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HORMONAL CHANGES AS RELATED TO MAMMARY GLANDS DEVELOPMENT AND MILK PRODUCTION IN SHE-CAMEL

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ABSTRACT

In this research, two experiments would be conducted. She-camels were selected in the first experiment so that they were of different ages, which were the stage of sexual maturity, the pregnancy period, the production period, the dryness stage. Samples were taken from the udder cells. The current study was jointly planned by the Department of Animal Production, Faculty of Agriculture, Al-Azhar University, Cairo, and the Animal Production Research Institute. The current study was aimed to study the relationship between histological changes in the udder of she-camels at different ages and the hormonal changes associated with these histological changes. The udder samples of (she-camel's dromedaries) were collected immediately after the slaughter of animals from locals such as Al-Basateen slaughterhouse, Nahia slaughterhouse, and Kardasa. The age of the animals was determined by dentition. After collection, samples were directly fixed in 10 per cent neutral buffered formalin, The most important results obtained were that there was a close relationship between the tissue changes in the udder and the hormonal changes. From this, it could infer the development occurring in the udder through various hormonal analyses. Also, through hormonal analyses, it could assume the expected milk production rate in the season.

Key Words: She-camels, dromedaries, Histological Procedure, Electron microscopic, and blood serum.

INTRODUCTION

The she-camel is an important species uniquely adapted to hot and arid environments and, therefore, contributes significantly to the food security of the nomadic pastoral households. This unique adaptability makes this species ideal for exportation under the arid and semi arid land conditions. The versatility of she-camel is suitability to survive and perform in the arid and semi-arid regions of the world. This animal has a unique ability to convert the scanty plant resources of the desert into milk, meat and fiber. She-camel has almost no competition for feed with other animals and is a hardy animal.

She-camel milk is one of the most valuable food resources for nomads in arid regions and can contribute to a better income for pastoralists, especially as in the last years milk consumption among the

urban population was increasing **(Farah, 2004 and Chaibou, 2005)**. The fact that it is mainly consumed in its raw state (boiling of the milk is not common as it is known to remove its "goodness"). The high ambient temperature and the lack of refrigeration facilities in many arid areas are the main reasons for hygienic problems **(Radwan *et al.*, 1992 ; Semereab and Molla, 2001)**. In addition, she-camel milk (compared to cow milk) has a positive effect on patients with multi-resistant tuberculosis **(Mal *et al.*, 2001)**.

Milking more than two daily milking results in increasing milk yield and milk secretion rate in dairy cows **(Hillerton *et al.*, 1994)**, goats **(Knight *et al.*, 1990b)**, ewes **(McKusick *et al.*, 2002)** and she-camels **(Alshaikh and Salah, 1994)**. In this respect, the mammary gland milked three daily milking was larger than that two daily milking, suggesting either growth or reduced regression (involution) of the three daily milking glands **(Henderson *et al.*, 1985)** and increasing the mammary parenchyma, parenchymal DNA and number of cells **(Wilde *et al.*, I987b)** Moreover, 3 or 4 daily milking in early lactation was found to increase 2 mammary cell proliferation of dairy cows **(Hale *et al.*, 2003 and Norgaard *et al.*, 2005)**, indicating relatively more mammary epithelial cells. Frequent milking may have inhibited my epithelial cells (MEC) death by decreasing the alveolar distension **(Wilde et al., 1999a)**. **Peaker and Blatchford (1988)** reported that the rate of milk secretion in individual glands of lactating goats was inversely related to the fraction of milk left after milking, irrespective of the actual volume of milk in the gland at the time of milk removal. Milking for one time caused significant increases in fat and total protein percentages in dairy cows **(O'Brien *et al.*, 2002 and Remond et al., 2004)**. Nevertheless, **Holmes *et al.*, (1992) and Remond *et al.*, (2002)** reported no changes in fat and protein for one milking cows.

As one-humped she-camels are not systematically bred for milk production, there is a great variety in different udder and teat shapes and sizes. Additionally, the shape can vary according to age and stage of lactation **(Tibari and Anouassi, 2000; Albrecht, 2003 and Wernery *et al.*, 2004)**.

The current research was aimed to study the relationship between histological changes in the udder of she-camels at different ages and the hormonal changes associated with these histological changes.

MATERIALS AND METHODS

The current study was jointly planned by the Department of Animal Production, Faculty of Agriculture, Al-Azhar University, Cairo and the Animal Production Research Institute. The udder samples of (she-camels dromedaries) were collected immediately after slaughter of animals from Al-Basateen slaughterhouse, Nahia slaughterhouse, and Kardasa. Age of

the animals was determined by dentition. After collection, samples were directly fixed in 10 per cent neutral buffered formalin, 2021 till February, 2023.

1. Materials

1.1 Animals and management

Animals used in the study were dromedary she-camel. At different ages, which is the stage of sexual maturity, the period of pregnancy, the period of production, and the stage of dehydration, and samples were taken from the udder cells.

1.2. Experimental design

In this research, two experiments would be conducted. She-camels were selected in the first experiment, so that they were of different ages, which were the stage of sexual maturity, the pregnancy period, the production period, and the dryness stage, and samples were taken from the udder cells.

She-camels were selected in the second experiment at different ages as well, namely the stage of sexual maturity, pregnancy period, production period, and drought stage, and blood samples were taken from them

2. Procedures:

2.1 Histological

She-camels are selected in the first experiment so that they were of different ages, namely the stage of sexual maturity, pregnancy period, production period, and drought stage, and we take samples of udder cells from them.

2.2. Some blood serum components

Blood samples were collected from Jugular vein in the non-heparinized vacationer tube of each she-camel, then centrifuged at 100g for 15 minutes. Serum samples were harvested and stared frozen of -20^{o}C until the assay of Hormonal assay Prolactin- oxytocin estrogen - Progesterone

3.Histological Procedure:

Fixation: Specimens were immediately fixed in 10% buffered formalin solution for 24 hours and washed by running tap water for 18-24 hours, Dehydration: The fixed samples were dehydrated in ascending grads of alcohol 60, 70, 80, 90 and 95% (one bath for each) and absolute alcohol (two baths) to remove water from the samples gradually.

Clearing: The dehydrated samples were place in zylen (as aclearing agent) for 8-10 hours.

