Risk Factors in Diabetes and Pregnant Women with Urinary Tract Infections Compared to Younger Aged Female.

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Abstract
Background: Urinary tract infection is common with health impact in women and characterised by failure to treatment and recurrent episodes.
Aim: This study was conducted to determine the risk factors for the development of urinary tract infection in diabetic and pregnant women in comparison to student female.
Materials and methods: A prospective cross-sectional study conducted during the period from 1st of June 2015 to the end of January 2016. The population included in the study are 563 women, of them 425 were outpatients, and 138 were inpatients. Their age range between 18 and 80 years, with a mean age of 33.59±15.29 years. Urine samples collected and cultured on blood agar and MacConkey agar by spread plate technique. Bacterial colonies with different morphology were selected, purified and identified according to their biochemical characteristics using conventional standard methods.
Results: In diabetic women, there were no significant difference in mean age and BMI values between culture positive and culture negative groups. However, pus cell mean scale was significantly higher [P=0.000] in women with urinary tract infection [1.76±1.25] than in those with negative culture [0.69±1.00]. In pregnant women, BMI mean value was significantly [P=0.013] lower in pregnant women with UTI [26.14] as compared to those without infection [26.99]. Pus cell scale mean value was significantly [P=0.000] higher in pregnant women with UTI [1.55] than women with negative UTI [0.85]. While there was no significant difference in mean age between UTI positive and negative pregnant women. In female student, there was a significant difference between UTI infected and non-infected in mean age [P=0.041] and pus cell scale [P=0.000]. However, BMI was not significantly different between infected and non-infected female student. Other risk factors association are variables in the 3 groups when analysed using X^2, while AUC and OR show different trends of association between risk factors and UTI.
Conclusion: BMI, pus cell scale, child number, delivery method, operation history and hospital setting were significantly associated with culture positivity in the 3 studied groups as determined by AUC. While OR confirmed association with pus sale scale in the 3 groups.
Key words: UTI, Pregnancy, student, risk factor.

Introduction

Urinary tract infection is more common in female as compared to male [1]. In addition, other risk factors influenced the prevalence of urinary tract infections [2]. Although, the infection is common globally, however, regional variation in its epidemiologic characteristics were reported [3-7].

Age, gender, diabetes and pregnancy are with association with urinary tract infections . In Iraq a limited studies that evaluated the risk factors of UTI and are with small size study population [8-11]. Thus this study was conducted to clarify the risk factors in diabetic and pregnant women in comparison to those in student female.

Materials and methods

Study design:

A prospective cross-sectional study conducted during the period from 1st of June 2015 to the end of January 2016. The population included in the study are 563 women, of them 425 [75.5%] were outpatients, and 138 [24.5%] were inpatients. Their age range between 18 and 80 years, with a mean age of 33.59±15.29 years. The study proposal was approved by the Ethical Committee of College of Science, Tikrit University and verbal informed consent taken from each woman before enrolment in the study. The subjects included in the study were divided in to those culture positive and culture negative for the three studied groups [12]. Age, pus cell scale, BMI, marital status, child number, delivery methods, operation history, education level, economic status, and hospital setting were evaluated as risk factors for UTI in women.

Bacterial isolation:

Urine samples were centrifuged and sediments immediately cultured on blood agar and MacConkey agar by spread plate technique. Bacterial colonies with different morphology were selected, purify and identified according to their biochemical characteristics using conventional standard methods. [13]

Statistical analysis:

Analysis performed using SPSS [version20]. The data presented as percentages, mean value and standard deviation. Chi square used to calculate significance for frequency, while t test used to determine significance in mean difference. P value of < 0.05 regarded significant. Logistic regression line analysis was used to determine Odd Ratio [OR]. Area under ROC curve was determined using SPSS package.

Results

In diabetic women, there were no significant difference in mean age and BMI values between culture positive and culture negative groups. However, pus cell mean scale was significantly higher [P=0.000] in women with urinary tract infection [1.76±1.25] than in those with negative culture [0.69±1.00], Table 1. In pregnant women, BMI mean value was significantly [P=0.013] lower in pregnant women with UTI [26.14] as compared to those without infection [26.99]. Pus cell scale mean value was significantly [P=0.000] higher in pregnant women with UTI [1.55] than women with negative UTI [0.85]. While there was no significant difference in mean age between UTI positive and negative pregnant women, Table 1. In female student, there was a significant difference between UTI infected and non-infected in pus cell scale [P=0.000]. However, mean age and BMI was not significantly different between infected and non-infected female student, Table 1. Comparison between the three groups show a significant differences [P<0.001] in mean values for BMI , age and pus cell scale in women with urinary tract infections, however, there was a significant differences in mean values of BMI and age in negative cases, Table1.

