REFERENCES

1. Reid G, Bruce AW. Urogenital infections in women: can probiotics help? Postgrad Med J 2003;79:428-32.
2. Naber KG. Urogenital Infections: The pivotal role of the urologist. Eur Urol 2006;50:657-9.
3. Nicolle LE. Urinary tract infection: traditional pharmacologic therapies. Am J Med 2002;113:35-44.
4. Richards MJ, Edwards JR, Culver DH, Gaynes RP. Nosocomial infections in medical intensive care units in the United States. National Nosoclomial Infections Surveillance System. Crit Care Med 1999;27:887-92.
5. Burke JP. Infection control-a problem for patient safety. N Engl J Med 2003;348:651-6.
6. Lolekha S, Ratanaubol B, Manu P. Nosocomial infection in a teaching hospital in Thailand. Phil J Microbiol Infect Dis. 1981;103-14.
7. Danchaivijitrmd S, Dhiraputra C, Santiprasitkul S, Judaeng T. Prevalence and impacts of nosocomial infection in Thailand 2001. J Med Assoc Thai 2005;88:S1-9.
8. Maraha B, Bonten H, van Hooff H, Fiolet H, Buiting AG, Stobberingh EE. Infectious complications and antibiotic use in renal transplant recipients during a 1-year follow-up. Clin Microbiol Infect 2001;7:619-25.

9. Wagenlehner ME, Naber KG. Emergence of antibiotic resistance and prudent use of antibiotic therapy in nosocomially acquired urinary tract infections. Int J Antimicrob Agents 2004;23:24-9.

10. Chayakulkeeree M, Junsriwong P, Keerasuntonpong A, Tribuddharat C, Thamlikitkul V. Epidemiology of extended-spectrum β-lactamase producing gram-negative bacilli at Siriraj Hospital, Thailand, 2003. Southeast Asian J Trop Med Public Health 2005;36:1503-9.

11. Roberfroid MB. Prebiotics and probiotics: are they functional foods? Am J Clin Nutr 2000;71:1682S-7S.

12. Antonia A. *Lactobacillus* as a probiotic for preventing urogenital infections. Rev Med Microbiol 2004;15:1-6.

13. Reid G, Bruce AW. Probiotics to prevent urinary tract infections: the rationale and evidence. World J Urol 2006;24:28-32.

14. Klaenhammer TR, Barrangou R, Buck BL, Azcarate-Peril MA, Altermann E. Genomic features of lactic acid bacteria effecting bioprocessing and health. FEMS Microbiol Rev 2005;29:393-409.

15. Meurman JH. Probiotics: do they have a role in oral medicine and dentistry? Eur J Oral Sci 2005;113:188-96.

16. Boyko EJ, Fihn SD, Scholes D, Abraham L, Monsey B. Risk of urinary tract infection and asymptomatic bacteriuria among diabetic and nondiabetic postmenopausal women. Am J Epidemiol 2005;161:557-64.

17. Cosgrove SE, Carmeli Y. The impact of antimicrobial resistance on health and economic outcomes. Clin Infect Dis 2003;36:1433-7.

18. Balcázara JL, de Blasa I, Ruiz-Zarzuelaa I, Cunninghamb D, Vendrella D, Múzquiza JL. The role of probiotics in aquaculture. Vet Microbiol 2006;114:173-86.

19. Tashjian JH, Coulam CB, Washington JA 2nd. Vaginal flora in asymptomatic women. Mayo Clin Proc 1976;51:557-61.

20. Hyman RW, Fukushima M, Diamond L, Kumm J, Giudice LC, Davis RW. Microbes on the human vaginal epithelium. Proc Natl Acad Sci USA 2005;102:7952-7.

21. Burton JP, Cadieux PA, Reid G. Improved understanding of the bacterial vaginal microbiota of women before and after probiotic instillation. Appl Environ Microbiol 2003;69:97-101.

22. Antonio MA, Hawes SE, Hillier SL. The identification of vaginal *Lactobacillus* species and the demographic and microbiologic characteristics of women colonized by these species. J Infect Dis 1999;180:1950-6.

23. Vasquez A, Jakobsson T, Ahrné S, Forsum U, Molin G. Vaginal *lactobacillus* flora of healthy Swedish women. J Clin Microbiol 2002;40:2746-9.

24. Redondo-Lopez V, Cook RL, Sobel JD. Emerging role of lactobacilli in the control and maintenance of the vaginal bacterial microflora. Rev Infect Dis 1990;12:856-72.

25. Rönnqvist PD, Forsgren-Brusk UB, Grahn-Håkansson EE. Lactobacilli in the female genital tract in relation to other genital microbes and vaginal pH. Acta Obstet Gynecol Scand 2006;85:726-35.

26. Shafer MA, Sweet RL, Ohm-Smith MJ, Shalwitz J, Beck A, Schachter J. Microbiology of the lower genital tract in postmenarchal adolescent

girls: differences by sexual activity, contraception, and presence of nonspecific vaginitis. J Pediatr 1985;107:974-81.

27. Marrazzo JM, Koutsky LA, Eschenbach DA, Agnew K, Stine K, Hillier SL. Characterization of vaginal flora and bacterial vaginosis in women who have sex with women. J Infect Dis 2002;185:1307-13.

28. Eschenbach DA, Thwin SS, Patton DL, Hooton TM, Stapleton AE, Agnew K, *et al.* Influence of the normal menstrual cycle on vaginal tissue, discharge, and microflora. Clin Infect Dis 2000;30:901-7.

29. Cauci S, Driussi S, De Santo D, Penacchioni P, Iannicelli T, Lanzafame P, *et al.* Prevalence of bacterial vaginosis and vaginal flora changes in peri- and postmenopausal women. J Clin Microbiol 2002;40:2147-52.

30. Schwebke JR, Richey CM, Weiss HL. Correlation of behaviors with microbiological changes in vaginal flora. J Infect Dis 1999;180:1632-6.

31. Ness RB, Hillier SL, Richter HE, Soper DE, Stamm C, McGregor J, *et al.* Douching in relation to bacterial vaginosis, lactobacilli, and facultative bacteria in the vagina. Obstet Gynecol 2002;100:765.

32. Valore EV, Park CH, Igreti SL, Ganz T. Antimicrobial components of vaginal fluid. Am J Obstet Gynecol 2002;187:561-8.

33. Paavonen J. Physiology and ecology of the vagina. Scand J Infect Dis Suppl 1983;40:31-5.

34. Boris S, Barbés C. Role played by lactobacilli in controlling the population of vaginal pathogens. Microbes Infect 2000;2:543-6.

35. Eschenbach DA, Davick PR, Williams BL, Klebanoff SJ, Young-Smith K, Critchlow CM, *et al.* Prevalence of hydrogen peroxide-producing

Lactobacillus species in normal women and women with bacterial vaginosis. J Clin Microbiol 1989;27:251-6.

36. Al-Mushrif S, Jones BM. A study of the prevalence of hydrogen peroxide generating Lactobacilli in bacterial vaginosis: the determination of H_2O_2 concentrations generated, *in vitro*, by isolated strains and the levels found in vaginal secretions of women with and without infection. J Obstet Gynaecol 1998;18:63-7.

37. Hawes SE, Hillier SL, Benedetti J, Stevens CE, Koutsky LA, Wolner- Hanssen P, et al. Hydrogen peroxide-producing lactobacilli and acquisition of vaginal infections. J Infect Dis 1996;174:1058-63.

38. McLean NW, McGroarty JA. Growth inhibition of metronidazole-susceptible and metronidazole-resistant strains of *Gardnerella vaginalis* by Lactobacilli *in vitro*. Appl Environ Microbiol 1996;62:1089-92.

39. Demba E, Morison L, van der Loeff MS, Awasana AA, Gooding E, Bailey R, *et al.* Bacterial vaginosis, vaginal flora patterns and vaginal hygiene practices in patients presenting with vaginal discharge syndrome in the Gambia, West Africa. BMC Infect Dis 2005;5:12.

40. Singh PK, Tack BF, McCray PB Jr, Welsh MJ. Synergistic and additive killing by antimicrobial factors found in human airway surface liquid. Am J Physiol Lung Cell Mol Physiol. 2000;279:L799-805.

41. Ganz T. Defensins in the urinary tract and other tissues. J Infect Dis 2001;183:S41-2.

42. Genç MR, Kara ahin E, Onderdonk AB, Bongiovanni AM, Delaney ML, Witkin SS. Association between vaginal 70-kd heat shock protein, interleukin-1

receptor antagonist, and microbial flora in mid trimester pregnant women. Am J Obstet Gynecol 2005;192:916-21.

43. Underhill DM, Ozinsky A. Toll-like receptors: key mediators of microbe detection. Curr Opin Immunol 2002;14:103-10.

44. Hernández D, Cardell E, Zárate V. Antimicrobial activity of lactic acid bacteria isolated from Tenerife cheese: initial characterization of plantaricin TF711, a bacteriocin-like substance produced by *Lactobacillus plantarum* TF711. J Appl Microbiol 2005;99:77-84.

45. Bandenbergh PA. Lactic acid bacteria, their metabolic products and interference with microbial growth. FEMS Microbiol Rev 1993;12:221-38.

46. Hudault S, Liévin V, Bernet-Camard MF, Servin AL. Antagonistic activity exerted *in vitro* and *in vivo* by *Lactobacillus casei* (strain GG) against *Salmonella* Typhimurium C5 infection. Appl Environ Microbiol 1997;63:513-8.

47. Alakomi HL, Skyttä E, Saarela M, Mattila-Sandholm T, Latva-Kala K, Helander IM. Lactic acid permeabilizes gram-negative bacteria by disrupting the outer membrane. Appl Environ Microbiol 2000;66:2001-5.

48. Apella MC, González SN, Nader de Macías ME, Romero N, Oliveer G. *In vitro* studies on the growth of *Shigella sonnei* by *Lactobacillus casei* and *L. acidophilus*. J Appl Bacteriol 1992;73:480-3.

49. Reid G, Burton J. Use of *Lactobacillus* to prevent infection by pathogenic bacteria. Microbes Infect 2002;4:319-24.

50. Servin AL. Antagonistic activities of lactobacilli and bifidobacteria against microbial pathogens. FEMS Microbiol Rev 2004;28:405-40.

51. Bruno ME, Montville TJ. Common Mechanistic Action of Bacteriocins from Lactic acid bacteria. Appl Environ Microbiol 1993;59:3003-10.

52. Abee T. Pore-forming bacteriocins of gram-positive bacteria and self-protection mechanisms of producer organisms. FEMS Microbiol Lett 1995;129:1-10.

53. Moll GN, Roberts GC, Konings WN, Driessen AJ. Mechanism of lantibiotic-induced pore-formation. Antonie Van Leeuwenhoek 1996;69:185-91.

54. Kayser FH, Bienz KA, Eckert, Zinkernagel. Medical microbiology. New York: Thieme; 2005.p. 278-9.

55. Centre for infection. 2007. Identification of Enterobacteriaceae. [Online]. Available: http://www.hpa-standardmethods.org.uk/documents/bsopid/pdf/bsopid16.pdf [9 November 2007]

56. Forbes B, Sahm D, Weissfeld A. Bailey & Scott's Diagnostic Microbiology. 12th ed. : Mississippi: Mosby; 2007.

57. Stenutz R, Weintraub A, Widmalm G. The structures of *Escherichia coli* O-polysaccharide antigens. FEMS Microbiol Rev 2006;30:382-403.

58. Pien FD, Shrum S, Swenson JM, Hill BC, Thornsberry C, Farmer JJ. Colonization of human wounds by *Escherichia vulneris* and *Escherichia hermannii*. J Clin Microbiol 1985;22:283-5.

59. Chaudhury A, Nath G, Tikoo A, Sanyal SC. Enteropathogenicity and antimicrobial susceptibility of new *Escherichia* spp. J Diarrhoeal Dis Res 1999;17:85-7.