Impregnations: The samples were placed in three successive baths of melted paraffin wax (55-58-C) for two hours each.

Embedding in paraffin: Pieces of the samples were place in melted wax blocks.

Sectioning: The paraffin blocks were cut into thin sections (5-10Um) by microtome.

Staining: The prepped sections were stained by hematoxylin and eosin and mounted in Canada balsam using the routine after **(Bancroft and Stevens 1990).**

4. Electron microscopic procedure:

The tissue was placed in 5% glutaraldehyde, buffered to pH 7.3 at 4^{o}C. After 24 hours it was cut into small pieces about 1 mm each. The samples were placed in fresh 5% cold glutaraldehyde and fixation was continued for five hours. Samples were then washed in two changed of cold phosphate buffer pH 7.3 for 1 hour **(Hayat, 1970)**. The specimens were then post-fixed 1-2 hours in buffered 1% osmium tetra oxide **(Palade, 1952)**. They were washed twice for 15 minutes, each in buffer solution at pH 7.3 then dehydrated in cold ethanol 30% (two changes, 5 minutes each), followed by two other changes of 50% ethanol, 5 minutes each. Specimens were then brought to 70% ethanol and dehydrated in ethanol 80% for ten minutes, followed by three changes of ten minutes each in absolute ethanol. The alcohol was then replaced by using two changes, 10 minutes each.

Embedding was then carried out in 1:2 epon 812 acetone mixture for half hour, then in 1:1 epon 812 acetone for further 3 hours with slight shaking. Specimens were transferred to a third mixture of 2:1 peon 812 acetone where they were kept for 6 hours at room temperature, and could be left over night. Finally, the pieces of peon 812 infiltrated tissue were transferred to pure epon 812 and left overnight The well infiltrated specimens were then embedded in rubber boats filled with fresh epon 812. Blocks were polymerized at 60^{o}C for 24 hours.

Semi-thin section of 0.7 Um thickness was cut with glass knives on the 6000 MT RMC ultramicrotome. They were mounted on glass slides and stained with 25% toluidine blue. Toluidine blue was prepared by adding 0.1 gm toluidine blue to 0.2 gm sodium borate (borax) in 100 ml distilled water (stock solution), 25 ml of this solution was filtered and completed to 100 ml with distilled water **(Davis, 1971)**. For the electron microscope preparations, thin sections were cut from a preselected area of the block provided by viewing a semi-thin section with alight microscope. Silver thin sections of 60 to 90 nm, were prepared by diamond knife and collected on copper grids. These section were stained with 5% uranyl acetate for 20 minutes. Uranyl acetate adds 0.5 gm to 100 ml 30% ethanol, mix well, filter and store in amber glass bottle in the dark. Thin section was then stained in lead citrate for **(Reynolds, 1963)**. The later solution was prepared by adding 1.33 gm lead acetate and 1.76 gm sodium citrate to 30 ml distilled water, shaking resultant suspension

vigorously for 1 minute and allow standing for 30 minutes with intermittent shaking to ensure complete conversion of lead acetate. After 30 minutes, 8ml of 1N sodium hydroxide (carbonate-free) was added and the solution was diluted. Dilute to 50 ml with distilled water and mix by inversion. Grids were stained for 20 minutes. The sections were then examined photographically by a JEOL 1200 EXII transmission electron microscope.

3. Statistical analysis :

Data were statistically analyzed using **SAS (2006)**. The percentage values were transformed to arc-sin values before being statistically analyzed. Duncan's multiple range test **(Duncan, 1955)** was used for the multiple comparisons

RESULTS AND DISCUSSION

Before Puberty(G1)

Histologyical results:

Fig (1) shows the structured the mammary gland in she-camels during before puberty showed small, few clusters of loose arranged ducts system surrounded by dense connective tissue. These ducts are composed of epithelial cells that will differentiate into the ducts and lobules of the mature mammary gland. The abundant stromal tissue surrounding the ducts also contains fat cells and fibroblasts that provide support and nourishment to the developing glands. Overall, the mammary gland is in a state of early development and is not yet mature enough to produce milk or fully functional for lactation.

In the pre-pubertal and multiparous females, only the small teats are visible, as the mammary tissue does not develop until the end of the first pregnancy. At the peak of lactation, the udder is well developed in size and show well developed milk vein. The udder of she-camel consists of four glandular quarters, each with it is own teat **(Nosier, 1974).** Each mammary gland consists of parenchyma, connective stormy, ducts and alveolar systems. The gland is mode of several individual lobules separated by septa of connective tissue (interlobular connective tissue). The glandular unites of the lobule. The alveoli is separated from each other by intralobular connective tissue, which projects from the interlobular connective tissue **(Nosier, 1974).** The duct system begins with small intraocular ducts that enlarge progressively and each duct is lined by an epithelium resting on distinct basement membrane. The duct epithelium is low, simple and secretary in the smallest interlobular duct but becomes columnar in the larger duct **(Nosier, 1974).** In the prepubertal cow the mammary gland contained only a few ducts **(Turner, 1952).**

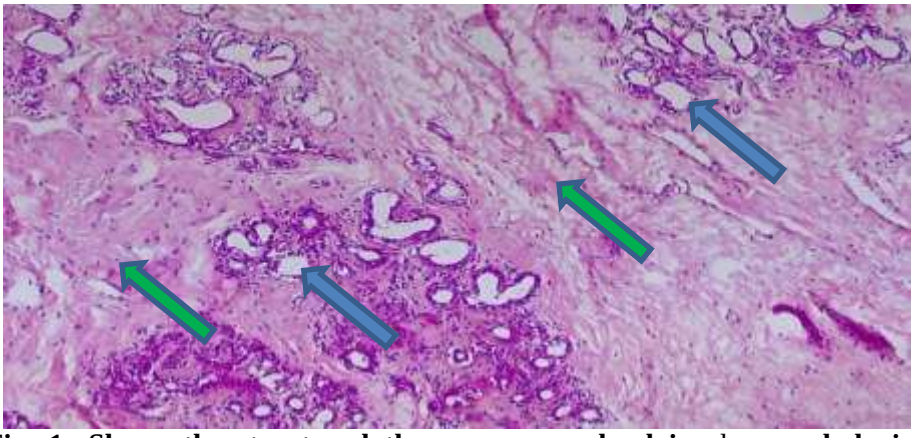

Fig. 1: Shows the structured the mammary gland in she-**camel during <u>before Puberty:</u>** Photomicrograph of section in mammary gland showing few clusters. loose arranged ducts system (blue arrow) scattered throughout the abundant stromal tissue (green arrow), absent lobulo alveolar structure HX&E 10

<u>Electron Microscopic Results:</u>

The electron microscopic structure of the mammary gland **<u>before Puberty</u>**

show the presence of rudimentary ductal structures surrounded by a layer of myoepithelial cells. These rudimentary ducts are composed of epithelial cells that are relatively undifferentiated and immature.
Observed epithelial cells with sparse organelles and minimal cytoplasmic volume. The cells are arranged in a single layer within the ductal structure.

