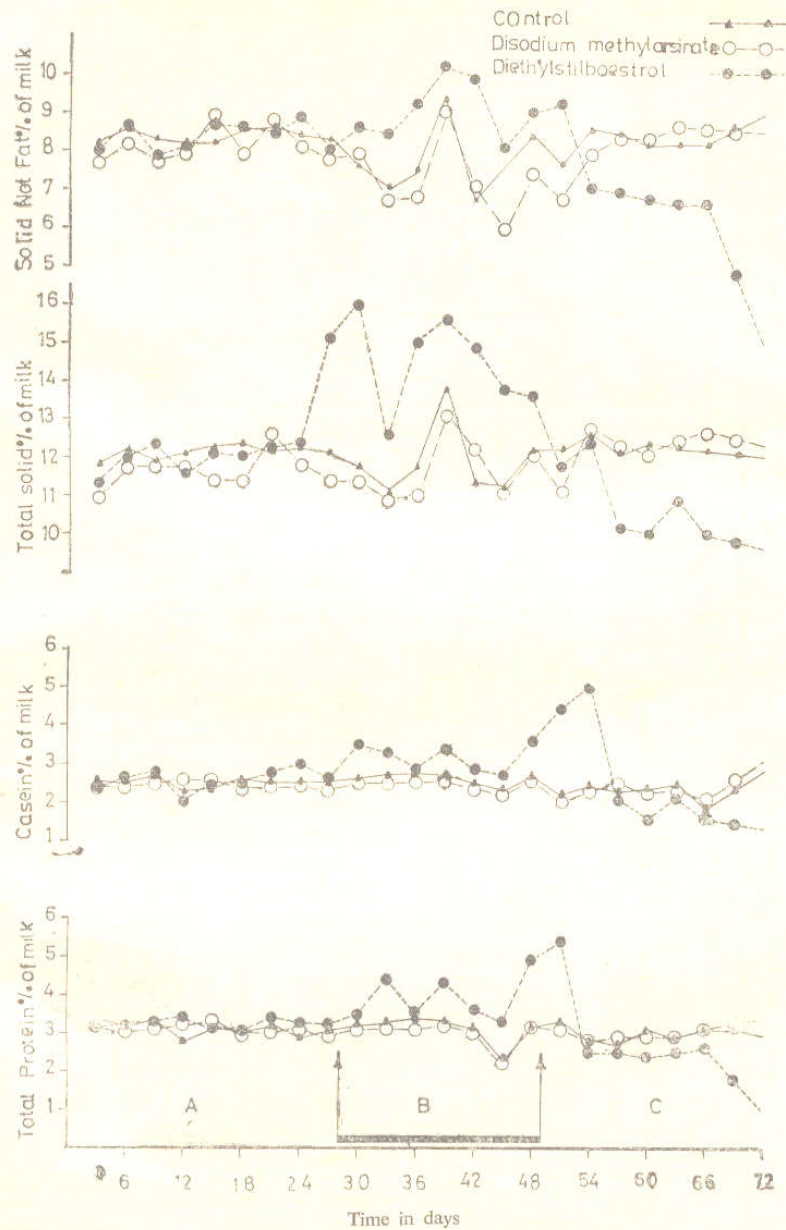


Fig. 2. Changes in total protein, casein, total solids and solids not-fat percentages of Friesian cow milk before, during and after parenteral administration of Diethylstilboesterol (0.025 ug/kg. b. wt./day) and disodium methylarsenate (2mg/kg. b. wt./day).

TABLE 1. Showing the values of "F" test of milk yield, fat, lactose and chloride contents of Friesian cows milk treated with diethylstilbo-
 esterol (0.025 Ug/kg.b.wt./day) and disodium methylarsenate (2mg/kg.b.wt./day) with their standard errors and interrelationship.

