STUDY OF BACTERIAL INFECTIONS IN THE URINARY SYSTEM OF GOATS IN MOSUL CITY.

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ABSTRACT

The objectives of this study were to isolate different bacterial species from goat urine, and determining some physical and chemical parameters in goat's urine to record some microscopic changes in the urine sediments of the samples. Altogether, 200 urine samples were collected from 1-7 years old goats of both sexes from slaughtered goats in the abattoir in Mosul City, Iraq, half of them from male goats (bucks) and the other half from female goats (does).The number of control group was 88 samples in males and 80 samples in females.The results showed that the urine samples of infected animals were highly turbid, dark yellow color with low specific gravity. The microscopic examination of the urine sediments revealed increased number of pus cells (WBCs), erythrocytes, epithelial cells, casts and crystals/high power field (HPF) in the urine samples of infected animals in comparison with the urine samples of non-infected animals (free from bacterial isolates).The chemical examination of the urine samples revealed elevated urobilinogen, glucose, ketones, blood, proteins, leukocytes and pH levels of the urine samples of the infected animals with bacterial infections. Culture of urine samples revealed that the overall bacterial infection was 32 (16%) out of 200 urine samples.The infection rate with *Corynebacterium renale* was 2%, *Corynebacterium cystitidis* 2% , *Corynebacterium pilosum* 1.5% , *Escherichia coli* 2%, *Staphylococcus aureus* 2%, *Streptococcus pyogenes* 1.5%, *Klebsiella pneumonae* 1%, *Enterococcus faecalis* 1%, *Pseudomonus aeruginosa* 1%, *Trueperella pyogenes*1% and *Proteus mirabilis* 1%. The infection rate with different bacterial species was higher in female goats (Doe goats) than the male goats (bucks) and the infection rate was higher in old animals compared to the young animals.

INTRODUCTION

Diseases of the urinary system in goats have been less frequently reported in comparison with other ruminants (1).Vulvovaginitis and balanoposthitis are significant urinary infections which result in infertility in small ruminants (2) and this causes economic losses (3). Ulcerative balanoposthitis and vulvovaginitis in small ruminants are venereal diseases characterized by erosion and ulceration of the glans penis and vulval mucosa (4).Ulcerative conditions of the genitalia of goats have been described in New Zealand, India, Nigeria and Australia (5-8). Ulcerative balanoposthitis is caused by many organisms such as *Corynebacterium renale, Corynebacterium pilosum* and *Corynebacterium xylosus* (9). Urethritis and obstructive urolithiasis in goats have been widely reported (10-12). Male goats have higher risk for this condition than female goats because of the length and curvature of the urethra and due to the existence of urethral process with a narrow diameter in which the calculi is retained (13). Cystitis occurs in goats characterized by frequent, painful urination and evidence of blood, inflammatory cells and bacteria in the urine. Many bacterial spp cause cystitis but predominantly *Escherichia coli, Corynebacterium renale, Streptococcus* and *Pseudomonus spp*. (14). The bacteria usually invade the bladder by ascending through the urethra or by descending infection from embolic nephritis and pyelonephritis cases (15). The pyelonephritis occurs when bacteria ascend from the lower urinary tract to the ureters and reach the renal pelvis, medulla and cortex or through hematological routes due to septicemic cases caused by *Pseudomonus aeruginosa* (16). The urine stasis may occur due to the ureters being blocked by inflammatory debris or because of pressure from the uterus in pregnant animals and by obstructive urolithiasis (17). Pyelonephritis is attended by pyuria and hematuria due to inflammatory lesions of the ureters and bladder (18).

Urinalysis is a useful tool for diagnosis of urinary tract infections (19). The complete urinalysis includes physical examination of urine such as the color and transparency of urine samples and determination of specific gravity, while the chemical analysis of urine includes determination of pH, proteins, glucose, ketone bodies and bilirubin in urine samples (20-25). The microscopic examination of urine has many clinical importance including determination of casts, epithelial cells, crystals, leukocytes and erythrocytes in urine sediments(15)

The aims of this study are to isolate different bacterial agents in goat urine, determining some physical and chemical parameters in goat urine and microscopically examining urine sediments in urinary tract-infected animals.