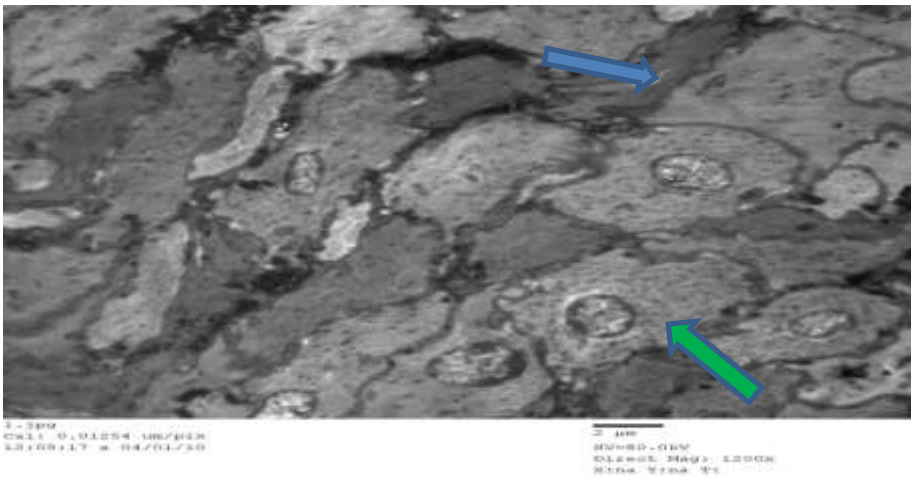

Fig. 2: Electron micrograph of section in mammary gland showing rudimentary ductal structures (blue arrow), surrounded by a layer of myoepithelial cells. (green arrow)

After Puberty :

Histologyical results:

Fig (3) shows the structured the mammary gland in she-camel during **After Puberty** cha accumulate more fatty tissue.
nags as an increase in the number of lobules and ducts. The number of glandular tissues has increased, while that of the connective tissue has decreased. The glandular tissue within the mammary gland composed of lobules, which are clusters of glandular cells, as well as ducts well defined lobules of duct system, stromal, adipose tissue blood vessel. Additionally, adipose (fat) tissue increases as they The 15–25 ducts drain the alveoli and merge into larger ducts that eventually converge into the central milk duct, which dilates slightly to form the lactiferous sinus before narrowing as nit passes through the nipple and open into the nipple surface. The nipple has different 5–9 ducts on average **(Love, and Barsky, 1957)**. The diameter of the main ducts in the non-lactating mammary gland is 1.2–2.5 mm. The nipple pores are 0.4–0.7 mm in diameter and are surrounded by circular muscle fibers **(Vorherr,1974. and Bannister, *et al.*, 1995)**. The glandular and adipose tissue ratio is 1:1 on average and declines with advancing age **(Jamal, *et al.*, 2004).** After puberty, these ducts divided into small ductless, and some alveoli appeared after five or six estrous cycles **(Turner, 1952)**.

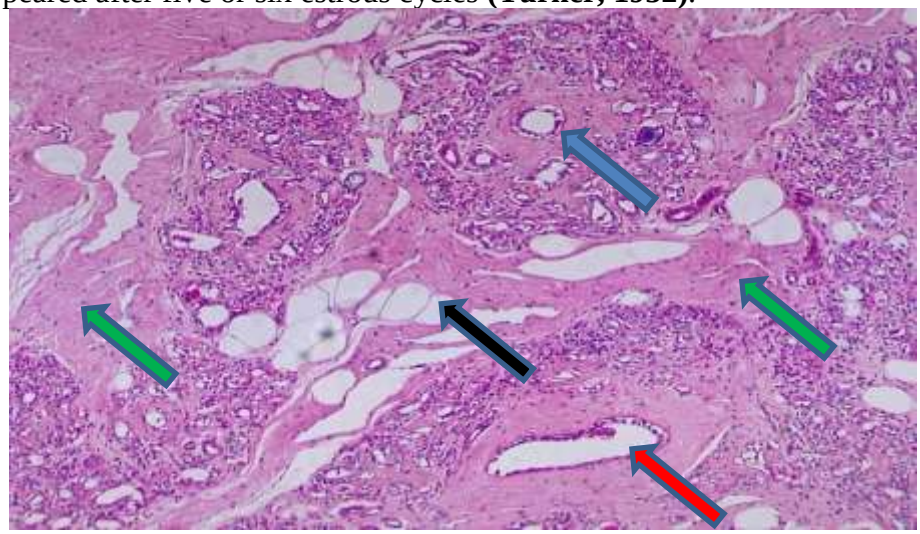

Fig. 3: Photomicrograph section in mammary gland showing that amount of the glandular tissues were increased, while that of the connective tissue were decreased.; well defined lobules of duct system (blue arrow), stroma (green arrow) , adipose tissue(black arrow) blood vessel (red arrow) HX&E 100

Electron Microscopic Results:

The electron microscopic structure of the mammary gland at **Puberty** involves development of numerous terminal end buds and ductal elongation, are comprised of multiple layers of epithelial cells, surrounded by my epithelial cells and stromal components. The epithelial cells within the well proliferated and differentiated to form alveoli, there is an increase in the number of stromal cells and blood vessels to support the growing glandular tissue.