Period	Source of variance	d.f.	Total protein			Casein %			Total solids			Solids not-fat					
			Summation square	Mean square	"F"	Summation square	Mean square	"F"	Summation square	Mean square	"F"	Summation square	Mean square	"F"			
Before drug administration	Total	14	2972.8														
	Drugs	2	396.78	198.39	0.819	0.06885	0.34425	0.5519595	0.0123	0.0061	0.4629	0.0002982	0.0001491	1.9696			
	Repetition	4	638.26	159.564	0.659	0.5157	0.28928	0.4637742	0.0017	0.0004	0.3272	0.000655	0.0001637	2.1624			
During drug administration	Total	14	5674.824														
	Drugs	2	2845.28	1422.64	6.20*	5.39618	1.54669	6.2798*	0.3314	0.0325	1.6309	0.0007702	0.0003851	4.0115			
	Repetition	4	995.27	248.82	1.085	3.09338	0.8311	0.3374	0.0649	0.0268	1.3483	0.0005403	0.000135	1.4062			
After drug administration	Total	14	11378.666														
	Drugs	2	5746.354	2873.16	8.8365**	16.99694	0.63123	0.3991	17.0334	1.575	1.4097	0.00076	0.00038	0.3439			
	Repetition	4	3051.129	757.46	2.3306	1.26264	0.77013	0.4869	3.1496	1.2361	1.1063	0.00324	0.00081	0.0733			
Error	Total	8	2601.183	325.15		0.49895	0.0623687		0.1059	0.0132							
	Drugs	2	1834.274	229.29		1.97037	0.246295										
	Repetition	4	766.910	191.73													

* Significant at ($P < 0.05$)

** Highly significant ($P < 0.01$)

TABLE 2. Showing the values of "F" test of total protein, casein, total solids and solids not-fat contents of milk of Friesian cows treated with diethylstilboesterol (0.025 ug/kg.b.wt./day) and disodium methyl-arsenate (2mg/kg b.wt. day) with their standard errors and interrelationship.

Period	Source of variance	d.f.	Total protein			Casein %			Total solids %			Solids not-fat %		
			Summation square	Mean square	"F"	Summation square	Mean square	"F"	Summation square	Mean square	"F"	Summation square	Mean square	"F"
After drug administration	Total	14	0.7444	0.01512	0.275894	0.65184	0.00486	0.0997571	3.6725	0.17045	0.4929506	3.1617	0.1268	0.4704791
	Drugs	2	0.03024	0.01512	0.275894	0.00972	0.00486	0.0997571	0.3409	0.17045	0.4929506	0.2536	0.1268	0.4704791
	Repetition	4	0.27577	0.068942	1.2580133	0.252373	0.063093	1.2950635	0.5652	0.1413	0.4086472	0.752	0.188	0.697557
	Error	8	0.43843	0.054807		0.3897467	0.048718		2.7662	0.345775		2.1561	0.2695125	
During drug administration	Total	14	7.52078	1.73125	4.562765*	4.89156	1.04426	3.9091096	39.3649	11.182199	9.3304131	16.4234	4.5731	5.8687233
	Drugs	2	3.4625	1.73125	4.562765*	2.08852	1.04426	3.9091096	22.3644	11.182199	9.3304131	9.1462	4.5731	5.8687233
	Repetition	4	1.02284	0.25571	0.673932	0.66596	0.16649	0.6232429	2.8691	0.717275	0.4060602	1.04334	0.260835	0.334332
	Error	8	3.03544	0.37943		2.13708	0.267135		14.1314	1.766425		6.23386	0.7792325	
After drug administration	Total	14	8.5438	0.54141	0.830344	5.74816	0.37922	0.8830981	14.58643	11.4368	1.0664478	68.96914	6.23525	1.4743676
	Drugs	2	1.08282	0.54141	0.830344	0.75844	0.37922	0.8830981	22.8736	11.4368	1.0664478	12.47046	6.23525	1.4743676
	Repetition	4	2.24231	0.560578	0.85974	1.55436	0.38859	0.90491826	39.8971	9.97427	0.9300717	22.66587	5.6664675	1.3398751
	Error	8	5.21625	0.6520312		3.43536	0.42942		85.7936	10.72425		33.83281	4.2291012	

* Significant at (P < 0.05)

** Highly significant (P < 0.01)

Total protein percent of milk of treated cows was significantly higher than that of the control ones. The present finding is paralleled with that of Hutton (1957), Comberg and Mayer (1962), Caruolo and Mochrie (1968) and Haenlein (1974). Moreover, the total solids and solids not-fat percent of milk were significantly increased and this is in agreement with the results of Folley *et al.* (1941) and Spielman *et al.* (1941) for total solids and Hutton (1957), Caruolo and Mochrie (1968) and Haenlein (1974) for solids not-fat. Chloride and lactose percentages of milk were unchanged either during or after diethylstilbo-esterol injection. This to some extent is in agreement with the results obtained by Hutton (1957) and Fulkerson and McDowel (1974) who recorded an increase in non-fatty solids which was mainly due to the increase in protein, lactose and ash fractions.