60. Kenneth Todar. Todar's Online Textbook of Bacteriology. [Online]. 2008. [cited 2010 Jan 12]; Available from:URL:http://www.textbookofbacteriology.net/

61. Cassels FJ, Wolf MK. Colonization factors of diarrheagenic *E. coli* and their intestinal receptors. J Ind Microbiol 1995;15:214-26.

62. Keller R, Ordoñez JG, de Oliveira RR, Trabulsi LR, Baldwin TJ, Knutton S. Afa, a diffuse adherence fibrillar adhesin associated with enteropathogenic *Escherichia coli*. Infect Immun 2002;70:2681-9.

63. Tieng V, Le Bouguénec C, du Merle L, Bertheau P, Desreumaux P, Janin A, *et al.* Binding of *Escherichia coli* adhesin AfaE to CD55 triggers cell-surface expression of the MHC class I-related molecule MICA. Proc Natl Acad Sci USA 2002;99: 2977-82.

64. Goldberg MB, Theriot JA. *Shigella flexneri* surface protein IcsA is sufficient to direct actin-based motility. Proc Natl Acad Sci USA 1995;92:6572-6.

65. Tapping RI, Akashi S, Miyake K, Godowski PJ, Tobias PS. Toll-like receptor 4, but not toll-like receptor 2, is a signaling receptor for *Escherichia* and *Salmonella* lipopolysaccharides. J Immunol 2000;165:5780-7.

66. Hayashi F, Smith KD, Ozinsky A, Hawn TR, Yi EC, Goodlett DR, *et al.* The innate immune response to bacterial flagellin is mediated by Toll-like receptor 5. Nature 2001;410:1099-103.

67. Kaper JB, Nataro JP, Mobley HL. Pathogenic *Escherichia coli*. Nat Rev Microbiol 2004;2:123-40.

68. Sears CL, Kaper JB. Enteric bacterial toxins: mechanisms of action and linkage to intestinal secretion. Microbiol Rev 1996;60:167-215.

69. Melton-Celsa A, O'Brien AD. *Escherichia coli* O157:H7 and other shiga toxin-producing *E. coli* Strains. Washington (DC): ASM Press; 1998. p. 121-8.

70. De Rycke J, Oswald E. Cytolethal distending toxin (CDT): a bacterial weapon to control host cell proliferation? FEMS Microbiol Lett 2001;203:141-8.

71. Marchès O, Ledger TN, Boury M, Ohara M, Tu X, Goffaux F, *et al.* Enteropathogenic and enterohaemorrhagic *Escherichia coli* deliver a novel effector called Cif, which blocks cell cycle G2/M transition. Mol Microbiol 2003;50:1553-67.

72. Lerm M, Selzer J, Hoffmeyer A, Rapp UR, Aktories K, Schmidt G. Deamidation of Cdc42 and Rac by *Escherichia coli* cytotoxic necrotizing factor 1: activation of c-Jun N-terminal kinase in HeLa cells. Infect Immun 1999;67:496-503.

73. Kenny B, Ellis S, Leard AD, Warawa J, Mellor H, Jepson MA. Co-ordinate regulation of distinct host cell signalling pathways by multifunctional enteropathogenic *Escherichia coli* effector molecules. Mol Microbiol 2002;44:1095-107.

74. Scaletsky ICA, Fabbricotti SH, Carvalho RLB, Nunes CR, Maranhão HS, Morais MB, *et al.* Diffusely adherent *Escherichia coli* as a cause of acute diarrhea in young children in northeast Brazil: a case-control study. J Clin Microbiol 2002;40:645-8.

75. Bilge SS, Clausen CR, LauW, Moseley SL. Molecular characterization of a fimbrial adhesin, F1845, mediating diffuse adherence of diarrhea-associated *Escherichia coli* to HEp-2 cells. J Bacteriol 1989;171:4281-9.

76. Hasan RJ, Pawelczyk E, Urvil PT, Venkatarajan MS, Goluszko P, Kur J, *et al.* Structure-function analysis of decay-accelerating factor: identification of residues important for binding of the *Escherichia coli* Dr adhesin and complement regulation. Infect Immun 2002;70:4485-93.

77. Bernet-Camard MF, Coconnier MH, Hudault S, Servin AL. Pathogenicity of the diffusely adhering strain *Escherichia coli* C1845: F1845 adhesin-decay accelerating factor interaction, brush border microvillus injury, and actin disassembly in cultured human intestinal epithelial cells. Infect Immun 1996;64:1918-28.

78. Peiffer I, Servin AL, Bernet-Camard MF. Piracy of decay-accelerating factor (CD55) signal transduction by the diffusely adhering strain *Escherichia coli* C1845 promotes cytoskeletal F-actin rearrangements in cultured human intestinal INT407 cells. Infect Immun 1998;66:4036-42.

79. Peiffer I, Bernet-Camard MF, Rousset M, Servin AL. Impairments in enzyme activity and biosynthesis of brush border-associated hydrolases in human intestinal Caco-2/TC7 cells infected by members of the Afa/Dr family of diffusely adhering *Escherichia coli*. Cell Microbiol 2001;3:341-57.

80. Phillips I, Eykyn S, King A, Gransden WR, Rowe B, Frost JA, *et al.* Epidemic multiresistant *Escherichia coli* infection in West Lambeth Health District. Lancet 1988;1:1038-41.

81. Nowicki B, Svanborg-Edén C, Hull R, Hull S. Molecular analysis and epidemiology of the Dr hemagglutinin of uropathogenic *Escherichia coli*. Infect Immun 1989;57:446-51.

82. Gunther NW 4th, Lockatell V, Johnson DE, Mobley HL. *In vivo* dynamics of type 1 fimbria regulation in uropathogenic *Escherichia coli* during experimental urinary tract infection. Infect Immun 2001;69:2838-46.

83. Connell I, Agace W, Klemm P, Schembri M, M rild S, Svanborg C. Type 1 fimbrial expression enhances *Escherichia coli* virulence for the urinary tract. Proc Natl Acad Sci USA 1996;93:9827-32.

84. Mulvey MA, Lopez-Boado YS, Wilson CL, Roth R, Parks WC, Heuser J, *et al.* Induction and evasion of host defenses by type 1-piliated uropathogenic *Escherichia coli*. Science 1998;282:1494-7.

85. Anderson GG, Palermo JJ, Schilling JD, Roth R, Heuser J, Hultgren SJ. Intracellular bacterial biofilm-like pods in urinary tract infections. Science 2003; 301:105-7.

86. Trifillis AL, Donnenberg MS, Cui X, Russell RG, Utsalo SJ, Mobley HL, *et al.* Binding to and killing of human renal epithelial cells by hemolytic P-fimbriated *E. coli*. Kidney Int 1994;46:1083-91.

87. Uhlén P, Laestadius A, Jahnukainen T, Söderblom T, Bäckhed F, Celsi G, *et al.* Alpha-Haemolysin of uropathogenic *E. coli* induces Ca^{2+} oscillations in renal epithelial cells. Nature 2000;405:694-7.

88. Guyer DM, Henderson IR, Nataro JP, Mobley HL. Identification of Sat, an autotransporter toxin produced by uropathogenic *Escherichia coli*. Mol Microbiol 2000;38:53-66.

89. Podschun R, Ullmann U. *Klebsiella* spp. as nosocomial pathogens: epidemiology, taxonomy, typing methods, and pathogenicity factors. Clin Microbiol Rev 1998;11:589-603.

90. Morgan ME, Hart CA, Cooke RW. *Klebsiella* infection in a neonatal intensive care unit: role of bacteriological surveillance. J Hosp Infect 1984;5:377-85.

91. Griffiths E, Chart H, Stevenson P. High affinity iron uptake systems and bacterial virulence. In: Roth JA, editor. Virulence mechanics of bacterial pathogens. Washington DC: American Society for Microbiology; 1988. p. 121-37.

92. Emmerson AM, Gillespie SH. Shigella. In: Emmerson AM, Hawkey PM, Gillespie SH, editors. Principles and practice of clinical bacteriology. Chichester (UK): John Wiley & Sons; 1997. p. 389-98.

93. Barnes BJ, Wiederhold NP, Micek ST, Polish LB, Ritchie DJ. *Enterobacter cloacae* ventriculitis successfully treated with cefepime and gentamicin: case report and review of the literature. Pharmacotherapy 2003;23:537-42.

94. Guentzel MN. *Escherichia, Klebsiella, Enterobacter, Serratia, Citrobacter, and Proteus.* 4th ed. In: Barron S, editors. Barron's Medical Microbiology: University of Texas Medical Branch; 1996.

95. Gray LD. *Escherichia, Salmonella, Shigella* and *Yersinia*. 6th ed. In: Murry PR, Baron EJ, Pfaller MA, Tenover FC, Yolken RH, editors. Manual of Clinical Microbiology. Washington DC: Society for Microbiology; 1995. p. 450-6.

96. Bichai F, Payment P, Barbeau B. Protection of waterborne pathogens by higher organisms in drinking water: a review. Can J Microbiol 2008;54:509-24.

97. Drelichman V, Band JD. Bacteremias due to *Citrobacter diversus* and *Citrobacter freundii*. Incidence, risk factors, and clinical outcome. Arch Intern Med 1985;145:1808-10.

98. Badger JL, Stins MF, Kim KS. *Citrobacter freundii* invades and replicates in human brain microvascular endothelial cells. Infect Immun 1999;67:4208-15.

99. Juneja P, Lazzaro BP. *Providencia sneebia* sp. nov. and *Providencia burhodogranariea* sp. Nov., isolated from wild *Drosophila melanogaster*. Int J Syst Evol Microbiol 2009;59:1108-11.

100. Kucheria R, Dasgupta P, Sacks SH, Khan MS, Sheerin NS. Urinary tract infections: new insights into a common problem. Postgrad Med J 2005;81:83-6.

101. Hull RA, Gill RE, Hsu P, Minshew BH, Falkow S. Construction and expression of recombinant plasmids encoding type-1 or D-mannose-resistant pili from a urinary tract infection *Escherichia coli* isolate. Infect Immun 1981;33:933-8.

102. Plos K, Connell H, Jodal U, Marklund BI, Mårild S, Wettergren B, *et al.* Intestinal carriage of P fimbriated *Escherichia coli* and the susceptibility to urinary tract infection in young children. J Infect Dis 1995;171:625-31.

103. Bryan LE. General mechanisms of resistance to antibiotics. J Antimicrob Chemother 1988;22:1-15.

104. Sykes RB, Mathew M. The beta-lactamases of gram-negative bacteria and their role in resistance to beta-lactam antibiotic. J Antimicrob Chemother 1976;2:115-57.

105. Livermore DM. Beta-lactamases in laboratory and clinical resistance. Clin Microbiol Rev 1995;8:557-84.

106. Frere JM. Beta-lactamases and bacterial resistance to antibiotics. Mol Microbiol 1995;16: 385-95.

107. Neu HC. Changing patterns of hospital infections: implications for therapy. Changing mechanisms of bacterial resistance. Am J Med 1984;77:11-23.

108. Waley SG. Beta-lactamase: mechanism of action. In: Page MI, editors. The chemistry of β-lactam. London (UK): A & P Blackie; 1992, p. 198-228.

109. Patterson JE. Extended-spectrum beta-lactamases. Semin Respir Infect 2000;15:299-307.

110. Sanders CC, Sanders WE Jr. Beta-lactam resistance in gram-negative bacteria: Global trends and clinical impact. Clin Infect Dis 1992;15:824-39.

111. Bush K, Jacoby GA, Medeiros AA. A functional classification scheme for Beta-lactamases and its correlation with molecular structures. Antimicrob Agents Chemother 1995;39:1211-33.

112. Hamilton-Miller JM. Beta-lactamases and their clinical significance. J Antimicrob Chemother 1982;9:11-9.

113. Ledent P, Raquet X, Joris B, Van Beeumen J, Frère JM. A comparative study of class-D beta-lactamases. Biochem J 1993;292:555-62.