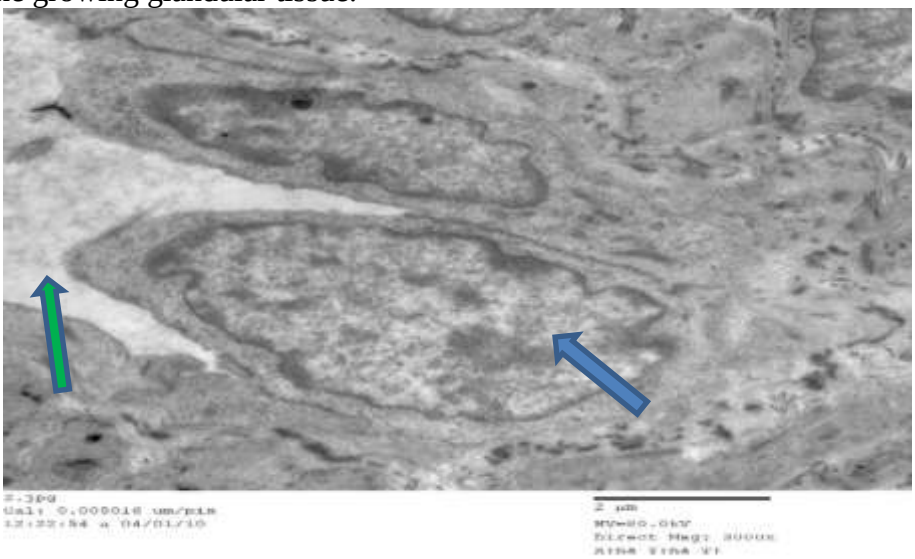

Fig. 4: Electron micrograph section in mammary gland showing development of ducts. (green arrow) The epithelial cells within the well proliferated and differentiated to form alveoli (blue arrow).

Pregnancy stage:

Histological results:

Fig (5) shows the structured the mammary gland in she-camel during pregnancy mammary gland in this figure show that the composed of lobules, which contain clusters of alveoli where milk production occurs. This figure also shows that the alveoli increase in size and number. The epithelial cells within them proliferate and become more active and large, clear areas of apical cytoplasm, a region occupied by glycogen and lipid. The lobules of alveoli are forming in groups and there is still considerable stromal tissue. The lobules also become more vascularized. Additionally, the connective tissue surrounding the lobules becomes more developed to provide structural support. During pregnancy, mammary branching occurs through two distinct phases: An

early or proliferative phase and the second secretory or differentiation (functional) phase. The proliferative phase starts with the onset of conception (early pregnancy), characterized by rapid and extensive proliferation of mammary epithelial cells within the ductal branches, developing alveoli, and enhanced survival **(Russo 2004 and Russo *et al.*, 2005)** in early stage of gestation in cow. However, **Kensinger *et al.*, (2002)**, reported that the lobuloalveolar structure of the mammary gland began to develop at about day 150 of pregnancy, and development was nearly complete by the end of gestation **(Cowie, 1970)**. Ultra structural examinations revealed that the prolactating alveolar cell had an irregularly shaped nucleus centrally located, a small amount of rough endoplasmic reticulum, a poorly developed Golgi apparatus, and few mitochondria **(Howard, *et al.*, 2005),(Heald, 1974), (Saakeand, 1974).**

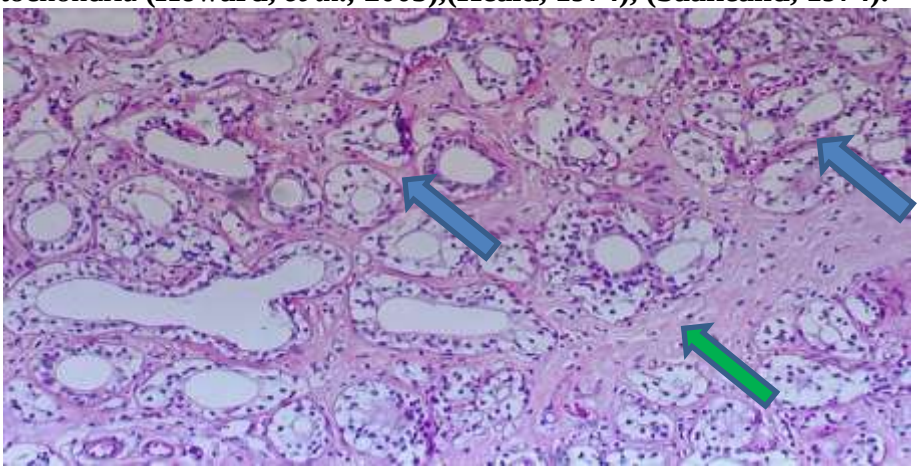

Fig. 5: Photomicrograph section in mammary gland showing the lobules of alveoli. The epithelial lining is again two layered, the bottom layer being principally my epithelium are forming in groups (blue arrow) and there is still considerable stromal tissue green arrow HX&E 200

Electron Microscopic Results:

The electron microscopic structure of the mammary gland in pregnancy shows that there were an increase in the number and size of alveoli, which are lined with epithelial cells, which become more prominent and active. Additionally, the mammary gland ducts also become more branched and complex. Ultra structural examinations revealed that the prelactating alveolar cell had an irregularly shaped nucleus centrally located, a small amount of rough endoplasmic reticulum, a poorly developed Golgi apparatus, and few mitochondria **(Howard, *et al.*, 2005),(Heald, 1974), (Saakeand, 1974).**

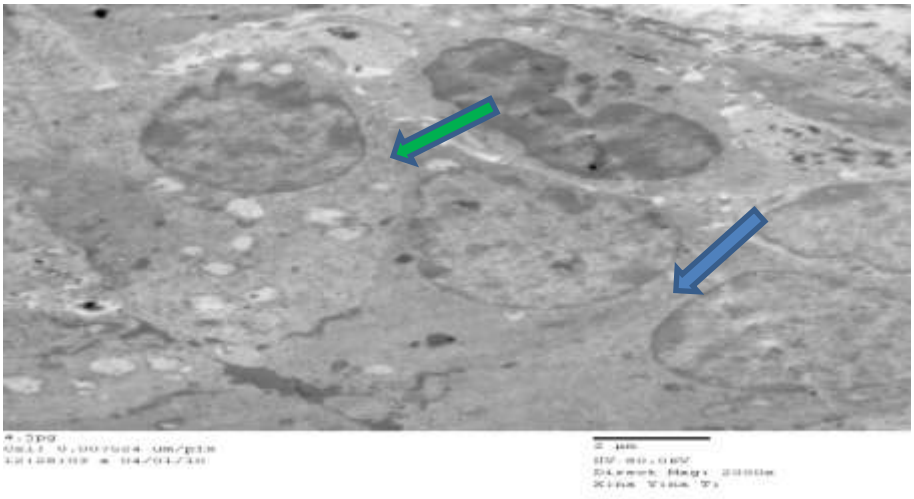

Fig. 6: Electron micrograph section in mammary gland showing increase in the number and size of alveoli(blue arrow) which are lined with epithelial cells, which become more prominent and active. (green arrow)