MATERIALS AND METHODS

Animals and samples collection

Two hundred urine samples were collected in the abattoir from the period 3 November,2019 to 3 March,2020 half of them from slaughtered male goats (bucks) and the other half from slaughtered female goats(does) with 1-7 years age through aspiration of urine from urinary bladder directly by using sterile 20 ml syringes and collected in sterile containers (19,26,27). The number of control group were 88 samples in males and 80 samples in females which were free from bacterial isolates. The female goats(does) were not pregnant.

Physical examination of urine samples

The physical examination of urine included the color, transparency and specific gravity of urine by observing it in a urinometer cylinder.The color was given many grades- straw, light yellow, yellow, and dark yellow - while transparency was graded as transparent, light turbid, medium turbid and highly turbid, and the specific gravity was measured by the urinometer apparatus (19).

Chemical analysis of urine

The urine samples were chemically analyzed using urine strips from (Plasmatec Laboratory Products Limited, Unit 29 Dreadnought Trading Estate, Bridport, Dorset DT6 5BU. UK.) which including urobilinogen, glucose, bilirubin, ketones, specific gravity, occult blood, pH, protein and leukocytes in urine samples (19,21,24,28).

Microscopic examination of urine

The urine samples were microscopically examined by centrifuging 5 ml of urine in a test tube at 3000 rpm; the supernatant was discarded and the sediment was agitated, then one drop of the sediment was applied on a slide and covered with coverslip. It was then examined with high power field (HPF,40X) to determine the number of leukocytes (pus cells), erythrocytes, epithelial cells, casts and crystals in the urine sediments (15,19,29).

Bacterial isolation

The urine samples were cultured primerly on blood agar, Macconkey agar, and nutrient agar and then subjected to incubation at 37°C for 24 hours. Then, the bacterial colonies were subcultured on selective media including Manitol salt agar for *Staphylococcus spp*, Edward's medium for *Streptococcus spp*, Hoyles medium for *Corynebacterium spp*, and Staphylococcus

medium No.110. for *Staphylococcus spp* and incubated at 37°C for 24 hours. Then, biochemical tests were performed including Indole test, Methyle red test, Voges-proskauer test, Citrate utilization test, Urease test, Nitrate reduction test, Catalase test, sugar fermentation test, Oxidase test and Coagulase test (30).

Some bacterial colonies were identified using Vitek 2 Technology. The VITEK® 2 gram-positive and gram- negative identification cards are intended for use with VITEK® 2 system for automated identification of most gram-positive and gram-negative organisms. They are based on established 42 biochemical tests measuring carbon source utilization, enzymatic activities and resistance (Bio Merieux,USA). The negative bacterial isolates sample were regarded as control.

Statistical analysis

The independent T-test was used for differentiation between the results of positive bacterial isolates urine samples and negative bacterial isolates urine samples and the SPSS program was used in the statistical analysis of the data and determination of the significant differences (Microsoft version 10.6).

RESULTS

The results of the physical examination of urine samples of the slaughtered animal urine samples with positive bacterial isolates revealed that 16% of urine samples of the slaughtered animals had dark yellow color, while the urine samples with negative bacterial isolates revealed that 25% of urine samples had straw color, 28% had light yellow color and 31% had yellow color (Table 1).

The results of transparency of the slaughtered animal urine samples with positive bacterial isolates revealed that 6% of urine samples were light turbid, 6% were medium turbid, and 4% were highly turbid while the results of urine samples which were free from bacterial isolates revealed that 47% of urine samples were transparent and 37% were light turbid (Table 2).

The results of measurement of specific gravity of urine samples revealed that there was a significant decrease in the levels of specific gravity of urine samples of animals with bacterial infections in comparison with the levels of specific gravity of urine samples of non-infected animals with bacterial infections (Table 3).

Table 1: Color of urine in the urine samples of slaughtered animals (n=200).

No. of urine samples	Status of bacterial isolation	Color of urine	No. of male urine samples	No. of female urine samples	Total number	%
No. of **slaughtered animal urine samples (200 samples)**	Positive bacterial isolates (infected) 32 samples	Dark yellow	12	20	32	١٦
	Negative bacterial isolates (control) 168 samples	Straw color	٢٥	25	50	٢٥
		Light yellow	32	24	56	28
		yellow	31	31	62	31
Total			100	100	200	100

Table 2: Transparency of urine in the urine samples of slaughtered animals (n=200)

No. of urine samples	Status of bacterial isolation	Grade of transparency	No. of male urine samples	No. of female urine samples	Total number	%
No. of slaughtered animal urine samples (200 samples)	Positive bacterial isolates (infected) 32 samples	Light turbid	4	8	12	6
		Medium turbid	6	6	12	6
		Highly turbid	2	6	8	4
	Negative bacterial isolates (control) 168 samples	transparent	46	48	94	47
		Light turbid	42	32	74	37
Total			100	100	200	100

Table 3 : The specific gravity of urine samples of infected and non- infected animals with urinary tract infections (n=200).