Table 1. Mean of BMI, Age and Pus Cell Index Comparison between groups

Group	Culture	Diabetic			Pregnant			Student			P
		Number	Mean	SD	Number	Mean	SD	Number	Mean	SD	
BMI	Positive	78	26.06	2.05	106	26.14	2.91	50	23.25	2.83	<0.001
	Negative	90	25.85	1.80	130	26.99	2.34	109	22.53	3.11	<0.001
	P	>0.05			>0.05			> 0.05			
Age	Positive	78	52.83	14.15	106	27.42	5.98	50	21.10	1.37	<0.001
	Negative	90	53.54	11.56	130	28.08	5.56	109	21.67	1.72	<0.001
	P	>0.05			>0.05			>0.05			
Pus cell	Positive	78	1.76	1.25	106	1.55	1.19	50	2.32	0.98	<0.001
	Negative	90	0.69	1.00	130	0.85	0.95	109	0.61	0.78	>0.05
	P	0.0001			0.0001			0.0001			

Marital status was not with significant [X^2 =1.19, P>0.05] influence on urinary tract infection in women with diabetes, however, culture positivity was 91% in married diabetic women, and 9% in single diabetic women, Table 2. Additionally, UTI in female student was not significantly influenced by marital status [X^2 =1.81, P>0.05], Table 2. There was a significant [**X^2=7.54; P=0.023]** differences in UTI between the 3 groups in married women but not in single, Table 2.

Table 2. Marital status influence on culture positivity in urinary tract infection in diabetic and pregnant women in comparison to student female.

Marital status		Culture		Total
		Negative	Positive	
Married	Count	Number [%]		
	Student	35 [32.1]	12 [24.0]	47 [29.6%]
	Diabetic	77 [85.6%]	71 [91.0%]	148 [88.1%]
	Pregnant	130 [100%]	106 [100%]	236 [100%]
	X^2 P	X^2 =7.54; P=0.023		
Single	Student	74 [67.9%]	38 [76.0%]	112 [70.4%]
	Diabetic	13 [14.4%]	7 [9.0%]	20 [11.9%]
	Pregnant	0	0	0
	X^2 P	X^2 = 0.23; P>0.05		

Marital status within group
Diabetic Chi =1.19; P>0.05
Student Chi=1.08; >0.05

Child number significantly [X^2 =19.4, P=0.007] influence urinary tract infection in diabetic women and the pattern of urinary tract infection was with Poisson distribution , Table 3. However, child number was not with significant influence [X^2 =1.49, P>0.05] on UTI in female student, Table 3. In addition, in pregnant women, child number not influence urinary tract infection [X^2 =11.62, P>0.05], Table 3**.** However, comparison between the groups in regard to child number, show that only women with child number of 6 demonstrate a significant differences, Table3.

Table 3. Child number influence on culture positivity in diabetic, pregnant And student female