In lactation

Histological results:

The microscopic structure of the mammary gland during lactation in Fig(7) shows the lobules of alveoli are almost fully developed. The alveoli are full of secretion, distended alveoli with the characteristic secretory epithelium. The epithelial lining is again two layered, the bottom layer being principally my epithelium, and the stromal tissue is reduced to thin bands separating lobules. These alveoli are surrounded by my epithelial cells, there is an increase in blood vessels at lactation. A diffuse layer of contractile basal-my epithelial cell surrounds the secretory epithelial cells in the alveoli, whereas the smooth muscles surround the areola-nipple complex. My epithelial cells support the collecting and ejection of milk from the 15 to 20 lobular ducts, which are connected to interlobular ducts. In turn, each lobe drains milk into the nipple. The my epithelial cells contract in response to oxytocin stimulation, which results in milk release, whereas the high levels of progesterone inhibit milk production during pregnancy). In lactating mammary glands, there is a huge expansion of the vasculature within the stromal to support milk production through supplying a large number of various micro-and macro-molecules **(Djonov *et al.*, 2001).** in sheep and goat that during late gestation, as well as during early to mid- lactation, mammary gland expansion occurs, with an increase in the number of epithelial cells and lumen area, which leads to increment of the parenchyma tissue, as well as a reduction of stromal, corresponding macroscopically to the increase in mammary gland volume reported by **Joana *et al.*, (2014)**. During lactating stage, the alveolar lumen was large

and filled with electron dense casein micelle and lipid droplets. The same was reported by **Kensinger *et al.*, (2002)**. After lacto genesis, the alveolar cell had a flattened nucleus in basal position, an extensively developed rough endoplasmic reticulum, a Golgi apparatus with enlarged vesicles containing secretory material, and increased number of mite-Chandra. The diameter of alveolar lumen in non-lactating non-pregnant animal reduced up to two months. However, in non-lactating early to late pregnant stage, a linear increase in the diameter of alveolar lumen was observed (DURGA , et al 2019) The diameter of alveolar lumen was found reduced with the advancement of lactation from colostrum stage to ten months of lactation (Durga , et al 2019) in sheep and goat that during late gestation, as well as during early to mid- lactation, mammary gland expansion occurs, with an increase in the number of epithelial cells and lumen area, which leads to increment of the parenchyma tissue, as well as a reduction of stromal, corresponding macroscopically to the increase in mammary gland volume **Joana *et al.*, (2014).** The mammary gland of the dromedaries she-camel is composed of connective stromal and glandular parenchyma. The glandular parenchyma of the dromedaries she-camel mammary gland showed an arrangement of lobules in between the interlobular connective tissue. Each lobule presents a group of small unequal size secretory units' "alveoli" (Kausar et al. 2001).

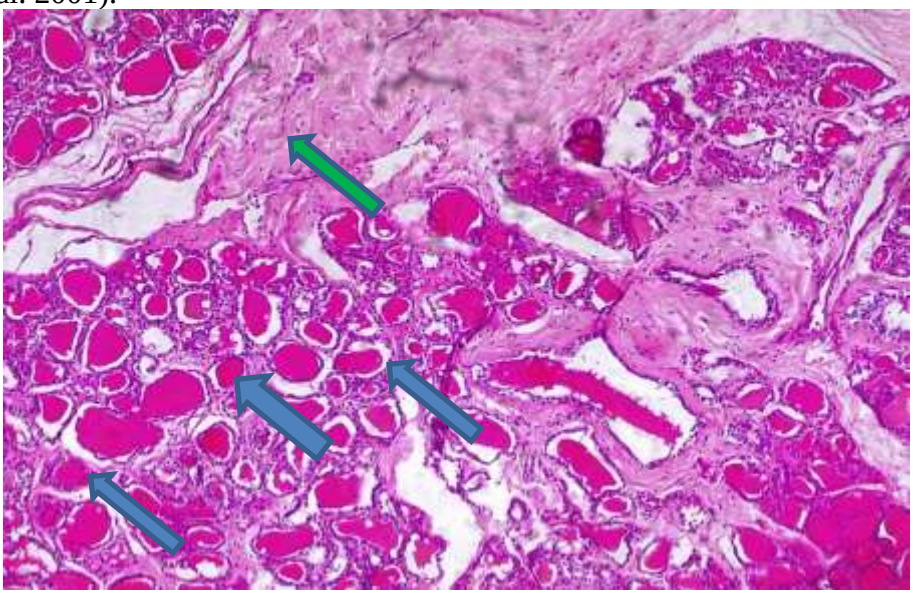

Fig. 7: Photomicrograph section in mammary gland showing the lobules of alveoli are almost fully developed. The alveoli are full of secretion (blue arrow), and the stromal tissue is reduced to thin bands separating lobules (green arrow) HX&E 200

Electron Microscopic Results:

The mammary gland in lactation shows significant changes at the electron microscopic. The secretory alveoli of the mammary gland have enlarged, with increased numbers of secretory vesicles containing milk proteins. The cells lining the alveoli show a high level of activity with abundant rough endoplasmic reticulum (RER) and Golgi apparatus, secretory vesicles. also shows an increase in the number of my epithelial cells surrounding the alveoli.

Fig. 8: Electron micrograph section in mammary gland showing The secretory alveoli. (blue arrow) The cells lining the alveoli show a high level of activity with abundant rough endoplasmic reticulum (RER) and Golgi apparatus, (green arrow)

In Dry

Histological results:

Fig (9) shows the structure of the mammary gland in dry. abundant and dominant stromal tissue rudimentary glandular tissue . The lobules within the gland, which are responsible for producing milk, decrease in size and number. This reduction in lobular tissue is known as involution. Additionally, there is an increase in fibrous and fatty tissue within the gland, leading to a decrease in overall glandular tissue.