Animal ages	Urine samples of slaughtered animals (200 samples) Mean ± S.E.			
	Males 100 samples		Females 100 samples	
	Negative bacterial isolates (control) 88 samples	Positive bacterial isolates (infected) 12 samples	Negative bacterial isolates (control) 80 samples	Positive bacterial isolates (infected) 20 samples
1-2years	1.038 ± 0.31	*1.016 ± 0.01	1.040 ± 0.12	*1.018 ± 0.13
3-4years	1.039 ± 0.14	*1.014 ± 0.03	1.038 ± 0.14	1.016 ± 0.04
5-7years	1.040 ± 0.02	*1.011 ± 0.03	1.038 ± 0.02	*1.010 ± 0.01

* Means presence of significant differences at($P<0.05$).

The findings of chemical analysis of urine samples revealed a significant increase in the levels of Glucose,Ketones,Blood,Proteins and leukocytes in the urine samples of infected animals with bacterial infections in comparison with their levels in the urine samples of the non- infected animals with bacterial infections in slaughtered animal urine samples (Table 4).

The results of pH values of urine samples revealed a significant increase in the pH values of urine samples of infected animals with bacterial infections in comparison with the pH values of urine samples of non-infected animals with bacterial infections in slaughtered animal urine samples (Table 5).

Table 4: The chemical analysis of urine samples of infected and non-infected animals with bacterial infections (n = 200).

Chemical parameters	**Urine samples of slaughtered animals (200 samples) Mean ± S.E.**	
	Negative bacterial isolates (control) 168 samples	Positive bacterial isolates (infected) 32 samples
Urobilinogen mg/dl.	0.8 ± 0.01	* 5.42 ± 0.14
Glucose mg/dl.	0.6 ± 0.02	* 126.4 ± 8.33
Ketones mg/dl.	0	* 17.27± 2.31
Blood RBC/µl.	0	* 12.45 ± 1.48
Proteins mg/dl.	1.4 ± 0.02	* 42.18 ± 5.66
Leukocytes WBC/µl	0	* 32.28 ± 3.41

*Means presence of significant defferences at (P<0.05).

Table 5 : The pH values of urine samples of infected and non-infected animals with bacterial infections (n=200) .

Animal ages	**Urine samples of slaughtered animals (200 samples) Mean ± S.E.**			
	Males 100 samples		**Females** 100 samples	
	Negative bacterial isolates (control) 88samples	Positive bacterial isolates (infected) 12samples	Negative bacterial isolates (control) 80samples	Positive bacterial isolates (infected) 20samples
1-2years	7.25 ±0.02	*8.19 ± 0.11	7.18 ± 0.03	*8.91 ± 0.12
3-4years	6.94 ± 0.08	*8.26 ± 0.12	7.16 ± 0.06	*8.84 ± 0.12
5-7years	6.94 ± 0.05	*8.12 ± 0.03	6.92 ± 0.04	*8.64 ± 0.14

* Means presence of significant defferences at (P<0.05).

The results of microscopic examination of the urine sediments revealed significant rise in the number of leukocytes per high power field (HPF) 40X in the sediments of urine samples of infected animals with bacterial infections in comparison with the number of leukocytes in the sediments of urine samples of non-infected animals with bacterial infections (Table 6).

The microscopic examination of the urine sediments revealed a significant elevation in the number of erythrocytes per (HPF) in the sediments of urine samples of infected animals with bacterial infections in comparison with the number of erythrocytes in the sediments of urine samples of non- infected animals with bacterial infections (Table 7). Besides, the microscopic examination of the urine sediments indicated the presence of a significant rise in the number of epithelial cells per (HPF) in the sediments of urine samples of infected animals with bacterial infections in comparison with the number of epithelial cells in the sediments of urine samples of non-infected animals with bacterial infections (Table 8).