114. Labia R, Morand A, Tiwari K, Sirot D. Chanal C. Interactions of meropenem, with beta-lactamases, including enzymes with extended-spectrum

activity against third-generation cephalosporins. J Antimicrob Chemother 1989;24:219-23.

115. Yang YJ, Livermore DM. Interactions of meropenem with class I chromosomal beta-lactamases. J Antimicrob Chemother 1989;24:207-17.

116. Li XZ, Ma D, Livermore DM, Nikaido H. Role of efflux pump(s) in intrinsic resistance of *Pseudomonas aeruginosa*: active efflux as a contributing factor to beta-lactam resistance. Antimicrob Agents Chemother 1994;38:1742-52.

117. Perilli M, Segatore B, de Massis MR, Riccio ML, Bianchi C, Zollo A, *et al.* TEM-72, a new extended-spectrum beta-lactamase detected in *Proteus mirabilis* and *Morganella morganii* in Italy. Antimicrob Agents Chemother 2000;44:2537-9.

118. Richmond MH, Sykes RB. The beta-lactamases of gram-negative bacteria and their possible physiological role. Adv Microb Physiol 1973;9:31-88.

119. Rosenau A, Cattier B, Gousset N, Harriau P, Philippon A, Quentin R. *Capnocytophaga ochracea*: characterization of a plasmid-encoded extended-spectrum TEM-17 beta-lactamase in the phylum Flavobacter-bacteroides. Antimicrob Agents Chemother 2000;44:760-2.

120. Bush K. New beta-lactamases in gram-negative bacteria: Diversity and impact on the selection of antimicrobial therapy. Clin Infect Dis 2001;32:1085-9.

121. Ambler RP. The structure of beta-lactamases. Philos Trans R Soc Lond B Biol Sci 1980;289: 321-31.

122. Medeiros A, Mayer KH, Opal SM. Plasmid-mediated beta-lactamases. Antimicrob Newsl 1988;5:61-5.

123. Hanson ND. AmpC beta-lactamases: what do we need to know for the future? J Antimicrob Chemother 2003;52:2-4.

124. Philippon A, Arlet G, Jacoby GA. Plasmid-determined AmpC-type beta-lactamases. Antimicrob Agents Chemother 2002;46:1-11.

125. Burman LG, Park JT, Lindström EB, Boman HG. Resistance of *Escherichia coli* to penicillins: identification of the structural gene for the chromosomal penicillinase. J Bacteriol 1973;116:123-30.

126. da Silva Dias RC, Borges-Neto AA, D'Almeida Ferraiuoli GI, de-Oliveira MP, Riley LW, Moreira BM. Prevalence of AmpC and other beta-lactamases in enterobacteria at a large urban university hospital in Brazil. Diagn Microbiol Infect Dis. 2008;60:79-87.

127. Knott-Hunziker V, Petursson S, Jayatilake GS, Waley SG, Jaurin B, Grundstrom T. Active sites of beta-lactamases. The chromosomal beta-lactamases of *Pseudomonas aeruginosa* and *Escherichia coli*. Biochem J 1982;201:621-7.

128. Fisher JF, Meroueh SO, Mobashery S. Bacterial resistance to beta-lactam antibiotics: compelling opportunism, compelling opportunity. Chem Rev 2005;105:395-424.

129. Cricco JA, Vila AJ. Class B beta-lactamases: the importance of being metallic. Curr Pharm Des 1999;5:915-27.

130. Frere JM, Galleni M, Bush K, Dideberg O. Is it necessary to change the classification of {beta}-lactamases? J Antimicrob Chemother 2005 ;55:1051-3.

131. Gordon MA, Lapa EW, Fitter MS, Lindsay M. Susceptibility of zoopathogenic fungi to phytoalexins. Antimicrob Agent Chemother 1980;17:120-3.

132. Sookkhee S, Chulasiri M, Prachyabrued W. Lactic acid bacteria from healthy oral cavity of Thai volunteers: inhibition of oral pathogens. J Appl Microbiol 2001;90:172-9.

133. PeroXOquant™Quantitative Peroxide Assay Kits. Rockford (IL): Pierce Biotechnology Inc; 2004.

134. Gutmann I, Wahlefild AW. Methods of enzymatic analysis. New York: 3rd ed. Academic Press; 1974. p. 1464-8.

135. Qubit® Fluorometer. Carlsbad (CA): Invitrogen Corp; 2007

136. Muriana PM, Klaenhammer TR. Purification and partial characterization of lactacin F, a bacteriocin produced by *Lactobacillus acidophilus* 11088. Appl Environ Microbiol 1991;57:114-21.

137. PlusOne™ Silver Staining Kit (Protein). Uppsala (Sweden): GE Healthcare Bio-Sciences AB; 2008.

138. Beveridge TJ. Use of the gram stain in microbiology. Biotech Histochem 2001;76:111-8.

139. Ederer GM, Lund ME, Blazevic DJ, Reller LB, Mirrett S. Motility-Indole-Lysine-Sulfide Medium. J Clin Microbiol 1975;2:266-7.

140. Bacteriological Analytical Manual [Online]. 2009 [cited 2010 Jan 16]; Available from:URL:http://www.fda.gov/Food/ScienceResearch/LaboratoryMethods/BacteriologicalAnalyticalManualBAM/ucm064558.htm

141. Citrate Utilization [Online]. [2005?] [cited 2010 Jan 15]; Available from:URL:http://web.clark.edu/tkibota/240/Unknowns/Citrate.htm

142. Clinical and Laboratory Standards Institute. Performance Standards for Antimicrobial Susceptibility Testing: Sixteenth Informational Supplement M100-S16. CLSI, Wayne, PA, USA, 2006;26.

143. Thomson KS, Sanders CC. Detection of extended-spectrum beta-lactamases in members of the family Enterobacteriaceae: Comparison of the double-disk and three-dimensional tests. Antimicrob Agents Chemother 1992;36:1877-82.

144. Han CT, Parnell KD, Chiew YF, Lin JY, Turner P, Wilson AS, et al. Otago Diagnostic Laboratories' (ODL) Method for the detection of beta-lactamases in Enterobacteriaceae. Pathology 2005;37;371-7.

145. Pai H, Hong JY, Byeon JH, Kim YK, Lee HJ. High prevalence of extended-spectrum beta-lactamase-producing strains among blood isolates of *Enterobacter* spp. collected in a tertiary hospital during an 8-year period and their antimicrobial susceptibility patterns. Antimicrob Agents Chemother 2004;48:3159-61.

146. Yano Y, Oguma T, Nagata H, Sasaki S. Application of logistic growth model to pharamacodynamic analysis of *in vitro* bactericidal kinetics. J Pharma Sci 1998;87:1177-83.

147. PeriPreps™ Periplasting Kit. Medison (WI): EPICENTRE® Biotechnologies; 2008.

148. Papanicolaou GA, Medeiros AA. Discrimination of extended-spectrum beta-lactamases by a novel nitrocefin competition assay. Antimicrob Agents Chemother 1990;34:2184-92.

149. Juárez Tomás MS, Ocaña VS, Wiese B, Nader-Macías ME. Growth and lactic acid production by vaginal *Lactobacillus acidophilus* CRL 1259, and inhibition of uropathogenic *Escherichia coli*. J Med Microbiol 2003;52:1117-24.

150. Mojgani N, Sabiri G, Ashtiani MP, Torshizi MAK. Characterization of Bacteriocins Produced by *Lactobacillus brevis* NM 24 and *L.fermentum* NM 332 Isolated from Green Olives in Iran. Int J Microb [Internet]. 2009 [cited 2010 Jan 16]; 6(2). Available from:URL:http://www.ispub.com/journal/the_internet_journal_of_microbiology/volume_6_number_2_34/article/characterization-of-bacteriocins-produced-by-lactobacillus-revis-nm-24-and-l-fermentum-nm-332-isolated-from-green-olives-in-ran.html.

151. Simm AM, Loveridge EJ, Crosby J, Avison MB, Walsh TR, Bennett PM. Bulgecin A: a novel inhibitor of binuclear metallo-beta-lactamases. Biochem J 2005;387:585-90.

152. Keane FE, Ison CA, Taylor-Robinson D. A longitudinal study of the vaginal flora over a menstrual cycle. Int J STD AIDS 1997;8:489-94.

153. Mårdh PA. The vaginal ecosystem. Am J Obstet Gynecol 1991;165:1163-8.

154. Antonio MA, Hawes SE, Hillier SL. The identification of vaginal Lactobacillus species and the demographic and microbiologic characteristics of women colonized by these species. J Infect Dis 1999;180:1950-6.

155. Hamnes W, Weiss N, Holzapfel W, Balows A, Truper H, Dworkin M, *et al.* 2nd ed. Handbook ant Biology of Bacteria: Ecophysiolog, Isolation, Applications. The genera *Lactbacillus* and *Cornobacterium*, Procaryotes. New York (NY): Springer-Verlag; 1999. p. 1536.

156. Okkers DJ, Dicks LM, Silvester M, Joubert JJ, Odendaal HJ. Characterization of pentocin TV35b, a bacteriocin-like peptide isolated from *Lactobacillus pentosus* with a fungistatic effect on *Candida albicans*. J Appl Microbiol. 1999;87:726-34.

157. McGoarty J. Probiotic use of lactobacilli in the human female urogenital tract. FEMS Immunol Med Microbiol 1993;6:251-64.

158. Guay DR. Contemporary management of uncomplicated urinary tract infections. Drugs 2008;68:1169-205.

159. Reid G, Bruce AW. Probiotics to prevent urinary tract infections: the rationale and evidence. World J Urol 2006;24:28-32.

160. Juárez Tomás MS, Ocaña VS, Wiese B, Nader-Macías ME. Growth and lactic acid production by vaginal *Lactobacillus acidophilus* CRL 1259, and inhibition of uropathogenic *Escherichia coli*. J Med Microbiol 2003 ;52:1117-24.

161. Aroutcheva A, Gariti D, Simon M, Shott S, Faro J, Simoes JA, *et al.* Defense factors of vaginal lactobacilli. Am J Obstet Gynecol 2001;185:375-9.

162. Ruiz FO, Gerbaldo G, Asurmendi P, Pascual LM, Giordano W, Barberis IL. Antimicrobial activity, inhibition of urogenital pathogens, and synergistic interactions between lactobacillus strains. Curr Microbiol 2009;59:497-501.

163. Fred EB, Peterson WH, Anderson JA. The characteristics of certain pentose destroying bacteria, especially as concerns their action on arabinose. J Biol Chem 1921;48:385-412.

164. Torriani S, Felis GE, Dellaglio F. Differentiation of *Lactobacillus plantarum*, *L. pentosus*, and *L. paraplantarum* by *recA* gene sequence analysis and multiplex PCR assay with recA gene-derived primers. Appl Environ Microbiol 2001;67:3450-4.

165. Dellaglio F, Bottazzi V, Vescovo M. Deoxyribonucleic acid homology among *Lactobacillus* species of the subgenus *Streptobacterium* Orla-Jensen. Int J Syst Bacteriol 1975;25:160-172.

166. Bergey DH, Harrison FC, Breed RS, Hammer BW, Huntoon FM. 1st ed. In Buchanan RE, Gibbons NE, editors. Bergey's manual of determinative bacteriology. Baltimore (Md): The Williams & Wilkins Co.; 1923. p. 250.

167. Zanoni P, Farrow JAE, Phillips BA, Collins MD. *Lactobacillus pentosus* (Fred, Peterson and Anderson) sp. nov., nom. rev. Int J Syst Bacteriol 1987;37:339-41.

168. Curk MC, Hubert JC, Bringel F. *Lactobacillus paraplantarum* sp. nov., a new species related to *Lactobacillus plantarum*. Int J Syst Bacteriol 1996;46:595-8.

169. Olasupo NA. Bacteriocins of *Lactobacillus plantarum* strains from fermented foods. Folia Microbiol (Praha) 1996;41:130-6.