A non-lactating dry period between successive lactations is necessary to permit replacement of damaged or senescent epithelial cells

through the processes of cell turnover **(Capuco *et al.*, 1997 and Fitzgerald *et al.*, 2004)**, which, in turn, allows maximum milk production to occur during the ensuing lactation. **Wall *et al.*, (2005)** indicated apoptosis and proliferation indices in (MEC) during dry off in dairy cows. When milk stasis occurs in pregnant animals, the mammogenic and lactogenic stimulation of pregnancy opposes stimuli for mammary involution. Traditionally, the sequential events occurring within bovine mammary tissue during a 60-d dry period were classified as: 1) active involution (transition from lactating to non-lactating state), 2) steady state involution (non-lactating state), and 3) differentiation (colostrum formation), with respective durations of approximately 21, 18, and 21 d **(Hurley, 1989)**. Thus, a dry period of <40days would be considered insufficient time for the sequential processes of involution to occur **(Hurley, 1989)**. However, the importance of steady state involution has never been established **(Grummer and Rastani, 2004)**. 20 Based on comparisons of mammary weight, total mammary DNA content and histology. **Swanson *et al.*, (1967)** concluded that little cellular involution occurred during dry period. Using a combined evaluation of tissue morphology and total udder DNA, **(Capuco *et al.*, 1997)** reported that throughout a 60-day dry period no net loss of MEC occurred, tissue area occupied by epithelium did not decrease, and alveolar structures remained intact when compared with 0-day dry period.

The secretary units, actinic or alveoli, are small vesicles of unequal size that from the lobule-alveolar system. The epithelial lining of the alveoli (flattened to columnar epithelium) shows great variation according to stage of lactation and secretary activity of the gland. In the non-lactating she-camel, the number and size of alveoli per lobule decreases, the parenchyma tissue regresses and the inter alveolar filled with interstitial connective tissue **(Nosier, 1974)**. A non-lactating mammary gland comprises glandular (secretory) and adipose (fatty) tissue with fibrous connective tissue called Cooper's ligaments. The glandular tissue has 15 to 20 lobes and lobules containing 10 to 100 alveoli (0.12 mm in diameter) **(Hartmann 1991).** The lobe size varies from 20 to 30 folds **(Moffatt and Going 1996).** In non-lactating, non-pregnant stage presence of desquamated cells in small alveolar lumen were observed. However, in non-lactating, late pregnant animals, the alveolar lumen was filled with large amount of secretory material, consisted of electron dense predominant granular protein material and large lipid droplets of intermediate electron density between them. Same was reported by **Morales (1977)**.

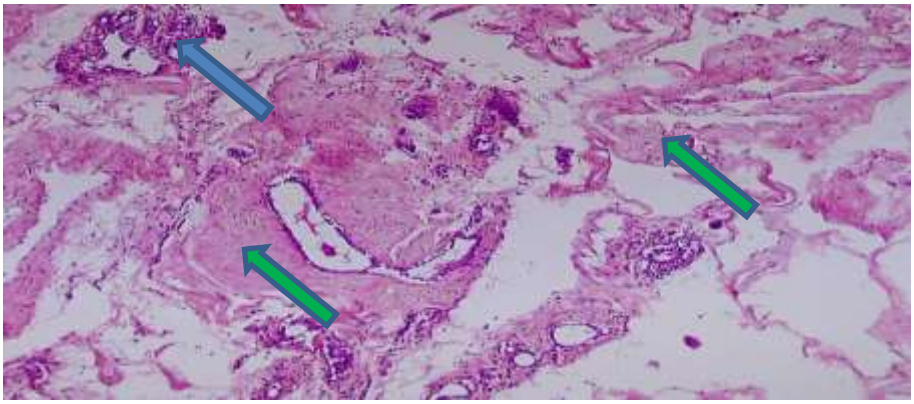

Fig. 9: Photomicrograph section in mammary gland showing abundant and dominant stromal tissue (green arrow) rudimentary glandular tissue (blue arrow), HX&E 200

Electron Microscopic Results:

The electron microscope Fig. of the mammary gland during dry showed decrease in the number and size of the lobules and alveoli in the mammary gland, a reduction in the presence of secretory cells, and an increase in fibrous and adipose tissue within the breast. The number and size of alveoli per lobule were decreased, and the parenchymatous tissue was reduced and replaced by interstitial connective tissue during the non-lactating phase **(Nosier 1974; Kausar et al. 2001)**.

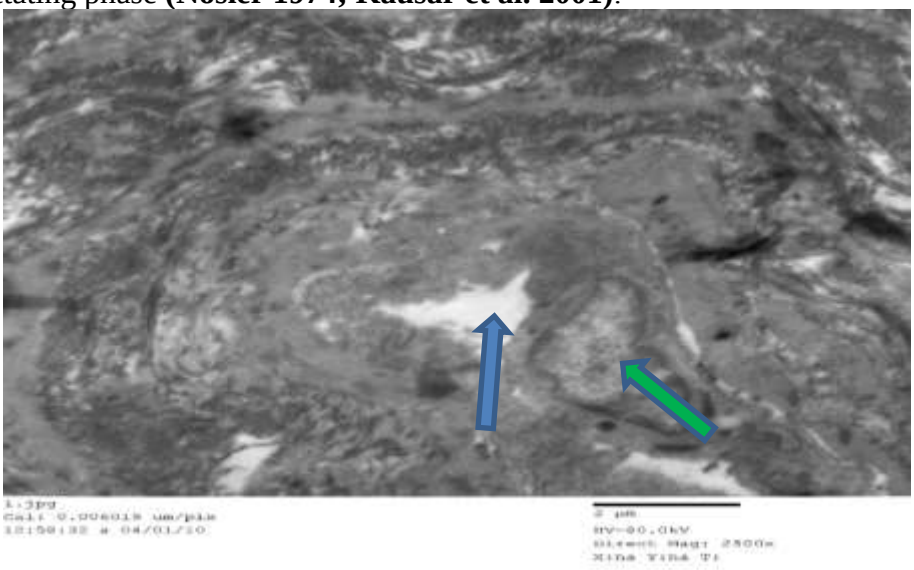

Fig. 10: Electron micrograph section in mammary gland showing rudimentary alveoli (blue arrow),a reduction in the presence of secretory cells (green arrow)