Child number	Group	Culture		Total
		Negative	Positive	
0	Count	Number [%]		
	Student	95 [87.2%]	44 [88%]	139 [87.4%]
	Diabetic	30 [33.3%]	10 [12.8%]	40 [23.8%]
	Pregnant	22 [16.9%]	15 [14.2%]	37 [15.7%]
	X^2 P	X^2 = 2.15;P>0.05		
1	Student	11 [10.1%]	6 [12%]	17 [10.7%]
	Diabetic	4 [4.4%]	1 [1.3%]	5 [3.0%]
	Pregnant	15 [11.5%]	22 [20.8%]	37 [15.7%]
	X^2 P	X^2 = 4.58;P>0.05		
2	Student	3 [2.8%]	0 [0%]	3 [1.9%]
	Diabetic	8 [8.9%]	7 [9.0%]	15 [8.9%]
	Pregnant	25 [19.2%]	24 [22.6]	49 [20.8]
	X^2 P	X^2 =0.85; P>0.05		
3	Student	0 [0%]	0 [0%]	0 [0%]
	Diabetic	17 [18.9%]	12 [15.4%]	29 [17.3]
	Pregnant	24 [18.5%]	22 [20.8%]	46 [19.5%]
	X^2 P	X^2 =0.32; P>0.05		
4	Student	0 [0%]	0 [0%]	0 [0%]
	Diabetic	16 [17.8%]	20 [25.6%]	36 [21.4%]
	Pregnant	18 [13.8%]	10 [9.4%]	28 [11.9%]
	X^2 P	X^2 =2.5; P>0.05		
5	Student	0 [0%]	0 [0%]	0 [0%]
	Diabetic	13 [14.4%]	17 [21.8%]	30 [17.9%]
	Pregnant	17 [13.1%]	9 [8.5%]	26 [11.0%]
	X^2 P	X^2 = 2.73; P>0.05		
6	Student	0 [0%]	0 [0%]	0 [0%]
	Diabetic	2 [2.2%]	9 [11.5%]	11 [6.5%]
	Pregnant	8 [6.2%]	1 [0.9%]	9 [3.8%]
	X^2 P	X^2 =9.90; P=0.007		
7	Student	0 [0%]	0 [0%]	0 [0%]
	Diabetic	0 [0.0%]	2 [2.6%]	2 [1.2%]
	Pregnant	1 [0.8%]	3 [2.8%]	4 [1.7%]
	X^2 P	X^2 =0.37; P>0.05		

Child number within group
Diabetic Chi=19.4; P=0.007
Pregnant Chi=11.62; P>0.05
Student Chi=1.49; P>0.05

Delivery method significantly [X^2 =12.48, P=0.002] influence urinary tract infection. The infection rate was significantly lower in women with normal vaginal delivery [50.4%] than those delivered through caesarean section [73.3%], Table 4. However, in female student group delivery method was not with significant influence

[X^2 =**2**.449, P>0.05] on UTI, Table 4. In addition, delivery method in pregnant women group does not demonstrated a significant [X^2 =**3.**15, P>0.05] influence on UTI, however, UTI infection was higher in women delivered by caesarean section [58.8%] that those delivered by vaginal delivery [41%], Table 4. Delivery method DOES not show significant differences between the groups as risk factor for UTI.

Table 4. Delivery method influence on culture positivity in diabetic, pregnant and student female.

Delivery method		Culture		Total
		Negative	Positive	
No pregnancy	Count	Number [%]		
	Student	94 [86.2%]	44 [88%]	138 [86.8%]
	Diabetic	30 [33.3%]	10 [12.8%]	40 [23.8%]
	Pregnant	23 [17.7%]	16 [15.1%]	39 [16.5%]
	X^2 P	X^2 =2.35; P>0.05		
Vaginal delivery	Students	14 [12.8%]	4 [8%]	18 [11.3%]
	Diabetic	56 [62.2%]	57 [73.1%]	113 [67.3%]
	Pregnant	93 [71.5%]	70 [66%]	163 [69.1%]
	X^2 P	X^2 =5.39; P>0.05		
Caesarean section	Student	1 [0.9%]	2 [4%]	3 [1.9%]
	Diabetic	4 [4.4%]	11 [14.1%]	15 [8.9%]
	Pregnant	14 [10.8%]	20 [18.9%]	34 [14.4%]
	X^2 P	X^2 = 0.96; P>0.05		

Delivery method within group
Diabetic group Chi= 12.48, P=0.002
Pregnant women Chi=3.15, P>0.05
Student group Chi=2.449, P>0.05

UTI in female student was not significantly influenced by operation history [X^2 =0.162, P>0.05], Table 5. UTI was higher in pregnant women with operation history [48%] than in those with no history of operation [44.3%], but the difference not reach significant level, Table 5. However, Diabetic women with history of operation were with significantly [X^2 =10.63, P=0.001] higher rate of UTI [91.7%] than in those without history of operation [42.9%], Table 5. Operation history was with significant differences between the 3 groups as risk factor for UTI, Table5.

Education levels significantly [X^2 =15.83, P=0.001] influenced UTI in pregnant women, however, there was no specific pattern for the incidence of UTI, Table 6. In addition, education level significantly [X^2 =14.17, P=0.003] influence urinary tract infection in diabetic women, Table 6. There was a significant differences in influence of education levels in illiterate and those with higher education between pregnant and diabetic women, Table 6.