170. Todorov SD, Dicks LMT. Effect of Growth Medium on Bacteriocin Production by *Lactobacillus plantarum* ST194BZ, a Strain Isolated from Boza. Food Technol Biotech 2005;43:165-73.

171. Todorov SD. Bacteriocin production by *Lactobacillus plantarum* AMA-K isolated from Amasi, a Zimbabwean fermented milk product and study of the adsorption of bacteriocin AMA-K to *Listeria* sp. Braz J Microbiol 2008;39:178-87.

172. Jiménez-Díaz R, Rios-Sánchez RM, Desmazeaud M, Ruiz-Barba JL, Piard JC. Plantaricins S and T, Two New Bacteriocins Produced by *Lactobacillus plantarum* LPCO10 Isolated from a Green Olive Fermentation. Appl Environ Microbiol 1993;59:1416-24.

173. Okkers DJ, Dicks LM, Silvester M, Joubert JJ, Odendaal HJ. Characterization of pentocin TV35b, a bacteriocin-like peptide isolated from *Lactobacillus pentosus* with a fungistatic effect on *Candida albicans*. J Appl Microbiol 1999;87:726-34.

174. Todorov SD, Dicks LMT. Bacteriocin production by *Lactobacillus pentosus* ST712BZ isolated from boza. Braz. J. Microbiol. 2007;38:166-72.

175. Gardam MA, Burrows LL, Kus JV, Brunton J, Low DE, Conly JM, Humar A. Is surveillance for multidrug-resistant enterobacteriaceae an effective

infection control strategy in the absence of an outbreak? J Infect Dis 2002;186:1754-60

176. ผลการทดสอบความไวของเชื้อแบคทีเรียต่อยาต้านจุลชีพ จากสิ่งส่งตรวจประจำปี พ.ศ.2550 [Online]. 2009 [cite 2010 Apil 14]; Available from: URL:http://www.med.cmu.ac.th/hospital/lab/bac_menu_test50.htm

177. ผลการทดสอบความไวของเชื้อแบคทีเรียต่อยาต้านจุลชีพ จากสิ่งส่งตรวจประจำปี พ.ศ.2551 [Online]. 2009 [cite 2010 Apil 14]; Available from: URL:http://www.med.cmu.ac.th/hospital/lab/bac_menu_test51.html

178. University Hospital, Geneva. Enterobacteriaceae Producing Extended-spectrum β-lactamases (ESBL) Decolonization Study. [Online]. 2009 [cite 2010 June 13]; Available from: URL:http://clinicaltrials.gov/ct2/show/NCT00826670

179. MacDonald AA, Maple PA, Kibbler CC, George RC, Johnson AP, Du Bois SK, *et al.* Ceftazidime-resistant *Klebsiella pneumoniae*. Lancet. 1991;337: 1609-10.

180. Mammeri H, Laurans G, Eveillard M, Castelain S, Eb F. Coexistence of SHV-4- and TEM-24-producing *Enterobacter aerogenes* strains before a large outbreak of TEM-24-producing strains in a French hospital. J Clin Microbiol 2001;39:2184-90.

181. Kenneth Todar. The growth of bacterial populations: the bacterial growth curve [Online]. 2008 [cite 2010 June 13]; Available from: URL:http://www.textbookofbacteriology.net/ growth_3.html

182. O'Callaghan CH, Morris A, Kirby SM, Shingler AH. Novel method for detection of beta-lactamases by using a chromogenic cephalosporin substrate. Antimicrob Agents Chemother 1972;1:283-8.

183. Then RL. Ability of newer beta-lactam antibiotics to induce beta-lactamase production in Enterobacter cloacae. Eur J Clin Microbiol 1987;6:451-5.

184. Reid G, McGoarty JA, Angotti R, Cook RL. *Lactobacillus* inhibitor production against *Escherichia coli* and coaggregation ability with uropathogens. Can J Microbiol 1988;34:344-351.

185. Simm AM, Loveridge EJ, Crosby J, Avison MB, Walsh TR, Bennett PM. Bulgecin A: a novel inhibitor of binuclear metallo-beta-lactamases. Biochem J 2005;387:585-90.

APPENDICES

APPENDIX A

CHEMICAL AND MEDIA PREPARATIONS

1. Ammonium persulphate solution, 10% freshly prepared

	: per millilitre	
Ammonium persulphate (PlusOne ; Amersham Biosciences)	0.1	g
Deionized water	1	ml

Mix together and then use immediately

2. Blood Agar

	: per litre	
Blood agar base (Merck™ ; Merck KGaA)	40	g
Distilled water	950	ml

Suspend the medium powder and then autoclave at 121°C for 15 min. Cool to 50°C and add 50 ml sterile human blood to take 5% blood in total agar.

3. Nitrocefin, 500 µg/ml

	: per 2 ml	
Lyophilized nitrocefin (Oxoid ; Oxoid Ltd)	1	mg
Phosphate buffer (0.1M, pH 7.0) (Oxoid ; Oxoid Ltd)	1.9	ml
Dimethylsulphoxide (Oxoid ; Oxoid Ltd)	0.1	ml

Mix together. Keep the solution away from light and store at -20 °C.

4. Phosphate Buffer, pH 7.0

	: per litre
Monosodium phosphate (AnlalaR® ; BDH)	5.84 g
Disodium phosphate (AnlalaR® ; BDH)	15.47 g
1 mM EDTA (Vivantis ; Vivantis Technologies)	0.37 g
Deionized water	1 L

Mix together and make total volume up to 1 L with deionized water. Store at 4°C.

5. Phosphate buffer saline (PBS), 10X pH 7.2

	: per litre
Sodium chloride (Merck™ ; Merck KgaA)	80 g
Potassium chloride (M&B ; May&Baker Ltd, Dagenham, England)	2 g
Disodium hydrogen phosphate (AnlalaR® ; BDH, Dorset, England)	14.4 g
Photassium dihydrogen phosphate (AnlalaR® ; BDH)	2.4 g

Mix together in 900 ml of distilled water. Adjust to pH 7.2 by using 1 M NaOH and 1 M HCl. Add the distilled water up to 1 L. Store the solution at room temperature.

6. Resolving polyacrylamide gel, 12%

	: per 1 gel	
1.5 M Tris - HCL pH 8.8	2.5	ml
40% Acrylamide /Bis (PlusOne; Amersham Biosciences)	3.125	ml
10% (w/v) Sodium dodecyl sulphate	100	µl
10% (w/v) Ammonium persulphate	50	µl
TEMED (USB®; USB Corporation, Cleveland, OH)	3.3	µl
Deionized water	4.225	ml

Mix together and swirl gently to initiate polymerization.

7. SDS electrophoresis buffer, 10X

	: per litre	
Tris base (Merck™ ; Merck KGaA)	30.3	g
Glycine (Merck™ ; Merck KGaA)	144	g
Sodium dodecyl sulfate (Vivantis ; Vivantis Technologies, Selangor, Malaysia)	10	g
Deionized water	1	L

Mix together in 1 L of distilled water. Do not adjust pH. Store the solution at room temperature.

8. Sodium dodecyl sulphate solution (SDS), 10% w/v

	: per 100 ml
Sodium dodecyl sulphate	10 g
Deionized water	90 ml

Dissolve the sodium dodecyl sulphate in 90 ml of deionized water with gentle stirring and make to 100 ml with deionized water. Store at room temperature.

9. Stacking polyacrylamide gel, 4%

	: per 2 gels
0.5 M Tris-HCL pH 6.8	0.625 ml
40% Acrylamide /Bis	250 µl
10% (w/v) Solium dodecyl sulphate	25 µl
10% (w/v) Ammonium persulphate	12.5 µl
TEMED	3.3 µl
Deionized water	1.582 ml

Mix together and swirl gently to initiate polymerization.

10. Tris - HCl buffer, 0.5 M pH 6.8

	: per litre
Tris-base (Merck™ ; Merck KGaA)	60.5 g
Deionized water	900 ml

Mix together and then adjust the solution to pH 6.8 with 5 M HCl. Make total volume up to 1 L with deionized water and store at 4°C.

11. Tris - HCl buffer, 1.5 M pH 8.8

	: per litre
Tris - base	181.5 g
Deionized water	900 ml

Mix together and then adjust the solution to pH 8.8 with 5.0 M HCl. Make total volume up to 1 liter with deionized water and store at 4°C.

12. Urea Agar

	: per litre
Agar powder (BBL™ ; Becton Dickinson, Sparks, MD.)	15 g
Urea agar base (BBL™ ; Becton Dickinson)	29 g
Distilled water	1 L

Dissolve 29 g of the urea agar base powder in 100 mL of purified water. Mix thoroughly. Sterilize by filtration. Suspend 15 g of agar powder in 900 mL of purified water and autoclave at 121°C for 15 minutes. Cool to 50°C and add 100 mL of the sterile Urea Agar Base. Mix thoroughly and dispense aseptically in sterile tubes. Cool tubed medium in a slanted position. Do not remelt the complete medium.

APPENDIX B

LACTOBACILLUS

I. Data of primary antimicrobial screening

Table B1 Primary antimicrobial screening of lactobacilli (batch 1)

Isolates	Average diameter of inhibition zone (mm) against							
	S. aureus ATCC 25923		*S. lutea* ATCC 9341		*E. coli* ATCC 25922		*B. subtilis* ATCC 6633	
B309	13	14	11	12	10	10	13	13
B134	10	10	6	6	6	6	8	8
B16	12	13	13	13	11	11	15	15
B277	11	12	12	11	11	11	13	14
B35/2	15	16	13	13	10	11	15	15
B40/3	15	14	13	13	10	10	15	14
B1/4	14	15	11	11	11	11	13	13
B59/8	12	12	10	10	9	9	13	13
B1	16	14	12	12	11	10	12	12
B36/2	15	15	13	13	11	11	13	13
B43/3	14	14	12	14	10	10	13	13
B80/2	16	17	15	12	13	13	14	15
B93/2	13	13	12	11	11	9	13	13
B31/4	16	15	13	13	12	11	14	14
B97/3	12	13	12	11	9	9	11	11
B194	12	13	12	11	9	9	12	12
B16/3	11	10	12	12	11	12	15	14
B42/3	16	15	13	12	11	11	14	15
B19	12	12	6	6	10	10	13	13
B2	12	12	10	10	11	11	13	14
B247	12	12	6	6	11	11	12	12
B12/2	14	13	11	11	10	10	12	13
B8/2	16	16	13	13	12	13	14	15
B189	12	11	6	6	10	10	12	13
B11/4	13	14	13	13	12	12	14	15
B22/2	13	11	6	6	10	9	13	14
B211	11	11	6	6	10	10	13	13
B163	13	13	6	6	9	9	13	14
B18	13	13	12	10	9	10	13	12
B72/8	12	12	11	11	10	10	13	13
B21/8	15	15	14	14	12	13	15	15
B3	15	14	13	13	11	10	14	14
B8/8	12	12	12	12	11	10	12	12
B87/8	12	12	10	10	9	9	11	12
B22	17	17	15	15	13	13	15	15

Table B1 (continued)