The results of microscopic examination of the urine sediments revealed a significant rise in the number of casts per (HPF) in the sediments of urine samples of infected animals with bacterial infections in comparison with the number of casts in the sediments of urine samples of non-infected animals with bacterial infections (Table 9). Moreover, the microscopic examination of the urine sediments revealed a significant rise in the number of crystals per (HPF) in the sediments of urine samples of infected animals with bacterial infections in comparison with the number of crystals in the sediments of urine samples of non infected animals with bacterial infections (Table 10).

Table 6 : The number of leukocytes/ high power field (HPF) 40X in the sediments of urine samples with bacterial isolates and without bacterial isolates (n=200).

Animal ages	**Urine samples of slaughtered animals (200 samples) Mean ± S.E.**			
	Males 100 samples		**Females** 100 samples	
	Negative bacterial isolates (control) 88 samples	Positive bacterial isolates (Infected) 12 samples	Negative bacterial isolates (control) 80 samples	Positive bacterial isolates (infected) 20 samples
1-2years	1.88 ± 0.12	*5.41 ± 0.32	2.18 ± 0.17	*6.52 ± 0.24
3-4years	1.35 ± 0.14	*6.54 ± 0.22	2.05 ± 0.16	*7.95 ± 0.31
5-7years	1.76 ± 0.21	*8.44 ± 0.25	1.37 ± 0.17	*8.88 ± 0.14

* Means presence of significant defferences at (P<0.05).

Table 7 : The number of erythrocytes/high power field (HPF) 40X in the sediments of urine samples with bacterial isolates and without bacterial isolates (n=200).

Animal ages	Urine samples of slaughtered animals (200 samples) Mean ± S.E.			
	Males 100 samples		Females 100 samples	
	Negative bacterial isolates (control) 88 samples	Positive bacterial isolates (infected) 12 samples	Negative bacterial isolates (control) 80 samples	Positive bacterial isolates (infected) 20 samples
1-2years	1.23 ± 0.18	*5.12 ± 0.21	1.41 ± 0.12	*5.72 ± 0.44
3-4years	1.66 ± 0.21	*6.23 ± 1.21	1.72 ± 0.17	*6.46 ± 0.24
5-7years	1.22 ± 0.19	*7.45 ± 0.61	1.35 ± 0.31	*7.31 ± 0.22

* Means presence of significant defferences at (P<0.05).

Table 8 : The number of epithelial cells/ high power field (HPF) 40X in the sediments of urine samples with bacterial isolates and without bacterial isolates (n=200).

Animal ages	Urine samples of slaughtered animals (200 samples) Mean ± S.E.			
	Males 100 samples		Females 100 samples	
	Negative bacterial isolates (control) 88 samples	Positive bacterial isolates (infected) 12 samples	Negative bacterial isolates (control) 80 samples	Positive bacterial isolates (infected) 20 samples
1-2years	1.14 ± 0.12	*5.61 ± 0.41	1.32 ± 0.18	*5.25 ± 0.52
3-4years	1.36 ± 0.21	*6.77 ± 0.51	1.66 ± 0.26	*6.73 ± 0.62
5-7years	1.38 ± 0.18	*6.51 ± 0.31	1.42 ± 0.22	*6.88 ± 0.32

* Means presence of significant defferences at (P<0.05).

Table 9 : The number of casts/ high power field (HPF) 40X in the sediments of urine samples with bacterial isolates and without bacterial isolates (n=200).

Animal ages	Urine samples of slaughtered animals (200 samples) Mean ± S.E.			
	Males 100 samples		Females 100 samples	
	Negative bacterial isolates (control) 88 samples	Positive bacterial isolates (infected) 12 samples	Negative bacterial isolates (control) 80 samples	Positive bacterial isolates (infected) 20 samples
1-2years	0.78 ± 0.11	*4.34 ± 0.16	1.22 ± 0.14	*4.25 ± 0.21
3-4years	0.98 ± 0.13	*5.64 ± 0.22	1.26 ± 0.25	*5.42 ± 0.26
5-7years	1.44 ± 0.18	*6.34 ± 0.31	1.38 ± 0.16	*6.38 ± 0.35

* Means presence of significant defferences at (P<0.05).

Table 10 : The number of crystals/ high power field (HPF) 40X in the sediments of urine samples with bacterial isolates and without bacterial isolates (n=200) .