Table 5. Frequency of culture positivity in relation to operation history in diabetic, pregnant and student groups

Operation history		Culture		Total
		Negative	Positive	
No	Count	Number [%]		
	Student	103 [94.5%]	48 [96%]	151 [95%]
	Diabetic	89 [98.9%]	67 [85.9%]	156 [92.9%]
	Pregnant	117 [90%]	93 [88.6%]	210 [89.4%]
	X^2 P	X^2 =6.39; P=0.041		
Yes	Student	6 [5.5%]	2 [4%]	8 [5%]
	Diabetic	1 [1.1%]	11 [14.1%]	12 [7.1%]
	Pregnant	13 [10%]	12 [11.4%]	25 [10.6%]
	X^2 P	X^2 =9.94; P=0.007		

Operation history within group
Diabetic Chi =10.63, P=0.000
Pregnant Chi=0.125, P>0.05
Student Chi=0.162, P>0.05

Table 6. Education influence on culture positivity in diabetic and pregnant women.

Education level		Culture		Total
		Negative	Positive	
Illiterate	Count	Number [%]		
	Pregnant	44 [33.8%]	18 [17%]	62 [26.3%]
	Diabetic	32 [35.6%]	35 [44.9%]	67 [39.9%]
	X^2 P	X^2 =7.16; P=0.007		
Primary	Pregnant	1 [0.8%]	5 [4.7%]	6 [2.5%]
	Diabetic	18 [20.0%]	26 [33.3%]	44 [26.2%]
	X^2 P	X^2 =1.32; P>0.05		
Secondary	Pregnant	19 [14.6%]	31 [29.2%]	50 [21.2%]
	Diabetic	0 [0.0%]	2 [2.6%]	2 [1.2%]
	X^2 P	X^2 =0.26	P>0.05	
Diploma / B Sc	Pregnant	66 [50.8%]	52 [49.1%]	118 [50%]
	Diabetic	40 [44.4%]	15 [19.2%]	55 [32.7%]
	X^2 P	X^2 =4.46; P=0.035		

Education within group
Diabetic Chi=14.17, P=0.003
Pregnant Chi=15.83, P=0.001

Urinary tract infection was significantly [X^2 =23.34, P=0.000] higher in diabetic women with poor economic status [71.4%], than those with average [59.7%] and good [29.6%] economic status. The UTI incidence decreased with the increase in economic status, Table 7. In female student economic status significantly [X^2 =7.5,

P=0.023] influenced urinary tract infection and the infection increased with the increase of economic status level, Table 7.

UTI varies between pregnant women with different economic status, but the difference was not significant [X^2 =5.83, P>0.05] and not demonstrated a special pattern. UTI was 50% in pregnant women with poor economic status, 41.4% in those with average economic status, 54.1% in women with good economic status and 28.6% in women with very good economic status, Table 7. Economic status was with significant differences between 3 groups in those with average and good SES, Table 7.

Table 7. Economic status influence on culture positivity in Diabetic, pregnant and student female.

Economic status		Culture		Total
		Negative	Positive	
Poor	Count	Number [%]		
	Student	0	0	0
	Diabetic	8 [8.9%]	20 [25.6%]	28 [16.7%]
	Pregnant	1 [0.8%]	1 [0.9%]	2 [0.8%]
	X^2 P	X^2 =0.75; P>0.05		
Average	Student	42 [38.5%]	30 [60%]	72 [45.3%]
	Diabetic	25 [27.8%]	37 [47.4%]	62 [36.9%]
	Pregnant	75 [57.7%]	53 [50%]	128 [54.2%]
	X^2 P	X^2 =6.30	P=0.043	
Good	Student	57 [52.3%]	19 [38%]	76 [47.8%]
	Diabetic	57 [63.3%]	21 [26.9%]	78 [46.4%]
	Pregnant	39 [30%]	46 [43.4%]	85 [36%]
	X^2 P	X^2 =18.9; P=0.001		
Very good	Student	10 [9.2%]	1 [2%]	11 [6.9%]
	Diabetic	0	0	0
	Pregnant	15 [11.5%]	6 [5.7%]	21 [8.9%]
	X^2 P	X^2 =2.35; P>0.05		

Economic status within group
Diabetic Chi=23.34, P=0.000
Pregnant Chi= 5.83; >0.05
Student Chi = 7.504; P=0.023

Hospital setting not influence urinary tract infection [X^2 =0.31, P>0.05], however, the rate of infection was higher in inpatient diabetic women [49.2%] than in outpatient diabetic women [44.8%], Table 8. UTI in pregnant women was higher in

those recruited from outpatient [46.6%] setting than those from inpatient [41.3%] setting, but the difference was not significant [X^2 **=0.**57, P>0.05], Table 8. Hospital setting not influence infections between diabetic and pregnant women, Table 8.