Isolates	Average diameter of inhibition zone (mm) against							
	S. aureus		*S. lutea*		*E. coli*		*B. subtilis*	
	ATCC 25923		ATCC 9341		ATCC 25922		ATCC 6633	
B6/7	13	12	12	9	10	11	13	12
B8	11	15	14	14	11	11	15	15
B14	15	16	14	15	11	11	13	15
B126	12	11	6	6	6	6	8	8
B282	15	14	11	12	9	9	14	15
B40/8	12	12	9	10	8	8	12	12
B199	13	13	10	11	10	10	12	12
B280	18	18	16	16	13	13	17	16
B146	11	11	6	6	6	6	9	9
B79/3	10	10	6	6	11	11	9	10
B18/3	12	12	9	9	10	10	12	12
B38/3	11	10	6	6	6	6	9	9
B30/3	11	12	9	9	6	6	10	10
B120	10	10	6	6	6	6	7	7
B99/2	13	15	13	13	12	12	15	15
B85	11	10	6	6	6	6	9	9
B41	12	12	11	11	11	12	13	12
B18/9	10	10	7	7	6	6	9	9
B2/7	13	13	12	13	11	11	13	12
B1/9	12	12	12	12	11	12	12	12
B45	14	14	13	13	9	9	12	12
B305	16	17	17	16	13	11	14	14
B184	16	15	15	13	10	10	13	10
B63/8	9	9	9	10	10	9	10	12
B40/2	12	12	11	11	10	11	12	12
B85/4	11	11	6	6	9	9	11	11
B49	15	15	14	13	10	11	13	14
B37/5	14	15	12	12	10	11	12	13
B28/5	14	13	11	11	10	11	12	12
B39/5	15	14	11	12	11	11	12	12
B39/4	16	15	14	14	11	11	13	13
B18/4	15	14	13	13	11	11	13	13
B100/2	16	15	13	12	11	12	13	13
B92/4	14	14	11	11	11	11	13	12
B35/4	14	15	13	12	11	10	14	15
B50	15	14	13	13	12	12	15	15
B20/5	15	15	13	13	11	10	13	14

*Bold numbers : Selected isolates for further study

Table B2 Primary antimicrobial screening of lactobacilli (batch 2)

Isolates	Average diameter of inhibition zone (mm) against							
	S. aureus ATCC 25923		*S. lutea* ATCC 9341		*E. coli* ATCC 25922		*B. subtilis* ATCC 6633	
B2/22	17	16	18	16	13	14	16	16
G8/22	15	15	14	15	13	14	15	16
D6/22	15	14	15	15	13	14	17	16
B6/22	14	14	16	15	13	14	17	17
E1/22	15	14	14	14	13	13	17	16
G4/22	13	14	15	14	14	13	15	15
B4/22	14	14	18	17	14	14	17	17
B8/22	15	15	18	17	13	14	18	19
B6/6	9	10	14	13	9	9	14	14
H9/22	14	15	14	15	11	12	17	18
B9/22	15	16	16	15	12	12	18	18
F9/22	12	14	15	14	13	13	14	15
E3/22	14	15	18	18	12	14	15	14
D1/22	13	13	15	16	12	12	15	16
C9/22	16	17	16	17	14	14	17	17
G7/22	15	15	16	15	12	12	19	19
E9/22	14	15	17	16	12	12	17	16
I2/22	14	15	16	16	12	13	17	17
A5/6	9	10	10	10	8	9	11	12
H6/22	13	14	15	15	12	12	17	16
I8/22	14	14	16	16	13	13	16	16
B9/6	14	13	16	15	13	12	17	17
A1/6	13	15	15	15	12	13	17	18
A7/22	14	15	15	16	15	15	16	16
D7/22	16	14	14	15	12	12	16	19
A4/22	14	14	16	16	12	12	16	18
E6/22	15	14	16	16	12	13	15	15
B5/22	14	15	16	16	15	14	16	18
F1/22	15	15	16	17	13	11	16	18
A9/22	15	15	16	16	12	11	15	15
C6/22	15	14	15	16	12	11	16	16
A8/22	14	15	16	16	12	12	17	16
D4/22	15	15	18	15	12	12	17	17
I6/22	14	14	15	15	12	12	17	17
C8/22	13	14	16	16	13	12	16	17
A6/22	16	14	16	16	13	13	16	16
C3/22	15	15	15	15	14	14	18	17
D5/22	14	14	19	18	12	13	16	16
G9/22	14	15	14	15	12	13	16	16
A5/22	14	15	16	17	14	14	16	17
A8/6	13	12	11	11	10	10	16	16
F8/22	15	16	17	16	14	15	20	20
A4/6	13	12	15	14	13	13	16	16
E4/22	14	14	14	15	13	13	16	17
I9/22	14	14	16	16	13	13	17	17

Table B2 (continued)

Isolates	Average diameter of inhibition zone (mm) against							
	S. aureus		*S. lutea*		*E. coli*		*B. subtilis*	
	ATCC 25923		ATCC 9341		ATCC 25922		ATCC 6633	
B7/6	14	14	15	14	13	13	16	16
G1/22	15	15	17	16	13	13	18	19
F3/22	15	16	15	15	13	13	15	17
G5/22	15	16	16	15	13	13	17	18
G2/22	16	15	16	17	13	13	17	17
E2/22	14	13	15	15	13	13	15	15
F2/22	16	17	15	15	13	13	17	17
F7/22	15	15	16	15	13	13	18	17
E5/22	15	14	15	15	13	13	16	16
F4/22	15	14	15	16	12	13	16	17
B8/6	15	15	13	14	13	12	15	15
C2/22	15	14	15	15	12	12	16	18
F5/22	16	16	16	15	11	11	15	17
A3/6	15	14	17	14	11	12	16	16
D2/22	14	15	15	15	13	13	16	16
A9/6	13	12	14	15	9	10	15	15
A6/6	12	14	11	12	11	9	14	12
B1/6	13	13	16	15	13	13	17	17
H7/22	14	14	16	16	14	13	17	16
H5/22	15	14	16	16	13	13	17	19
I5/22	14	14	15	14	13	14	16	17
B3/6	11	11	14	14	11	10	15	15
H3/22	13	14	16	16	12	13	19	19
I4/22	15	15	15	15	15	15	16	17
B4/6	11	10	13	12	11	10	13	13
B5/6	10	10	12	12	9	8	14	14
A2/6	11	11	13	13	12	11	14	13
A7/6	13	13	13	14	13	13	16	16
C4/22	14	15	16	16	14	14	17	17
B1/22	15	15	17	18	13	13	16	16
B7/22	14	15	19	18	13	13	16	15
G6/22	15	14	16	15	13	12	16	16
C7/22	15	15	16	15	13	13	17	17
D9/22	15	15	16	15	13	14	15	16
D8/22	15	16	16	17	12	13	15	15
C5/22	13	13	15	15	12	12	15	15
D3/22	15	13	14	13	13	11	16	16
B3/22	12	15	15	15	11	12	9	9
B2/6	12	10	12	13	6	6	11	11
A3/22	14	15	15	15	14	14	17	17
F6/22	15	14	15	16	13	14	17	17
G3/22	15	15	15	15	13	14	17	17
C1/22	15	15	15	16	14	14	17	17
E8/22	15	14	15	14	12	13	16	17
E7/22	14	14	15	15	12	13	16	17

Table B2 (continued)

Isolates	Average diameter of inhibition zone (mm) against							
	S. aureus		*S. lutea*		*E. coli*		*B. subtilis*	
	ATCC 25923		ATCC 9341		ATCC 25922		ATCC 6633	
A2/22	13	14	14	14	13	13	17	16
A1/22	15	15	15	16	13	12	16	16
B16	15	13	15	15	12	12	16	15
B50	15	15	14	15	12	12	15	15
B309	10	11	13	12	10	9	13	13
B62/8	15	15	15	15	13	12	15	16
B184	14	14	17	15	14	13	17	17
B63/8	14	15	16	16	13	13	17	16
I7/22	15	14	16	16	14	13	16	16
B18	11	11	13	12	6	6	11	13

*Bold numbers : Selected isolates for further study

Table B3 Secondary screening of lactobacilli against 4 standard strains

Isolates	Average diameter of inhibition zone (mm) against							
	S. aureus		*S. lutea*		*E. coli*		*B. subtilis*	
	ATCC 25923		ATCC 9341		ATCC 25922		ATCC 6633	
F6/22	19	20	17	17	15	14	16	16
F7/22	16	16	27	27	25	22	17	17
B35/2	24	24	19	20	18	14	16	17
B50	16	16	28	28	26	14	16	16
L541	23	23	28	28	26	19	17	17
SS	19	20	25	25	23	16	17	17
B8	16	16	28	28	26	12	18	18
B14	16	15	26	27	25	17	18	18
B99/2	11	11	18	19	17	12	15	14
G1/22	16	15	24	24	22	14	15	15
F8/22	17	17	22	21	19	17	19	18
B80/2	17	16	25	25	23	14	17	17
G5/22	16	17	26	27	25	13	16	16
B8/2	14	14	20	19	17	11	17	16
LP055	17	17	25	25	23	15	16	16
LCR10	18	17	27	26	24	14	16	17
L1034	22	22	28	28	26	19	17	17
LC309	18	18	21	21	19	15	17	17
B31/4	16	16	24	23	21	14	16	16
G2/22	22	22	25	26	24	18	18	18
B305	19	20	27	27	25	19	18	18
B280	19	18	25	25	23	18	17	17
B16	16	17	23	22	20	19	15	16
B22	16	16	19	19	17	18	15	15
B42/3	14	15	18	18	16	14	16	15
B21/8	20	20	27	26	24	18	17	18
B11/4	16	16	19	18	16	16	16	15

Table B3 (continued)

Isolates	Average diameter of inhibition zone (mm) against							
	S. aureus		*S. lutea*		*E. coli*		*B. subtilis*	
	ATCC 25923		ATCC 9341		ATCC 25922		ATCC 6633	
B39/4	21	21	27	26	24	17	17	16
A5/22	15	14	23	24	22	12	13	13
B4/22	18	18	26	26	24	18	16	16
B49	15	15	18	18	16	15	14	15
B100/2	13	13	17	17	15	11	13	13
B2/22	17	17	27	26	24	13	15	16
B8/22	15	14	25	25	23	14	17	18
G3/22	12	13	25	26	24	13	17	16
C9/22	16	15	26	26	24	16	17	17
C4/22	16	16	24	25	23	13	18	18
C3/22	17	16	26	27	25	16	16	15
F2/22	15	15	25	25	23	13	16	17
B5/22	18	18	24	25	23	11	20	20
D4/22	16	16	27	28	26	14	17	17
F1/22	16	16	26	26	24	14	18	18
I4/22	14	14	25	24	22	15	18	18
H5/22	14	14	23	23	21	15	19	19
C7/22	15	14	22	21	19	14	19	18
B1/22	16	15	26	26	24	14	16	17
B184	16	16	23	23	21	14	17	18
C1/22	15	15	25	26	24	15	18	18
B9/22	16	15	21	20	18	14	15	14

*Bold numbers : Selected isolates for further study

Table B4 Antimicrobial screening of lactobacilli against 6 laboratory strains

Isolates	Average diameter of inhibition zone (mm) against											
	E. coli ATCC 25922		*P. aeruginosa* ATCC 27853		*A. baumannii*		*P. vulgaris*		*E. feacalis*		*S. agalactiae*	
F7/22	12	11	14	15	13	12	14	14	17	17	16	16
L541	13	13	15	16	14	14	14	13	19	18	16	17
B14	14	13	13	13	15	15	12	12	17	16	12	12
F8/22	13	14	17	16	16	15	13	14	18	17	17	17
G2/22	13	13	13	12	15	15	17	17	16	15	13	14
B305	14	14	14	14	16	16	17	17	19	19	15	15
B21/8	14	14	15	15	15	14	17	17	17	17	15	14
B39/4	13	13	12	12	15	14	14	14	19	18	15	15
LSS	17	16	15	15	14	14	17	16	16	15	13	13
B4/22	14	15	15	14	15	16	15	15	15	16	13	13
L1034	18	18	13	14	15	14	15	16	18	17	14	13
B280	15	14	14	15	15	15	17	16	19	20	15	15