Animal ages	Urine samples of slaughtered animals (200 samples) Mean ± S.E.			
	Males 100 samples		Females 100 samples	
	Negative bacterial isolates (control) 88 samples	Positive bacterial isolates (infected) 12 samples	Negative bacterial isolates (control) 80 samples	Positive bacterial isolates (infected) 20 samples
1-2years	1.36 ± 0.11	*5.23 ± 0.62	1.23 ± 0.21	*6.24 ± 0.41
3-4years	1.52 ± 0.18	*5.54 ± 0.43	1.43 ± 0.12	*6.42 ± 0.52
5-7years	1.64 ± 0.16	*5.71 ± 0.22	1.56 ± 0.16	*6.64 ± 0.62

* Means presence of significant defferences at (P<0.05).

The overall bacterial infection rate of the urinary system in the current study was 16% (32 out of 200).The detection of different spp of bacteria was performed according to their cultural characteristics, growing on selective media, biochemical tests in addition to the shape of bacteria after staining the slides with Grams stain. The results of bacterial isolation from urine samples of the infected animals revealed that the infection rate with *Corynebacterium renale* was 2%, *Corynebacterium cystitidis* 2%, *Corynebacterium pilosum* 1.5%, *Escherichia coli* 2%, *Staphylococcus aureus* 2%, *Streptococcus pyogenes*1.5%, *Klebsiella pneumonae* 1%, *Enterococcus faecalis* 1%, *Pseudomonus aeruginosa* 1%, *Trueperella pyogenes* 1% and *Proteus mirabilis* 1%.The infection rates were higher in female animals compared to male animals and the infection rates were higher in old age animals compared to young age animals (Table 11).

Table 11: The infection rates, types and frequencies of bacterial species isolated from urine samples of the infected animals (n=200).

Type of bacteria	1-2 years	3-4years	5-7years	Total	Infection rate %
Corynebacterium renale	-	١	٣	٤	2%
Corynebacterium cystitidis	١	١	٢	٤	2%
Corynebacterium pilosum	-	١	٢	٣	1.5%
Esherichia coli	١	١	٢	٤	2%
Staphylococcus aureus	-	٢	٢	٤	2%
Streptococcus pyogenes	-	١	٢	٣	1.5%
Klebsiella pneumonae	-	١	١	٢	1%
Enterococcus faecalis	-	١	١	٢	1%
Pseudomonus aeruginosa	١	-	١	٢	1%
Trueperella pyogenes	-	١	١	٢	1%
Proteus mirabilis	-	-	٢	2	1%
Total	٣	١٠	١٩	٣٢	16%

DISCUSSION

The appearance of straw color, light yellow or yellow color in urine samples free from bacterial isolates in slaughtered animal urine samples is due to the presence of urochromes and urobilinogin in the urine samples, while the appearance of dark yellow color in urine samples with positive bacterial isolates is due to increase in concentration of urochromes and urobilinogens in the urine samples of slaughtered animals which were infected with bacterial infections or it could be due to decrease in the volume of voided urine resulting from bacterial infections of the urinary tract, and this result is in agreement with (31,32) who explained the presence of dark yellow color in urine samples of animals infected with bacterial infections.

The appearance of urine samples free from bacterial isolates in slaughtered animal urine samples was transparent and light turbid, while the appearance of urine samples with positive bacterial isolates in slaughtered animal urine samples was light turbid, medium turbid, or highly turbid which could be attributed to the presence of crystals, cells , mucus, bacteria, casts and spermatozoa in the urine samples of infected animals with bacterial infections and this result is in agreement with (14,33) who reported high turbidity in the urine samples of infected animals with bacterial infections.

The levels of specific gravity of urine samples with positive bacterial isolates were lower than the levels of urine samples free from bacterial isolates which could be due to pathological changes in the kidneys such as cases of nephritis which are associated with tubular damage which occurs in chronic interstitial nephritis because the kidneys are unable to reabsorb water and concentrate the urine so that the specific gravity of urine samples will decrease, and this result is compatible with (34,35). The decrease in the levels of specific gravity of urine samples could be due to some diseases such as glomerulonephritis, or pyelonephritis. The specific gravity of urine samples of old animals was lower than young animals which could be due to the occurrence of urinary diseases in old animals rather than young animals because the old animals are more susceptible to urinary diseases than young animals (19).