Table 8. Hospital setting influence on culture positivity in Diabetic and pregnant women.

Hospital setting		Culture		Total
		Negative	Positive	
Outpatient	Count	Number [%]		
	Diabetic	58 [64.4%]	47 [60.3%]	105 [62.5%]
	Pregnant	86 [66.2%]	75 [70.8%]	161 [68.2%]
	X^2 P	X^2 =0.08; P>0.05		
Inpatient	Diabetic	32 [35.6%]	31 [39.7%]	63 [37.5%]
	Pregnant	44 [33.8%]	31 [29.2%]	75 [31.8%]
	X^2 P	X^2 =0.85; P>0.05		

Hospital setting within group
Diabetic Chi=0.31, P>0.05
Pregnant Chi=0.57; P>0.05

Area under ROC curve confirmed a significant association [AUC≥0.50, P<0.05] between UTI and BMI, pus sale scale, child number, delivery method, operation history, and hospital setting in diabetic, pregnant, and their pool. While in female student the significant association of UTI was with BMI, pus cell scale, marital status, child number, delivery method, operation history and education levels [AUC > 0.50; P<0.05]. In addition, AUC confirmed a significant [AUC=0.84, P>0.01] association between UTI infection and age in diabetic group only. While marital status and education level were with significant [AUC=0.50-0.54; P<0.05] association with UTI in female student group only, Table 9.

Odd ratio confirmed a significant association between age [OR=0.96,P=0.007], pus cell scale [OR=2.148, P=0.000], marital status [OR=2.984, P<0.05], child number [OR=1.572,P=0.003], operation history [OR=1.214,P=0.028] and economic status [OR=0.41,P=0.001] with urinary tract infection in diabetic women. Both age and economic status demonstrated an protective association in diabetic women, Table 10.

In pregnant women group, BMI [OR=0.872,P=0.022], pus cell scale [OR=1.805, P=0.000], delivery method [OR=2.117, P=0.01] were significantly associated with UTI. While in female student group, age [OR=0.737,P=0.2], pus cell scale [OR=5.214,P=0.000], child number [OR=0.124,P=0.028], and economic status [OR=0.432,P=0.009] were significantly associated with urinary tract infection. Pool of the groups show different trends of association between the risk factors and urinary tract infection whether using AUC Roc curve or odd ratio. This finding suggest that urinary tract infection risk factors better be studied in specified groups rather than pooled study population.

Table 9. Area under ROC curve according to groups

Variable	Diabetic		Pregnant		Student		Pool	
	AUC	P	AUC	P	AUC	P	AUC	P
Age	**0.84**	**<0.01**	**0.48**	>0.05	**0.41**	>0.05	**0.52**	**<0.05**
BMI	**0.53**	**<0.05**	**0.53**	**<0.05**	**0.61**	**<0.01**	**0.52**	**<0.05**
Pus cell	**0.73**	**<0.01**	**0.73**	**<0.01**	**0.88**	**<0.01**	**0.74**	**<0.01**
Marital status	**0.47**	>0.05	**0.47**	>0.05	**0.54**	**<0.05**	**0.46**	>0.05
Child number	**0.68**	**<0.01**	**0.68**	**<0.01**	**0.50**	**<0.05**	**0.58**	**<0.05**
Delivery Method	**0.63**	**<0.01**	**0.63**	**<0.01**	**0.50**	**<0.05**	**0.58**	**<0.05**
Operation	**0.57**	**<0.05**	**0.57**	**<0.05**	**0.50**	**<0.05**	**0.52**	**<0.05**
Education	**0.40**	>0.05	**0.40**	>0.05	**0.50**	**<0.05**	**0.44**	>0.05
Economic status	**0.30**	>0.05	**0.30**	>0.05	**0.38**	>0.05	**0.41**	>0.05
Hospital Setting	**0.52**	**<0.05**	**0.52**	**<0.05**	**NA**	**NA**	**0.52**	**<0.05**