Table1: Effect of physiological stage at hormonal concentration in she dromedary she-**camel**

Gr	PGR(IU/mg)	E2 pg/mL	PRL(IU/mg)	OX pg/mL
Before Puberty	ab 1.927 ±0.356	b 22.050 ±0.462	c 4.150 ±0.132	d 16.725 ±0.423
After Puberty	b 1.972 ±0.138	a 28.525 ±1.676	b 6.875 ±0.547	b 23.250 ±0.340
Pregnancy stage	a 2.183 ±0.922	c 14.650 ±0.678	b 7.450 ±0.366	d 16.375 ±0.301
Lactation stage	b 0.697 ±0.070	b 24.000 ±1.063	a 17.430 ±0.396	a 32.675 ±0.810
Dry stage	b 0.708 ±0.186	d 11.200 ±1.114	b 7.527 ±0.261	c 18.200 ±0.387
P	**0.0794**	**0.0001**	**0.0001**	**0.0001**

a.b.c.d.e. Values with the different superscripts within a column are significantly different (P<0.05) a,b Values with the different superscripts within a row are significantly different (P<0.05)

However, with regard to chemical decomposition, the results showed the following:

First, progesterone begins, and it was not the highest in the pregnancy stage, so its height decreases in a special period for each branch. There are significant differences between the various stages (0.07).

Secondly, estrogen: It was noted that the highest average was in the stages of puberty and after puberty, and the lowest was the stage where there was high significance between the seasons (0.0001).

Thirdly, Bronsactin: the highest percentage was moderate during the production period and the lowest during the sterilization period, and there were also no highly significant differences between the averages (0.0001).

Fourth quarter Oxytocin: The highest average percentages during the production period and the lowest during the period, with the exception of no highly significant differences between the averages (0.0001).

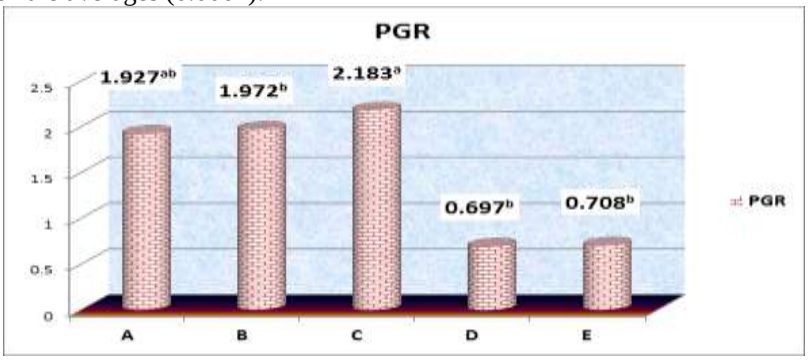

Fig. 11: The hormonal changes in serum estrogen, progesterone, prolactin and oxytocin during different stages (before puberty- after puberty- pregnancy (lactation- Dray) in she-camel. The results show that serum progesterone befor puberty 1.927± 0.356 while of after puberty serum progesterone were increased during pregnancy period to reach to 2.183 and were decreased the lowest level 0.697 during lactation stage. In dray beriod serum estrogen dray were decreased to reach to the lowest level 0.708

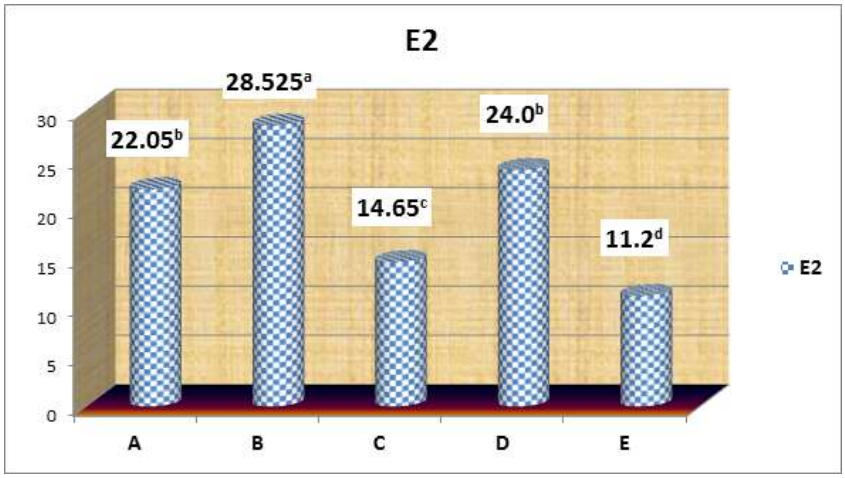

Fig. 12: The results show that serum estrogen before puberty 22.05±0.462 while of after puberty serum estrogen were decreased during pregnancy period to reach to 14.650 and were increased to reach to 24.00 during lactation stage. In dray period serum estrogen lactation were decreased to reach to the lowest level 11.2 Estrogen stimulates the development of mammary ducts, and a combination of progesterone and estrogen stimulates the development of alveolar tissues. The action of these hormones is mediated via their specific intracellular receptors; Estrogen receptor (ER) and Progesterone receptors (PR). The localization of the ER and PR in the mammary gland during the different stages of development varies between the different species **(Schams *et al.*, 2003; Colitti and Parillo 2013; Ellen *et al.*, 2017).**