The specific gravity of urine measures the ability of the kidney to dilute or concentrate the urine over that of plasma, so the loss of concentrating ability of the kidneys is between 1.020 and 1.040 (33).The low specific gravity of urine could be the result of osmotic dieresis, loss of medullary tonicity, deficiency of the anitidiuretic hormone (ADH) or due to resistance to anti-diuretic hormone, which is a secondary occurrence to several conditions including hyperadrenocotism, hypercalcaemia, pyometra, liver diseases, and hypokalaemia (36).

The urobilinogen is present in trace amounts in healthy animals urine, and in the current study there was a significant elevation of urobilinogen in the urine samples with positive bacterial isolates in comparison with its levels in the urine samples free from bacterial isolates and this could be attributed to some pathological changes such as bile duct obstruction, hepatic necrosis, leptospirosis and haemolytic diseases including immune mediated haemolytic anaemia or blood protozoa (37). The healthy animals excrete very small amounts of glucose in their urine, and in the current study there was a significant increase in the levels of glucose in the urine samples with positive bacterial isolates and this could be due to tubular resorption defect, acute renal failure, urinary obstruction, or diabetes mellitus (21,22). In cases of tubular resorption defect the renal tubules fail to reabsorb glucose from the glomerular filtrates which appear in urine (19,33).

The urine samples of healthy animals are normally free from red blood cells (RBCs) but in the current study there was a significant increase in the levels of RBCs / µl, in the urine samples with positive bacterial isolates and this probably might be due to hematuria which could be due to prerenal causes when there is vascular damage, such as trauma to the kidney, or septicemia. The renal causes of hematuria are acute glomerulonephritis, embolism of the renal artery, renal infarction, tubular damage due to toxic agents and pyelonephritis. The postrenal hematuria occurs due to cystitis and urolithiasis. The lesions in the kidney, bladder and proximal urethra lead to hemorrhage at the end of urination while the lesions in the middle and distal urethra causes bleeding at the beginning of urination (15).

Normal urine may have low levels of protein and this may be due to non-pathological causes such as high protein meals and exercise. In the current study, there was a significant increase in the levels of protein in the urine samples with positive bacterial isolates which may be due to pathological causes such as renal disease in which the glomerular leakage of proteins occurs, cardiac insufficiency, urinary tract infections, and hematuria. Many diseases lead to proteinuria because the inflammatory response causes glomerulonephritis(38). The proteinuria may be attributed to glomerulonephropathy, tubular inflammation or infection within the urinary tract, tubular transport defects, acute nephritis, pyelitis, urethritis, urolithiasis, cystitis, and pyelonephritis (28).

The urine samples of healthy animals are free from leukocytes (WBC) but in the current study there was a significant increase in the levels of WBC/µl, in the urine samples with positive bacterial isolates.These leukocytes might have originated in any part of the urinary tract indicating inflammatory exudate at some parts in the urinary tract such as bladder or renal pelvis. The pyuria is often associated with the presence of bacteria in the urine (15).

The urine pH is an indicator of the kidneys ability to conserve hydrogen ions and this is highly influenced by the bacterial infection, type of the diet, metabolic and respiratory alkalosis, urinary retention (24).

In the current study, there was a considerable increase in leukocyte numbers/HPF in the urine sediments of urine samples with positive bacterial isolates, which could be attributed to the bacterial infection of the urinary tract of these animals, and this outcome agrees with (33), who maintained that the presence of more than 5 leukocytes/HPF of the urine sediments indicates urogenital tract inflammation, which may be associated with bacteriuria. Furthermore, (39-41) reported that pyuria indicates a purulent inflammation in the urinary tract especially urethritis ,cystitis or pyelonephritis. The pyuria is normally attended by the presence of bacteria in the urine (15).

In the current study, there was a significant elevation in the erythrocyte numbers/HPF in the urine sediments of urine samples with positive bacterial isolates which could be due to hemorrhages or inflammations' in the urinary tract of the animals with bacterial infections, and this result agrees with that of (33), who reported that the presence of more than 5 erythrocytes/HPF indicates hemorrhage (hematuria) which may be traumatic or inflammatory in nature.The hematuria may occur due to renal causes such as cases of acute glomerulonephritis, embolism of the renal artery, renal infarction, tubular damage due to toxic agents, and pyelonephritis while the postrenal hematuria occurs in cases of urolithiasis and cystitis (15).