Table 10. Odd ratio according to groups

Variable	Diabetic		Pregnant		Student		Pool	
	OR	P	OR	P	OR	P	OR	P
Age	**0.96**	**0.007**	**1.043**	**>0.05**	**0.737**	**0.020**	**1.007**	>0.05
BMI	**1.009**	**>0.05**	**0.872**	**0.022**	**1.114**	**>0.05**	**1.032**	>0.05
Pus cell	**2.148**	**0.000**	**1.805**	**0.000**	**5.214**	**0.000**	**2.350**	**0.000**
Marital status	**2.984**	**<0.05**	**NA**	**NA**	**1.571**	**>0.05**	**0.66**	**0.047**
Child number	**1.572**	**0.003**	**0.806**	**>0.05**	**0.124**	**0.028**	**1.147**	**0.002**
Delivery Method	**1.164**	**>0.05**	**2.117**	**0.01**	**9.001**	**<0.05**	**1.822**	**0.000**
Operation	**1.214**	**0.028**	**1.053**	**>0.05**	**0.584**	**>0.05**	**1.857**	**0.048**
Education	**0.737**	**>0.05**	**1.166**	**>0.05**	**NA**	**NA**	**0.87**	**0.043**
Economic status	**0.410**	**0.001**	**0.956**	**>0.05**	**0.432**	**0.009**	**0.57**	**0.000**
Hospital Setting	**1.528**	**>0.05**	**0.775**	**>0.05**	**NA**	**NA**	**1.200**	>0.05

Discussion

Comparison between culture positive and culture negative not indicated a significant differences in age and BMI mean in diabetic women. However, pus cell mean was significantly higher in culture positive than in culture negative indicating the predictivity value of urine pus cell detection as non-invasive technique in diagnosis of UTI. However, Hamdan et al [4] not found a significant difference in BMI and age between diabetic women with bacteriurea and those without. In addition, Al-Bash et al [5] study in diabetic pregnant women not show significant age difference between those with pregestational diabetes and those with gestational diabetes. Marital status was not with significant influence on urinary tract infection in women with diabetes. This finding could be due to that most of the diabetic women are married [88.1%] and only 20 women [11.9%] are single and thus the analysis influenced by sample size. While UTI was significantly influenced by child number in diabetic women and the pattern of urinary tract infection was with Poisson distribution. In addition, delivery method significantly influence urinary tract infection. The infection rate was significantly lower in women with normal vaginal delivery than those delivered

through caesarean section. Furthermore, diabetic women with history of operation were with significantly higher rate of UTI than in those without history of operation. Also, urinary tract infection significantly influenced by education level in diabetic women. Women with poor economic status were with higher infection rate and urinary tract infection was declined with increase in economic status levels. High education level and economic status reduces urinary tract infection as they provide better nutritional status and personal hygiene. Urinary tract infection in diabetic women was found in 49.2% of inpatient, while it was 44.8% in outpatient women and hospitalised diabetic individuals are highly susceptible to urinary tract infection [1].

In pregnant women, BMI mean value was significantly lower in pregnant women with UTI as compared to those without infection . While pus cell scale mean value was significantly higher in pregnant women with UTI than women with negative UTI. While there was no significant difference in mean age between UTI positive and negative pregnant women.

Child number not significantly influence urinary tract infection in pregnant women. Nulliparous women was with lower urinary tract infection as compared to those with P1-3 and then declines for P4 -7 and this was consistent to that reported for Diyala, Iraq [9]. Obirikorang et al [14] reported that women with gravidity of 2 to 5 were with higher bacteriurea than nulliparous and primigravida. Manjula et al [15] found that UTI was higher in pregnant women in their third pregnancy and above followed by primigravida and then in those in their 2nd pregnancy. However, Essa et al [10] found that urinary tract infection was higher in primigravida pregnant women and reduced subsequently in second and third pregnancy. While Okonko et al [16] found that higher urinary tract infection was in the second and third pregnancies and above. The association between urinary tract infection and multiparity may be attributed to physiologic changes that occur during pregnancy and its subsequent effects on renal system and may be more profound in women without family planning and rapid pregnancy succession [17].