Concerning disodium methylarsenate and milk yield and constituents no available literature could be obtained except those focussed on the antiprotozoal (Behera, 1967), anthelmintic (Shakiev, 1974) and toxic (Balatsku, 1976) effects of arsenic and arsenite. As well as those concerning their excretion in urine (Peoples, 1964), milk (Shuvalov, 1969) and bile (Cikrt and Bencke, 1974) of lactating cows.

Subcutaneous injection of 2 mg, gk.b.wt. disodium methylarsenate for 21 days in Friesian cows insignificantly increased their milk yield, but not altered milk components (fat, lactose, chloride, protein, casein, total solids and solids not-fat). This may encourage the administration of this drug as it not only improves the general health condition of animals but also increases their milk yield without impairment of its components. Although administration of larger doses of this drug may lead to a more clear effect on both milk yield and constituents, it may result in poisoning among consumers as arsenic and arsenite proved to be excreted in milk of lactating cows (Shuval, 1969).

Conclusively, care must be taken in consideration with the administration of therapeutics to dairy animals as they may quantitatively or qualitatively alter their milk and makes it harmful to consumers.

References

- Afanas EV., Yu.I. ; and Sychev, D.A. (1970) The importance of exercises and sunshin for prophylaxis and for increase production in cows, *Anim. Breeding Abst.* 40, 1461.
- Balatsku, K.B. (1976) Arsenic poisoning in animals (experimental) sodium arsenic or calcium arsenate poisoning in cattle, treated with dimercaprol. *Otravlenis oscow USSR*, No. 9, 84.
- Bayoumi, M.S. (1959) Effect of season and stage of lactation on the yield and composition of milk in two herds of Univ. of Walce Aberystwght. *Indian J. Dairy Sci.* 12, 87.
- Behera, K.P. (1967), Treatment of balantidiosis in cattle and buffaloes with Liquor arsenicalis. *Indian Vet. J.* 44, 1080.
- British Standards Institution (1951) Methods for the chemical analysis of liquid milk, Publication No. 1741.
- Browning, C.B. Foyntaine, F.C., Marian, G.B. and Atkason, F.W. (1957). Effects on milk production of feeding low levels of diethylstilboestrol to five pairs of identical twin cows. *Dairy Sci.* 40, 1590.

Egypt. J. Anim. Prod. 22, No. 1 (1982)