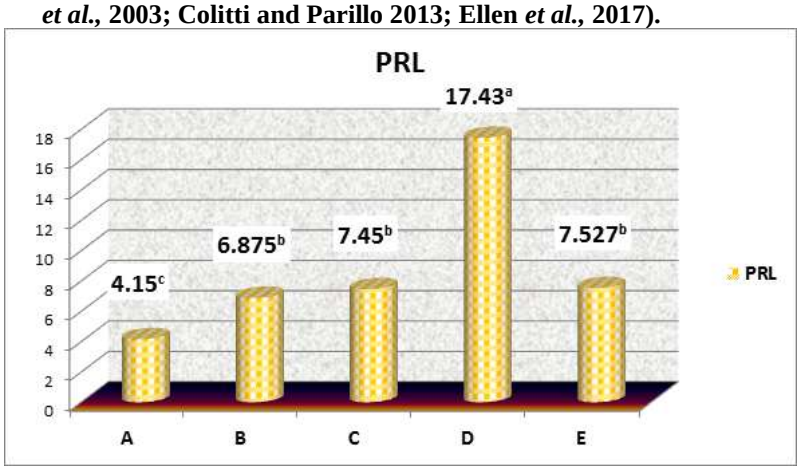

Fig. 13: The results show that serum prolactin after puberty 6.875±0.396 while of pregnancy serum prolactin were increased during pregnancy period to reach to 7.54 and were increased to reach to 17.43 during lactation stage. In dray period serum prolactin before puberty were decreased to reach to the lowest level 4.15

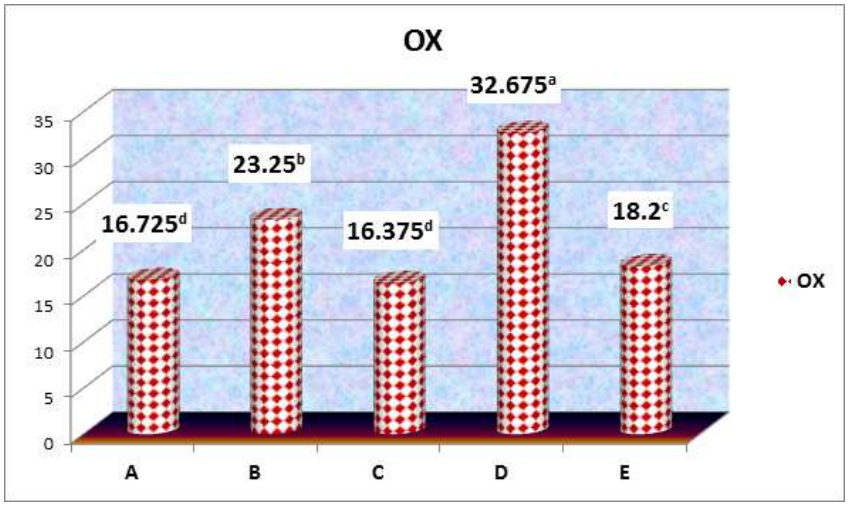

Fig. 14: The results show that serum oxytocin after puberty 23.25±0.423 while before puberty serum oxytocin were decreased in dry period to reach to 18.20 and were increased to reach to 32.675 during lactation stage. In dray period serum oxytocin during pregnancy were decreased to reach to the lowest level 16.375

CONCLUSION

The current study showed a close relationship between hormonal changes, especially sex hormones, and the development of the udder, as it was noted that there was a noticeable effect and increase in the hormones estrogen and progesterone during sexual puberty, indicating their significant impact on the growth rates of the udder. Their effect decreased during the birth stages, and this appeared in the histological results, as the development of the mammary vesicles was observed at this stage and their number increased. Oxytocin levels increased as an indication of the contraction of the udder muscles and the mammary vesicles as an indication of the udder's ability to secrete or collect milk secretions. Prolactin also increased during the birth stage as a clear indication of the mammary gland's ability to produce milk, and this was shown by the histological examination, as development, maturity, and an increase in the number and size of the mammary vesicles and the expansion of the mammary ducts were observed. It was also noted at the end of the milking season and during the dry stage that the levels of oxytocin hormones decreased as an indication of the inability of the mammary gland to collect secretions, as well as a decrease in the levels of prolactin hormone as an indication of the inability of the mammary gland to produce milk. The histological examination showed, where the decline and decrease in the number of mammary follicles were noted, and the progesterone and estrogen hormones rose again to rebuild the mammary follicles in preparation for the next milk season

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التغيرات الهرمونية وعلاقتها بتطور الغدد اللبنية وانتاج اللبن في النوق

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لقد تم تصميم هذه الدراسة بقسم الانتاج الحيوانى –كلية الزراعة –جامعة الازهر بالقاهرة بالتعاون مع معهد بحوث الانتاج الحيواني –مركز البحوث الزراعية – على 20 ناقة فى قطيع من الابل في مزرعة خاصة بمدينة بلبيس بمحافظة الشرقية وذلك خلال الفترة من يناير 2021 حتى فبراير 2024م.

وقد اجر يت التجارب العملية على عدد 20 ناقة من الابل العربية احادية السنام فى اعمار مختلفة حيث قسمت الى خمس مجموعات

اجريت الدراسة علي مرحلتين يتم اختيار الإبل بحيث ان تكون فى اعمار مختلفة وهى مرحلة قبل وبعد البلوغ الجنسي وفترة الحمل وفترة الانتاج ومرحلة الجفاف

اولا الدراسة الهيستولوجية

تم اخذ عينات من خلايا الضرع في الاعمار المختلفة في الخمس مراحل وتم دراستها بالميكرسكوب العادي والالكتروني

ثانيا / دراسة التغيرات الهرمونية

تم اخذ عينات دم من نفس الحيوانات لدراسة التغيرات الهرمونية في المراحل الخمس المختلفة وربطها بالتغيرات الهستولوجية .

بناء على الدراسة السابقة وجد أن

انه يمكن ربط التغيرات الهرمونية بالتغيرات الهستولوجية في الضرع فمن خلال التحليل الهرموني يمكن معرفة مستوي الخلايا الافرازية في الضرع والمرحلة التي يقع فيها الحيوان من مراحل التطور المختلفة خلال الحياة الإنتاجية.

- يمكن عن طريق التحليل الهرمونى فى الدم التنبؤ بكمية انتاج اللبن وطول موسم الإنتاج ومدى المثابرة على معدل ثابت انتاج اللبن.
- يمكن التنبؤ بصلاحية النوق في انتاج اللبن والتسمين والبيع لأن الإبل حيوان ثنائى الغرض.
- وعلية فإنه يمكن عمل المزيد من الدراسات على المواسم الانتاجية المتتالية والعمل على زيادة الإنتاج عن طريق التحكم الهرموتى وزيادة الحويصلات اللبنية وتطور الضرع.