*Bold numbers : Selected isolates for further study

Table B5 Antimicrobial screening of lactobacilli against 38 clinical strains

Isolates	Average diameter of inhibition zone (mm) against											
	L541		F8/22		L1034		LSS		B305		B280	
U808	12	11	13	12	14	14	11	11	11	11	12	12
U842	14	15	16	15	14	13	6	6	13	13	13	13
U1228	16	15	12	11	18	18	15	14	15	16	15	15
U947	12	12	12	13	12	11	13	14	13	14	11	10
U1224	19	19	16	17	17	17	17	17	16	16	18	17
U1264	14	14	15	15	15	16	15	15	12	12	13	14
U1104	17	17	17	16	16	16	18	17	18	17	16	17
U1035	16	16	15	15	17	17	15	15	14	15	16	16
U846	11	11	6	6	10	9	11	10	6	6	6	6
U978	16	15	14	14	15	14	14	14	12	13	13	12
U1242	18	18	18	18	18	18	18	18	19	18	17	16
U1266	16	16	15	15	18	18	15	15	15	15	13	13
U1202	16	16	14	14	16	16	15	15	15	15	15	15
U1226	16	16	13	14	16	17	16	16	15	15	13	13
U1220	17	17	15	15	18	18	16	15	17	17	15	15
U1210	14	15	14	14	14	14	15	14	15	14	14	14
U874	12	11	12	12	12	13	13	12	12	12	12	12
U965	14	13	12	12	12	11	12	12	13	13	14	14
U849	12	13	12	11	12	13	13	13	12	13	12	12
U883	10	10	10	9	11	11	12	11	11	11	12	13
U1284	17	17	15	14	19	19	17	17	16	16	15	15
U1256	16	16	17	18	16	16	16	16	16	16	17	17
U916	12	12	12	11	11	10	12	12	11	10	13	13
U940	15	14	9	9	11	10	13	14	13	12	15	14
U924	10	11	10	9	12	12	11	10	8	9	10	9
U1181	18	17	16	16	16	17	16	16	20	19	16	15
U958	11	10	11	11	10	9	11	10	11	11	8	9
U891	14	14	13	12	15	14	12	13	13	12	12	12

Table B5 (continued)

Isolates	Average diameter of inhibition zone (mm) against											
	L541*		F8/22		L1034		LSS*		B305		B280	
U863	12	12	13	13	14	14	14	14	12	12	13	13
U944	10	10	6	6	10	10	11	11	12	12	13	13
U981	12	12	12	11	12	12	14	14	13	13	14	14
U1003	12	12	12	12	12	13	12	12	11	12	11	11
U1092	17	17	16	15	17	17	15	15	17	17	16	16
U1027	18	17	17	17	18	18	18	18	19	19	19	18
U817	12	13	10	10	10	10	11	11	10	10	10	10
U885	13	13	13	13	14	14	14	14	15	14	12	13
U1249	17	17	18	18	17	17	18	18	18	17	18	18
U1043	17	17	16	15	17	16	17	17	18	17	15	15

* Selected isolates for further study

II. Data of biochemical identification and characterization of supernatant.

Table B6 Biochemical tests of 2 standard lactobacillus strains by using API50 CHL kit

Biochemical tests	Strains	
	L. casei TISTR 390	*L. rhamnosus* TISTR 108
CTRL	-	-
GLY	-	-
ERY	-	-
DARA	-	-
LARA	-	-
RIB	+	+
DXYL	-	-
LXYL	-	-
ADO	-	-
MDX	-	-
GAL	+	+
GLU	+	+
FRU	+	+
MNE	+	+
SBE	+	+
RHA	-	+
DUL	-	-
INO	-	-
MAN	+	+
SOR	+	+
MDM	-	-
MDG	-	+
NAG	+	+
AMY	±	+
ARB	±	+
ESC	+	+
SAL	±	+
CEL	±	+
MAL	±	+
LAC	+	+
MEL	-	-
SAC	+	+
TRE	+	+
INU	+	-
MLZ	+	+
RAF	-	-
AMD	-	-
GLYG	-	-
XLT	-	-
GEN	-	-
TUR	+	+

Table B6 (continued)

Biochemical tests	Strains	
	L. casei TISTR 390	*L. rhamnosus* TISTR 108
LYX	-	-
TAG	+	+
DFUC	-	-
LFUC	-	-
DARL	-	-
LARL	+	-
GNT	-	-
2KG	-	-
5KG	-	-

+, positive reaction; -, negative reaction; ±, doubtful

The species identification was accepted at 80% identity by database.

CTRL, control; GLY, glycerol; ERY, erythritol; DARA, D - arabinose; LARA, L - arabinose; RIB, D - ribose; DXYL, D - xylose; LXYL, L - xylose; ADO, D - adonitol; MDX, methyl - βD -xylopyranoside; GAL, D - galactose; GLU, D - glucose; FRU, D - fructose; MNE, D - mannose, SBE, L - sorbose; RHA, L - rhamnose; DUL, dulcitol; INO, inositol; MAN, D - mannitol; SOR, D -sorbitol; MDM, methyl - αD - mannopyranoside; MDG, methyl - αD - glucopyranoside; NAG, N -acetylglucosamine; AMY, amygdalin; ARB, arbutin; ESC, esculin ferric citrate; SAL, salicin; CEL, D - cellobiose; MAL, D - maltose; LAC, D - lactose (bovine origin); MEL, D - melibiose; SAC, D -saccharose (sucrose); TRE, D - trehalose; INU, inulin; MLZ, D - melezitose; RAF, D - raffinose; AMD, amidon (starch); GLYG, glycogen; XLT, xylitol; GEN, gentiobiose; TUR, D - turanose; LYX, D - lyxose; TAG, D - tagatose; DFUC, D - fucose; LFUC, L - fucose; DARL, D - arabitol; GNT, potassium gluconate; 2KG, potassium 2 - ketogluconate; 5KG, potassium 5 - ketogluconate

Table B7 Biochemical tests of 2 potent antimicrobial producing *Lactobacillus*

Biochemical tests	Strains	
	L541	LSS
CTRL	-	-
GLY	-	+
ERY	-	-
DARA	-	-
LARA	-	+
RIB	+	+
DXYL	-	+
LXYL	-	-
ADO	-	-
MDX	-	-
GAL	+	+
GLU	+	+
FRU	+	+
MNE	+	+

Table B7 (continued)

Biochemical tests	Strains	
	L541	LSS
SBE	-	-
RHA	-	+
DUL	-	+
INO	-	-
MAN	+	+
SOR	+	+
MDM	-	-
MDG	-	+
NAG	+	+
AMY	+	+
ARB	+	+
ESC	+	+
SAL	+	+
CEL	+	+
MAL	+	+
LAC	+	+
MEL	+	+
SAC	+	+
TRE	+	+
INU	-	-
MLZ	-	+
RAF	+	+
AMD	-	-
GLYG	-	-
XLT	-	-
GEN	+	+
TUR	-	±
LYX	-	-
TAG	-	-
DFUC	-	-
LFUC	-	±
DARL	±	+
LARL	-	-
GNT	±	±
2KG	-	-
5KG	-	-

+, positive reaction; -, negative reaction; ±, doubtful

The species identification was accepted at 80% identity by database.

Table B8 The cut - off concentration of hydrogen peroxide

Concentration (mmol/l)	Average diameter of inhibition zone (mm) against							
	E. coli ATCC 25922		U1249		U1104		U874	
10	13	13	10	10	10	9	12	11
9	12	11	11	10	11	11	11	13
8	11	12	9	9	11	11	12	11
7	11	10	10	9	9	9	11	12
6	10	10	10	10	9	9	10	11
5	10	10	9	9	9	8	11	11
4	10	9	9	9	-	-	11	10
3	9	9	9	9	-	-	10	10
2	8	9	-	-	-	-	10	9
1	-	-	-	-	-	-	9	9

-, No zone detected

Table B9 Hydrogen peroxide standard curve

Concentration (µmol/l)	$OD_{595}1$	$OD_{595}2$	OD_{595}(average)	OD_{595} test-blank
0.00	0.284	0.282	0.283	0.000
1.95	0.307	0.302	0.305	0.022
3.91	0.327	0.328	0.328	0.045
7.81	0.363	0.43	0.397	0.114
15.62	0.471	0.466	0.469	0.186
31.25	0.67	0.672	0.671	0.388

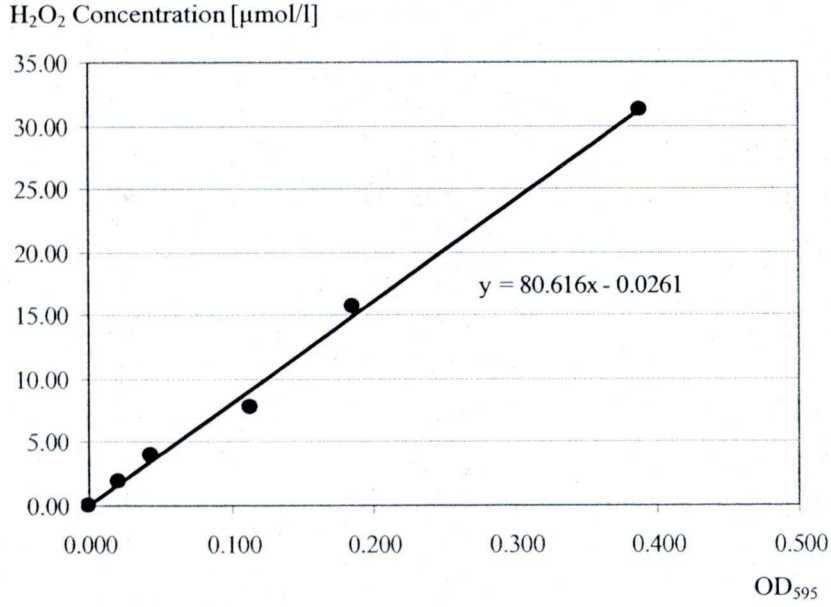

Figure B1 Standard curve of hydrogen peroxide determination

Table B10 Hydrogen peroxide determination of cell - free supernatants

Test	$OD_{595}1$	$OD_{595}2$	OD_{595}(average)
LSS	0.356	0.350	0.353
L541	0.359	0.357	0.358
MRS	0.304	0.302	0.303

Table B11 The cut - off concentration of lactic acid

Concentration (mmol/l)	Average diameter of inhibition zone (mm) against							
	E. coli ATCC 25922		U1249		U1104		U874	
500	20	21	23	20	17	17	18	15
250	18	17	16	15	12	11	14	12
200	16	16	15	14	11	10	13	12
175	14	15	12	12	10	11	11	10
150	12	13	11	11	9	8	10	10
125	11	11	10	9	9	8	11	9
100	11	10	11	11	-	-	10	9
75	8	9	9	9	-	-	9	8
50	-	-	-	-	-	-	-	-

-, Not zone detected

Table B12 Lactic acid standard curve

Concentration (mmol/l)	OD_{340}Af	OD_{340}Ai	OD_{340}Af-Ai	OD_{340}test-blank
0.000	0.320	0.281	0.039	0.000
0.019	0.314	0.274	0.040	0.010
0.038	0.344	0.267	0.077	0.039
0.075	0.471	0.272	0.199	0.160
0.150	0.498	0.246	0.252	0.214
0.300	0.766	0.263	0.504	0.465

Ai , initial absorbance; Af , final absorbance

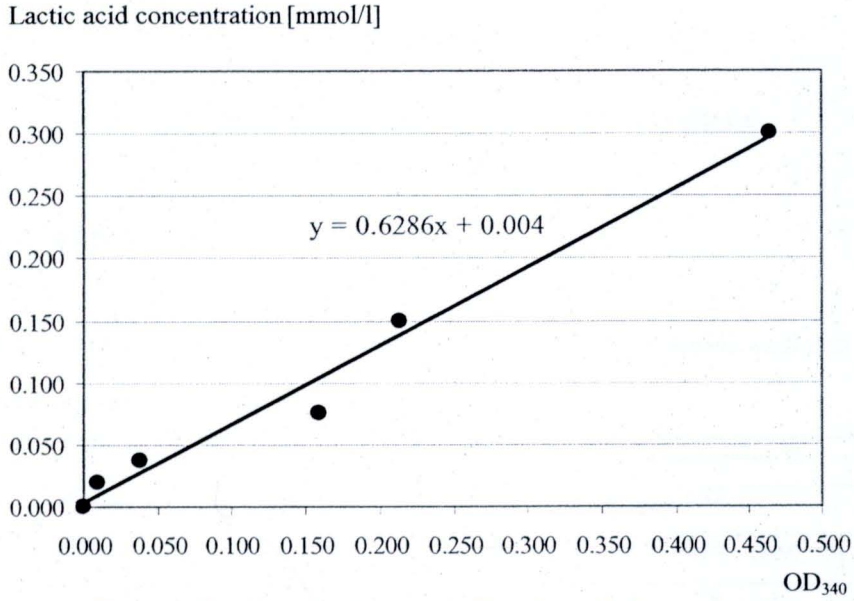

Figure B2 Standard curve of lactic acid determination

Table B13 Lactic acid determination of cell - free supernatants

Test	$OD_{340}Af$	$OD_{340}Ai$	$OD_{340}Af - Ai^*$
LSS	1.418	0.353	1.065
L541	1.789	0.331	1.458
MRS	0.972	0.705	0.267