In this study, there was a considerable elevation in the number of epithelial cells/HPF in the urine sediments of urine samples with positive bacterial isolates in comparison with the number of epithelial cells/HPF in the urine sediments of urine samples without bacterial isolates and this result is compatible with that of (42) who reported a significant elevation of epithelial cells/HPF in the urine sediments of the urinary tract of infected animals. The epithelial cells may be desquamated from the kidneys, ureters, bladder and reproductive tract. The squamouse epithelial cells may be desquamated from the urethra, vagina, or prepuse and the transitional epithelial cells may originate from the proximal urethra, urinary bladder, ureter or renal pelvis, while the renal epithelial cells may originate from the renal tubules (33).

In the current study there was a very noticeable increase in the number of casts/HPF in the urine sediments of urine samples with positive bacterial isolates in comparison with the number of casts/HPF in the urine samples free from bacterial isolates and this result is supported by the results of (14) who reported a significant elevation in the number of the casts/HPF in the urine sediments of urinary tract of infected animals.

The casts are organized tubular structures which vary in shape according to their composition, which appears in the urine sediments when there are pathological changes in the kidney (43). The presence of the casts in the urine sediments is an indicator for degenerative or inflammatory changes in the kidney where they form through agglomeration of desquamated cells and Tamm-Horsfall protein in the distal tubular epithelial cells (15).

The epithelial cell casts contain cells that have desquamated from the renal tubules, the WBCs casts appear in cases of renal inflammation, while RBCs casts appear in cases of renal hemorrhage and inflammation (33). In the current study there was an important elevation in the number of crystals/HPF in the urine sediments of urine samples with positive bacterial isolates in comparison with the number of crystals/HPF in the urine samples free from bacterial isolates and this result is compatible with that of (42), who reported a significant increase in the number of crystals/HPF in the urine sediments of the urinary tract infected animals. In the majority of cases the precipitation of crystals of calcium oxalate, calcium phosphate, tripple phosphate, uric acid and amorphous phosphate or urates is attributed to transient high saturation of urine, changes of urine temperature, ingestion of specific food and pH changes of the urine (19). The crystalluria occurrence is in association with some pathological conditions such as acute uric acid nephropathy, ethylene glycol poisoning, urolithiasis, hypereosinophilic syndrome and due to some drug's such as sulphadiazine (44,45).

In the current study the *Corynebacterium spp* were the predominant microorganisms isolated from urine samples and this result is compatible with that of (17,46), and this might be due to alkaline pH of urine samples .The *Corynebacterium renale, Corynebacterium cystitidis* and *Corynebacterium pilosum* cause cystitis and pyelonephritis in animals (15). The results of urine bacterial culture were compatible with previous reports on cystitis and pyelonephritis (47,48).

The *Corynebacterium spp*. are more isolated in the current study due to their ability to survive in soil for long periods, which comes in contact with vulval epithelial cells of the goats and the infection will ascend in the urinary tract leading to cystitis and pyelonephritis (36,49). The virulence of these species of bacteria is due to possing pilli which enhances its adhesion to the epithelial cells of the urinary tract and its production of urease enzyme which hydrolyses the urea and releases nitrogen and renalin which plays an important role in the lysis of the host epithelial cells (50). In the current study the infection rate of the urinary tract of the goats with *Staphylococcus aureus* was 2% and this finding is in agreement with (51) who indicated that *Staphylococcus aureus* contributes with *Corynebacterium renale* in cases of cystitis and pyelonephritis in animals.

The *Staphylococcus aureus* has many virulence factors which play important roles in human and veterinary infections, especially the antimicrobial resistant strains (30). In the present study the infection rate of the urinary tract of goats with *Trueperella pyogenes* was 1% and this result is lower than the percentage of other researches (42,48,52). The *Trueperella pyogenes* is usually found on mucus membrane and its adhesion to the urinary tract tissues is enhanced by neuraminidase and extracellular matrix binding proteins that facilitate its adherence to the deeper tissues which is predisposed by various injuries during pregnancy or parturition, trauma to the urethral mucosa or vagina, or obstruction of the lower urinary tract or other infections caused by mycoplasma, viruses and other types of bacteria leading to ascending cystitis and pyelonephritis (50). It possess many virulence factors including hemolytic exotoxin and pyolysin, which are cytolytic for macrophages and neutrophils (53) and causes pyelonephritis or embolic purulent nephritis in animals (54).