Although, multiparity significantly associated with bacteriuria in pregnant women [18,19]. However, our study finding was not show a significant parity association with urinary tract infection in pregnant women and this was consistent with others [4, 20-25]. In contrast other studies reported a significant association between UTI in pregnant women and parity [16, 26,27]

The present study indicated that UTI was higher in women delivered by caesarean section than those delivered by vaginal delivery, however, the difference statistically not significant. This finding inconsistent to that reported by Amiri et al [20] as they found significant higher rate of UTI in normal vaginal as compared to caesarean delivery. In addition, UTI was higher in pregnant women with operation history than in those with no history of operation, but the difference not reach significant level. The higher infection rate in our cohort study in women delivered by caesarean section could be due in proper sterilization technique and catheterization during the operation.

Education levels significantly influenced UTI in pregnant women, however, there was no specific pattern for the incidence of UTI in relation to education level. This finding was not in the line of that reported for other geographical areas [22-25, 28].

UTI varies between pregnant women with different economic status, but the difference was not significant and not demonstrated a special pattern. The low UTI infection rate in indigent women was due to sample influence as the main bulk of study population of the pregnant women was with average and good socioeconomic

levels. In literature it was reported that incidence of UTI during pregnancy was associated with socioeconomic status and the infection was higher in indigent subjects [3,29]. However, other studies not found such significant association [28,30]. While, in this study, UTI was 0.9% in poor women, 50% in those with average SES, 43.4% in women with good SES, and 5.7% in women with very good SES. Low SES may lead to increase in incidence of urinary tract infection may be due to effect on subject nutritional status and subsequent immunosuppression.

UTI in pregnant women was higher in those recruited from outpatient setting than those from inpatient setting, but the difference was not significant. However, hospitalization thought to be a risk factor for increase in urinary tract infections and nosocomial UTI form about 40% of hospital acquired infections [1]. The present study result was not agreed with the above hypothesis because our study population mainly were recruited from outpatient setting.

In female student, there was a significant difference between UTI infected and non-infected in mean age [P=0.041] and pus cell scale [P=0.000]. However, BMI was not significantly different between infected and non-infected female student. The UTI infection incidence was significantly more in younger female student and this may be due to their lack of personal hygiene and improper health care practice. BMI was not significantly different because of the low scale range of their age. An interesting finding in this study, is that urine pus cell scale is of predictive value in discriminate between infected and none infected urine samples. Our result concerning pus cells in urine was consistent to that reported previously [31-34]. Thus pus cell detection in urine sample could be used for the screening in a large sample size as non-invasive and cost-effective for diagnosis of urinary tract infection.

UTI in female student was not significantly influenced by marital status, child number, delivery method and operation history. However, economic status significantly influence urinary tract infection in female student and the infection increased with the increase of economic status level. No data in literature to perform the comparison with them as the studies in university students concentrated on the incidence and antibiogram of the isolated bacteria [31-34].

Association between UTI and BMI, pus sale scale, child number, delivery method, operation history, and hospital setting in diabetic, pregnant, student women [Except hospital setting] and their pool was confirmed by area under ROC curve. While AUC confirmed a significant association between UTI infection and age in diabetic group only. However, marital status and education level were with significant association with UTI in female student group only.

Logistic regression analysis confirmed a significant association between age, pus cell scale, marital status, child number, operation history and economic status with urinary tract infection in diabetic women. Both age and economic status demonstrated a protective association in diabetic women. In pregnant women group, BMI, pus cell scale, delivery method were significantly associated with UTI. While in female student group, age, pus cell scale, child number, and economic status were significantly associated with urinary tract infection. Pool of the groups show different trends of association between the risk factors and urinary tract infection whether using AUC Roc curve or odd ratio. This finding suggest that urinary tract infection risk factors better be studied in specified groups rather than pooled study population. Different studies show variable association between UTI and risk factors and this was due to differences in studies population recruitment, studies design, methods of analysis, inclusion and exclusion criteria [1,4,17, 22-25,27,28].

In conclusion, BMI, pus cell scale, child number, delivery method, operation history and hospital setting were significantly associated with culture positivity in the 3 studied groups as determined by AUC. While OR confirmed association with pus sale scale in the 3 groups. A large scale risk factors study is warranted to clarify the association with urinary tract infection in our community and other regions in Iraq.

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