Ai, initial absorbance; Af, final absorbance

* 1/10 dilution

Table B14 Total protein determination of cell - free supernatants

Test	Concentration - read (µg/ml)	Concentration - calculation (µg/ml)	Dilution of sample
LSS	18.5	1,850	undiluted
L541	19.3	1,930	undiluted
B120	20.0	2,000	undiluted
MRS	14.6	1,460	undiluted

Table B15 Total protein determination of crude bacteriocins

Test	Concentration - read (µg/ml)	Concentration - calculation (µg/ml)	Dilution of sample
LSS	4.05	405	1:10
L541	6.86	686	1:10
B120	7.55	755	1:10
MRS	18.6	1860	1:2

APPENDIX C

UROPATHOGENIC ENTEROBACTERIA

II. Data of antimicrobial susceptibility test

Table C1 Antimicrobial susceptibility test of 149 bacterial isolates toward the antibiotic drugs in group A and B antibiotics

Isolates	Average diameter of inhibition zone (mm) due to												
	Group A*			Group B**									
	AM	CF	GM	AK	AMC	CIP	CTX	FEP	FOX	IPM	MA	PRL	STX
u1/1	-	-	15	21	17	-	13	22	22	28	-	13	-
u1/2	-	-	17	23	15	-	12	17	14	30	-	11	-
u1/3	-	17	16	24	17	35	25	29	27	25	16	-	-
u1/4	-	-	-	23	10	-	-	17	10	27	-	10	-
u1/5	-	14	21	21	19	25	32	32	23	30	18	15	-
u1/6	-	-	17	20	26	-	17	29	22	28	15	10	14
u1/7	-	-	-	24	15	-	-	12	9	30	-	-	-
u1/8	-	-	-	21	14	-	-	15	24	28	-	10	-
u1/9	-	-	18	22	16	-	14	15	24	28	-	-	-
u1/10	-	-	-	20	23	18	25	29	21	29	18	14	29
u1/11	-	-	-	20	18	-	25	31	22	27	19	17	-
u1/12	-	-	19	25	18	-	25	13	13	30	-	-	21
u1/13	-	-	-	22	15	30	11	17	24	29	-	10	-
u1/14	-	18	22	22	18	12	31	33	24	29	25	18	-
u1/15	-	15	24	24	21	-	34	34	24	28	17	14	27
u1/16	-	-	-	23	23	8	-	14	22	33	-	9	-
u1/17	-	-	-	16	16	-	-	15	19	29	-	-	-
u1/18	-	17	22	22	18	33	31	35	26	28	26	19	-
u1/19	-	-	-	21	17	-	14	21	22	31	-	13	-
u1/20	-	-	-	19	14	-	13	18	15	30	-	12	-
u1/21	-	17	20	23	19	10	33	30	25	28	25	16	19
u1/22	-	-	-	20	14	-	-	11	23	29	-	-	14
u1/23	-	-	-	19	13	-	-	11	20	28	-	-	19
u1/24	-	-	-	18	13	8	13	11	20	24	-	-	-
u1/25	-	-	-	20	13	-	-	12	20	29	-	-	20
u1/26	-	-	-	20	13	-	12	15	20	28	-	-	-
u1/27	-	-	-	18	10	-	-	-	8	26	-	-	-
u1/28	-	-	18	19	9	29	22	30	9	24	15	11	-
u1/29	15	-	16	20	10	32	25	30	9	24	21	20	27
u1/30	-	-	-	-	20	-	10	16	8	30	-	-	-
u2/1	-	11	-	20	17	-	30	30	18	27	16	10	-
u2/2	-	-	7	16	13	-	-	11	20	26	-	7	-
u2/3	-	-	7	15	13	-	-	11	12	24	-	8	-

Table C1 (continued)

Isolates	Average diameter of inhibition zone (mm) due to												
	Group A*			Group B**									
	AM	CF	GM	AK	AMC	CIP	CTX	FEP	FOX	IPM	MA	PRL	STX
u2/4	-	-	-	20	18	-	-	18	11	25	-	-	-
u2/5	-	-	13	18	17	-	15	14	22	27	-	18	-
u2/6	-	-	-	22	18	10	-	11	20	27	-	-	-
u2/7	-	-	-	19	11	-	14	27	7	27	8	13	-
u2/8	-	-	-	20	21	-	-	13	21	27	-	-	-
u3/1	-	-	-	15	14	-	13	18	15	30	-	10	-
u3/2	-	-	17	22	17	-	13	20	23	35	10	12	28
u3/3	-	16	-	16	20	-	26	25	22	26	20	12	-
u3/4	-	-	18	17	17	-	23	26	10	27	12	11	22
u3/5	-	-	-	18	14	-	14	18	15	25	-	11	-
u3/6	-	16	-	19	20	9	26	29	26	28	20	13	-
u3/7	-	17	17	18	20	8	27	30	25	29	21	15	-
u3/8	-	-	-	20	21	-	15	19	27	30	-	-	-
u3/9	-	-	-	20	18	8	-	13	20	28	-	-	-
u3/10	-	11	16	20	17	35	26	28	23	29	17	15	-
u3/11	-	13	-	18	18	-	28	30	26	28	20	13	25
u3/12	-	11	-	20	16	21	26	26	21	26	15	10	-
u3/13	-	-	17	17	13	-	-	-	22	25	-	-	-
u3/14	-	-	-	15	14	-	11	13	21	25	-	-	-
u3/15	-	-	8	17	13	-	10	14	19	27	-	-	-
u4/1	-	15	18	20	18	32	27	28	24	27	20	12	30
u4/2	-	12	-	21	19	-	28	27	25	23	21	12	12
u4/3	-	8	8	20	21	30	21	27	24	26	12	18	-
u4/4	-	-	16	15	10	-	15	21	-	23	-	10	-
u4/5	-	-	7	16	17	-	14	18	22	25	-	10	-
u4/6	-	-	12	21	17	-	-	9	15	31	-	-	22
u4/7	-	-	19	19	18	20	-	12	25	26	-	-	26
u4/8	17	15	8	20	21	8	32	32	26	30	28	26	-
u4/9	-	14	-	20	18	-	30	32	20	27	21	11	-
u4/10	-	-	-	15	13	-	-	-	19	27	-	-	-
u4/11	-	16	12	20	20	12	28	26	25	27	23	17	-
u4/12	-	10	-	19	15	-	26	25	17	29	17	13	-
u4/13	-	16	10	18	18	10	26	26	21	27	21	16	-
u4/14	-	-	-	18	14	-	-	10	16	26	-	-	-
u4/15	-	15	23	22	17	23	28	30	25	28	20	10	-
u4/16	-	20	11	22	23	11	27	30	22	29	25	20	-
u4/17	-	-	21	13	17	21	-	13	22	28	-	-	-
u4/18	-	-	15	17	8	-	-	18	-	25	-	10	-
u5/1	-	8	17	15	13	-	20	22	23	25	10	12	-
u5/2	-	14	20	20	21	31	26	25	17	26	18	18	-
u5/3	-	-	-	19	13	16	-	11	19	24	-	-	-
u5/4	-	-	18	20	15	35	10	15	23	28	-	-	19
u5/5	-	-	-	22	10	-	11	16	-	22	-	-	-
u5/6	-	20	16	16	21	30	29	28	25	25	21	21	25

Table C1 (continued)

Isolates	Average diameter of inhibition zone (mm) due to												
	Group A*			Group B**									
	AM	CF	GM	AK	AMC	CIP	CTX	FEP	FOX	IPM	MA	PRL	STX
u5/7	-	-	-	18	13	-	-	-	17	25	-	-	-
u5/8	-	17	19	17	20	11	30	26	24	25	22	12	-
u5/9	-	17	9	20	18	-	25	24	24	29	20	14	-
u5/10	-	15	17	16	19	-	28	25	24	22	20	14	-
u5/11	-	-	-	18	17	-	8	-	17	27	-	-	-
u5/12	-	15	-	16	20	-	27	26	23	27	19	12	-
u5/13	-	18	20	20	21	-	34	34	26	32	22	20	-
u5/14	13	11	17	17	20	-	25	26	15	27	20	21	24
u5/15	-	15	18	18	16	38	34	30	26	27	15	11	14
u5/16	-	16	18	16	19	-	25	25	22	25	20	12	-
u5/17	-	11	15	14	17	24	25	23	25	24	13	-	23
u5/18	-	12	19	17	16	-	27	26	20	26	18	14	8
u5/19	-	12	16	17	17	24	25	23	24	25	12	10	26
u5/20	-	-	10	19	17	-	-	-	22	23	-	-	-
u5/21	-	15	8	18	18	27	29	27	24	22	18	12	24
u5/22	-	-	-	17	17	20	-	10	21	25	-	-	-
u5/23	-	-	-	18	11	-	-	-	9	28	-	-	-
u6/1	15	14	18	20	19	-	26	28	22	24	22	25	27
u6/2	-	15	-	22	20	-	21	27	20	30	17	16	-
u6/3	-	14	17	20	16	-	31	28	23	25	17	11	-
u6/4	-	-	-	22	18	-	14	17	18	27	-	-	-
u6/5	-	10	20	21	15	20	28	30	25	27	13	-	21
u6/6	-	12	20	21	18	-	28	26	21	27	18	15	-
u6/7	-	-	11	20	16	-	8	10	21	27	-	-	-
u6/8	-	-	10	19	11	-	-	10	21	25	-	-	-
u6/9	-	-	-	20	18	-	-	10	22	26	-	-	-
u6/10	-	-	9	21	17	-	-	8	21	18	-	-	-
u6/11	-	-	-	20	16	23	15	20	22	26	-	-	-
u6/12	-	-	18	19	19	26	20	23	21	25	12	11	-
u6/13	-	-	8	21	15	-	-	9	20	25	-	-	-
u7/1	-	-	20	21	17	-	-	12	20	27	-	-	24
u7/2	-	-	-	16	17	-	8	13	21	26	-	-	-
u7/3	-	-	17	17	20	-	14	15	24	22	-	8	21
u7/4	-	-	19	22	18	-	14	15	24	26	-	8	-
u7/5	-	-	10	22	18	30	11	11	11	23	-	-	-
u7/6	-	-	-	21	15	-	-	10	21	26	-	-	-
u7/7	-	-	-	18	15	-	8	11	23	28	-	-	-
u7/8	-	-	17	18	20	-	-	12	24	26	-	-	23
u7/9	-	-	-	16	14	-	-	-	15	16	-	-	-
u7/10	-	-	-	17	14	-	10	14	23	25	-	-	-
u7/11	-	-	8	20	18	-	-	10	23	25	-	-	-
u7/12	-	-	21	21	18	-	9	12	21	27	-	-	26
u7/13	-	-	-	17	16	-	9	13	20	22	-	-	-
u7/14	-	-	8	18	12	-	16	22	17	25	-	-	-

Table C1 (continued)