- Caruolo, E.V. and Mochrie, R.D. (1968) Effect of temporary hormonal suppression of lactation on milk constituents, clinical mastitis colostrum and the oestrus cycle, *J. Dairy Sci.* 51, 1436.
- Comberg, G. and Mayer, H. (1962) Effect of oestrogens on the mineral content in cow milk. *Dtsch tierarztl. Wschr.* 69, 506.
- Cikrt, M. and Bencke, V. (1974), Fats of arsenic after parenteral administration to rats with particular reference to excretion via bile, *J. of Hygiene, Epidemiology, Microbiology and Immunology*, 18, 129.
- Folley, S.J., Scott Watson, H. M. and Bottomley, A.R. (1941), Initiation of lactation in ulliparous heifers by diethylstilboestrol, *J. Physiol.* 100, 7.
- Fulkerson, W.J. and McDowell, G.H. (1974) Effect of oestrogen administered in early or late lactation on the yield and composition of milk in sheep, *J. Endocrinol.* 63, 1, 175.
- Haenlain, G.F.W., Krauss, W.C. and Woodmausee, C.W. (1974) Effect of repeated injections of oestrogens and thyroxin on milk composition and counts of leucocytes in milk of Holstein - Friesian and Juersey cattle, *Landwirtschaftlich, farschung*, 27, Hegt., 213.
- Herman, H.A. (1938) Variation in composition of milk and the effect on solids not-fat content. *J. Dairy Sci.* 21, 146.
- Hutton, J.A. (1957) Oestrogen function in established lactation in the cow. *Endocrin.* 17,121.
- Iofe, V.B. (1967) Relationships between fat and protein content in milk of Friesian cows. *Dairy Sci. Abst.* 30, 2928.
- John, A., Barnett, G. and Abdel Tawab, G. (1957) A rapid method for the determination of lactose in milk and cheese, *J. Sci. Food Agric.* 87, 437.
- Kordts, E. and Gravert, H.O. (1972) Effects of artificial light and exercise on the fertility of cows, *Anim. Breeding Abst.* 41, 2073.
- Karasek, V. and Smerha, J. (1962) The effect of exercise on the growth development and milk production of Red-Spotted Cattle, *Anim. Breeding Abst.* 31, 40.
- Ling, E. R. (1963) "A text Book Of Dairy Chemistry" 2nd Ed., 1 : 49, and 11 : 95, London (Chapman and Hall.)
- Peoples, S.A. (1964) Arsenic toxicity in cattle. *Ann. N.Y. Acad. Sci.* 111, 644.
- Pilla, A.M. and Melossini, F. (1964) Variations in milk yield and composition during lactation in Friesian cows. *Dairy Sci. Abst.* 28, 2288.
- Rook, J.A.F (1961) Variation in the chemical composition of milk of the cow part. I. *Dairy Sci. Abst.* 23,251.
- Shakiev E. Sh. (1974) Efficacy of felixan, calcium arsenate and tin arsenate against Monezia infection in lambs and adult sheep. Skopje veterimarnogo institut (1972) 209193-200.
- Shuyalov, Yu. W. (1969) Determination of arsenic by the neutron activation method. I. technique. II, Arsenic in the milk of cows treated with sodium arsenite. III. Arsenic in organs and tissue of animals following multiple application of sodium arsenite. Trudy Vses. Inst., Vet, Sanit, 32, 351-374.
- Snedecor, G.W. (1961) "Statistical Methods" V Ed, The Iowa State, U.S.A.
- Spielman, A., Ludwick, L.M. and Petersen, W.E. (1941) Effect of diethylstilboestrol on milk secretion. *J. Dairy Sci.* 24, 499.
- Waite, R., Whits, J.C.D. and Robertson, A. (1956) Variations in the chemical composition of milk. *Dairy Res.* 1, 65.
- Wease, S.J., Butcher, D. F. and Thomas R.O. (1967) Effect of breed, season and stage of lactation on certain constituents and properties of milk, *J. Dairy Res.* 390, 3640.

تأثير بروبيونات الداى ايشيل سمثامو ستيروى وثنائى صوديوم
ميثيل الزرنيخات على كمية اذوار اللبن ومكوناته فى ابقار
الفريزيان

عبد الخالق بكر حسن وفكرى محمد فؤاد

قسم الاقربانين والطب الشرعى ، كلية الطب البيطرى - جامعة القاهرة

الحقن العضلى لهرمون الداى ايشيل ستلبوستيروى فى جرعة ٢٥ر٠٠
ميكروجرام/كيلوجرام من وزنة الحيوان كل ثلاثة ايام ولدة ٢١ يوما فى ابقار
الفريزيان تقلل اذوار اللبن معنويا بنسبة ٢٦ر٥٢٪ وتزيد نسبة كل من
الدهن ، البروتين الكلى ، الجامدات الكلية ، الجامدات الغير دهنية بنسب
٢٤ر٩ ، ٢٩ر٠١ ، ٠٢ ، ٠١٧ر٠٪ على التوالي فوق مستواها قبل حقن
الهرمون مع عدم تغيير نسبة كل من الكلوريد وسكر اللاكتوز والكازين .
كما تبين ايقاف اعطاء هذا الهرمون يؤدى الى نقص معنوى فى كمية اذوار
اللبن ، الدهون ، البروتين ، الجامدات الكلية والجامدات الغير دهنية
باللبن حتى صارت ٥٠ر٩٧ ، ١١ر٨ ، ٢ر٤ ، ٢٠ر٤ ، ٢٢ر٧٪ على التوالي
بعد ٢١ يوما من ايقاف الحقن .

ولكن حقن الداى صوديوم ميثيل الزرنيخات تحت الجلد فى جرعة
٢ مجم/كيلو جرام من وزن الحيوان يوميا فى ابقار الفريزيان يزيد اذوار
اللبن زيادة غير معنوية ولم يغير من مكوناته المختلفة اثناء اعطاء العقار
او بعد ايقافه .