In the current study the infection rate of the urinary tract with *Enterococcus faecalis* was 1% and this result is supported by that of (15). The *Enterococcus faecalis* may carry different genes which contribute directly or indirectly to the virulence of this bacteria (55). The genes encode virulence factors like aggregation substances, gelatinase, enterococcal surface proteins and hyaluronidase (56). The *enterococcal* surface protein gene is associated with higher virulence, colonization and persistence of this bacteria in the urinary tract together with biofilm formation (57),while aggregation substances are responsible for greater bacterial adhesion to renal tubular cells.

In the present study, the infection rate of the urinary tract with *Pseudomonus aeruginosa* was 1% and this result is compatible with that of (16). This organism has many virulence factors which contribute in its pathogenicity including exocytotoxins, enterotoxins and toxins produced by protein secretion systems resulting from the expression of certain virulence operons. Many of these virulent factors cause infections, septicaemi and fatal conditions (58). After successive colonization of this bacteria, it causes extensive tissue damage, blood stream invasion and dissemination (59). The resistance of *Pseudomonus aeruginosa* to microbial agent continues to increase worldwide (60).

In the current study the infection rate of urinary system with *Proteus mirabilis* was 1%, which is in agreement with the finding of (61). The *Proteus mirabilis* possesses a variety of virulence factors such as urease, fimbria, potent toxins, proteases and other adhesions. The *Proteus mirabilis* are associated with formation of bladder and kidney stones (urolithiasis), permanent renal damage and may cause bacteremia and sepsis (31).

The urea is the substrate of urease enzyme, which is hydrolyzed to CO_2 and NH_3. The liberated ammonia elevates the pH values of the urine and initiates precipitation of soluble polyvalent anions and cations in urine leading to formation of struvite (MgNH3PO4) or apatite (CaPO4) stones. The stones may be formed in renal pelvis or renal tubules causing inflammation of the tissues. These bacteria may invade bladder epithelial cells and produce cytotoxins leading to damage of the epithelium of the bladder.

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دراسة الأخماج الجرثومية في الجهاز البولي للماعز في مدينة الموصل

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الخلاصة

كانت أهداف الدراسة الحالية هو عزل أنواع جرثومية مختلفة من بول الماعز ، وتحديد بعض المعايير الفيزيائية والكيميائية لبول الماعز ، ولتدوين بعض التغيرات المجهرية في رواسب بول العينات ، جمعت ٢٠٠ عينة بول من الماعز وبأعمار مختلفة من كلا الجنسين من الحيوانات المذبوحة في مجزرة الموصل / العراق . أظهرت النتائج بأن عينات بول الحيوانات المصابة بالجراثيم كانت عكرة قليلا والى شديدة العكارة وذات لون أصفر غامق وكثافة نوعية واطئة . وأظهر الفحص المجهري لرواسب البول زيادة في أعداد الخلايا القيحية وكريات الدم الحمراء والخلايا الظهارية والقوالب والبلورات / قوة تكبير عالية في عينات بول الحيوانات المصابة بالجراثيم مقارنة مع عينات بول الحيوانات غير المصابة بالجراثيم . وأظهر الفحص الكيميائي لعينات بول الحيوانات المصابة بالجراثيم حدوث ارتفاع معنوي في صبغة اليوروبيلينوجين والكلوكوز والأجسام الكيتونية والدم والبروتين والخلايا البيض والأس الهيدروجيني لعينات بول الحيوانات المصابة بالخمجات الجرثومية . وأظهر الزرع الجرثومي لعينات البول بأن الإصابات الجرثومية الكلية كانت ٣٢ (١٦%) من مجموع ٢٠٠ عينة بول . وكانت نسبة الإصابة بجراثيم الوتديات الكلوية ٢% ، والوتديات المثانية ٢% ، ووتديات البايلوسم ١.٥% ، والايشريشيا القولونية ٢% ، والمكورات العنقودية الذهبية ٢% ، والمكورات السبحية القيحية ١.٥% ، وجراثيم الكليبسيلا الرئوية ١% ، والمكورات المعوية البرازية ١% ، والزوائف الهوائية ١% ، وجراثيم تريبيريلا القيحية ١% ، وجراثيم بروتيس ميرابيليس ١% . نستنتج من هذه الدراسة بأن نسبة الإصابة بالأنواع الجرثومية المختلفة كانت أعلى في إناث الماعز من ذكور الماعز وكانت نسبة الإصابة أعلى في الحيوانات الكبيرة العمر من الحيوانات الصغيرة العمر.

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