Isolates	Average diameter of inhibition zone (mm) due to												
	Group A*			Group B**									
	AM	CF	GM	AK	AMC	CIP	CTX	FEP	FOX	IPM	MA	PRL	STX
u7/15	-	-	13	17	20	11	15	22	20	25	22	12	-
u7/16	-	-	9	19	14	-	13	14	19	26	-	-	-
u7/17	-	-	20	20	10	-	-	17	-	23	-	-	25
u7/18	-	-	10	21	10	-	-	10	-	25	-	-	-
u7/19	14	-	15	19	10	28	26	26	-	21	20	21	24
u7/20	-	-	20	20	-	30	-	16	9	21	-	-	27
u8/1	-	14	18	16	19	30	28	23	21	22	17	12	-
u8/2	-	16	18	17	17	30	26	26	21	22	21	12	-
u8/3	-	-	-	18	16	-	12	17	21	25	-	-	-
u8/4	-	-	-	20	14	-	-	12	17	14	-	-	-
u8/5	-	11	19	18	17	-	28	27	17	27	12	10	-
u8/6	-	10	-	15	14	-	25	20	14	25	14	10	15
u8/7	-	-	16	18	8	-	21	26	8	22	11	17	-
u8/8	19	12	-	16	22	23	27	30	21	25	25	25	13
u8/9	-	-	16	17	9	22	18	26	12	21	8	-	-
u8/10	-	-	-	17	16	-	11	18	23	25	-	-	-
u8/11	-	-	19	18	17	-	8	15	15	25	-	10	-
u8/12	-	-	17	17	17	12	13	16	22	25	-	8	10
u8/13	-	13	16	19	14	-	28	25	22	25	14	-	-
u8/14	-	-	-	17	11	-	-	9	14	26	-	-	-
u8/15	-	-	8	23	21	-	16	22	28	29	-	10	20
u8/16	-	-	-	18	12	-	-	9	21	24	-	-	-
u8/17	-	-	22	22	20	12	29	20	22	25	-	13	21
u8/18	-	-	-	18	12	-	-	9	19	23	-	-	-
u8/19	-	-	-	16	15	-	27	23	20	25	-	-	-
u9/1	-	25	18	19	21	25	25	25	24	23	26	21	25
u9/2	8	21	16	18	13	26	28	25	25	25	25	20	25
u9/3	-	21	16	17	20	30	28	27	21	26	21	20	25

Bold numbers: Selected isolates for further study

-, No zone detected

*Group A antibiotic; Primary test and Report: AM, Ampicillin 10 μg; CF, Cephalothin 30 μg; GM, Gentamicin 10 μg

**Group B antibiotic; Primary test Report selectively: AK, Amikacin 30 μg; AMC, Amoxicillin/clavulanic acid 30 μg; CIP, Ciprofloxacin 5 μg; CTX, Cefotaxime 30 μg; FEP, Cefepime 30 μg; FOX, Cefoxitin 30 μg; IPM, Imipenem 10 μg; MA, Cefamandole 30 μg; PRL, Piperacillin 100 μg; STX, Trimethoprim/sulfamethoxazole 25 μg

Table C2 Antimicrobial susceptibility test of 149 bacterial isolates toward antibiotic drug in group C and U antibiotics

Isolates	Average diameter of inhibition zone (mm) due to									
	Group C*						Group U**			
	C	CAZ	K	NET	TE	TOB	CAR	F/M	NOR	TMP
u1/1	24	22	19	18	-	18	-	20	-	-
u1/2	-	19	-	19	-	20	-	18	-	-
u1/3	24	25	17	19	24	20	-	18	36	-
u1/4	-	13	-	15	-	13	-	20	-	-
u1/5	28	29	22	26	-	21	-	22	20	-
u1/6	21	18	19	19	-	18	-	20	-	19
u1/7	8	12	-	14	-	13	-	17	-	-
u1/8	21	16	17	13	-	10	-	17	-	-
u1/9	11	21	20	20	-	22	-	17	-	-
u1/10	25	26	-	15	23	15	-	20	-	25
u1/11	-	24	17	14	-	14	-	18	-	-
u1/12	-	24	-	26	-	21	-	20	-	17
u1/13	8	23	18	19	-	12.5	-	17	26	-
u1/14	25	28	21	24	-	18	-	19	10	-
u1/15	27	31	25	25	-	20	-	22	-	28
u1/16	-	18	-	22	-	15	-	25	-	-
u1/17	20	21	-	18	-	8	-	17	-	-
u1/18	27	30	-	28	22	20	-	21	28	-
u1/19	25	13	16	20	-	11	-	25	-	-
u1/20	8	23	10	14	-	10	-	22	-	-
u1/21	26	28	20	25	-	20	-	20	-	25
u1/22	11	-	12	13	-	9	-	12	-	15
u1/23	12	-	12	11	-	8	-	12	-	16
u1/24	26	12	12	14	-	13	-	9	-	-
u1/25	10	-	12	14	-	9	-	13	-	16
u1/26	18	9	13	15	-	12	-	-	-	-
u1/27	-	-	-	8	-	-	-	9	-	-
u1/28	-	24	18	20	21	19	-	15	25	-
u1/29	25	26	20	20	23	19	-	14	23	21
u1/30	22	-	-	-	17	-	-	12	-	18
u2/1	-	26	-	-	18	12	-	14	-	-
u2/2	24	13	11	12	-	9	-	15	-	-
u2/3	22	9	11	19	-	9	-	20	-	-
u2/4	22	7	18	-	17	12	-	18	-	-
u2/5	13	15	14	13	-	13	-	21	-	-
u2/6	-	11	8	17	-	11	-	14	-	-
u2/7	-	15	11	15	-	10	-	23	-	-
u2/8	-	15	15	14	-	11	-	20	-	-
u3/1	-	21	-	15	-	11	-	20	-	-
u3/2	22	23	20	21	-	15	-	20	-	24
u3/3	-	25	14	13	-	11	-	18	-	-
u3/4	14	23	18	20	-	18	-	21	-	20
u3/5	8	20	-	14	-	11	-	20	-	-

Table C2 (continued)

Isolates	Average diameter of inhibition zone (mm) due to									
	Group C*						Group U**			
	C	CAZ	K	NET	TE	TOB	CAR	F/M	NOR	TMP
u3/6	23	25	15	14	-	12	-	20	-	-
u3/7	8	26	18	20	-	19	-	20	-	-
u3/8	20	24	17	15	-	11	-	20	-	-
u3/9	-	16	-	11	-	8	-	16	-	-
u3/10	22	25	19	19	-	18	-	18	26	-
u3/11	23	25	17	15	21	14	-	20	-	25
u3/12	-	22	15	16	-	12	-	17	20	-
u3/13	-	10	10	16	-	8	-	18	-	-
u3/14	12	-	8	12	20	8	-	10	-	-
u3/15	18	21	11	13	-	11	-	-	-	-
u4/1	22	23	18	18	-	17	-	20	26	26
u4/2	8	25	16	17	-	13	-	16	-	15
u4/3	-	21	17	14	23	11	-	20	28	-
u4/4	20	14	10	15	-	9	-	17	-	-
u4/5	-	22	-	16	8	10	-	15	-	-
u4/6	19	11	-	17	10	14	-	16	-	27
u4/7	26	15	20	20	23	17	-	17	18	24
u4/8	21	29	20	19	-	18	23	14	-	-
u4/9	-	26	15	15	-	10	-	19	-	-
u4/10	-	-	10	16	-	10	-	21	-	-
u4/11	26	27	13	21	-	18	-	21	11	-
u4/12	-	25	12	17	-	8	-	18	-	-
u4/13	-	23	19	19	-	13	-	20	8	-
u4/14	20	13	13	16	-	9	-	17	-	24
u4/15	22	22	-	23	-	19	-	16	24	23
u4/16	18	25	25	23	-	19	9	14	11	-
u4/17	12	-	8	12	21	8	-	17	20	-
u4/18	-	-	11	15	-	10	-	12	-	-
u5/1	24	23	11	16	23	8	-	20	-	-
u5/2	-	22	20	21	-	17	-	11	26	-
u5/3	-	9	-	17	-	11	-	16	15	-
u5/4	15	17	-	22	-	18	-	16	32	24
u5/5	23	11	-	18	23	12	-	17	-	-
u5/6	24	28	16	20	22	15	-	20	30	25
u5/7	-	16	13	10	-	-	-	18	-	-
u5/8	25	26	18	17	-	16	-	18	10	-
u5/9	-	24	-	18	-	14	-	22	-	-
u5/10	24	25	18	19	-	16	-	20	-	-
u5/11	-	12	-	27	-	13	-	21	-	-
u5/12	22	25	15	14	-	12	-	19	-	-
u5/13	25	30	21	24	-	18	-	25	-	-
u5/14	11	21	17	17	17	16	20	18	-	19
u5/15	-	26	18	20	25	17	-	21	29	-
u5/16	10	24	19	20	-	16	-	18	-	-

Table C2 (continued)

Isolates	Average diameter of inhibition zone (mm) due to									
	Group C*						Group U**			
	C	CAZ	K	NET	TE	TOB	CAR	F/M	NOR	TMP
u5/17	19	23	17	18	22	15	-	16	20	23
u5/18	-	23	20	20	-	16	-	20	-	-
u5/19	21	22	17	19	22	16	-	18	23	24
u5/20	-	11	-	17	-	13	-	19		-
u5/21	23	24	15	16	21	13	-	20	25	22
u5/22	-	9	-	14	-	11	-	13	20	-
u5/23	16	-	-	14	-	9	-	-	-	-
u6/1	24	25	17	18	23	18	22	25	-	26
u6/2	18	25	17	16	-	11	-	21	-	-
u6/3	24	26	18	20	-	17	-	20	-	-
u6/4	-	14	-	16	-	10	-	18	-	-
u6/5	24	28	21	20	-	20	-	21	25	25
u6/6	8	16	20	20	-	18	-	22	-	-
u6/7	12	10	15	18	-	11	-	20	-	-
u6/8	-	10	-	15	-	-	-	21	-	-
u6/9	-	11	-	18	-	14	-	16	-	-
u6/10	21	10	-	18	-	15	-	20	-	-
u6/11	-	22	17	16	-	12	-	16	20	-
u6/12	-	21	19	20	-	15	-	15	21	-
u6/13	-	8	-	20	-	13	-	12	-	-
u7/1	18	10	21	24	-	20	-	19	-	24
u7/2	25	15	-	12	-	-	-	20	-	-
u7/3	-	13	20	20	-	15	-	13	-	25
u7/4	10	21	21	21	-	20	-	18	-	-
u7/5	-	14	20	21	-	15	-	16	26	-
u7/6	-	19	16	13	-	10	-	20	-	-
u7/7	25	11	11	15	-	-	-	21	-	-
u7/8	20	12	18	19	20	17	-	19	-	21
u7/9	-	10	10	13	-	-	-	16	-	-
u7/10	-	14	-	15	-	8	-	20	-	-
u7/11	-	13	17	19	-	13	-	17	-	-
u7/12	14	19	20	22	-	19	-	22	-	24
u7/13	-	13	10	15	21	8	-	18	-	-
u7/14	-	14	17	15	8	14	-	-	12	-
u7/15	-	8	-	14	-	11	-	-	-	15
u7/16	20	10	13	15	-	12	-	-	-	-
u7/17	20	8	19	20	20	17	-	15	-	20
u7/18	-	11	-	18	-	15	-	20	-	-
u7/19	20	24	19	18	-	16	22	15	25	23
u7/20	20	-	21	20	22	17	8	17	25	25
u8/1	-	22	17	21	-	16	-	17	29	-
u8/2	25	21	20	20	-	16	-	18	30	-
u8/3	22	20	-	18	-	11	-	16	-	-
u8/4	-	17	14	13	-	8	-	21	-	-

Table C2 (continued)

Isolates	Average diameter of inhibition zone (mm) due to									
	Group C*						Group U**			
	C	CAZ	K	NET	TE	TOB	CAR	F/M	NOR	TMP
u8/5	17	23	17	21	-	17	-	20	-	-
u8/6	-	23	10	13	-	8	-	18	-	-
u8/7	12	16	11	20	-	11	17	20	-	-
u8/8	22	25	15	16	-	12	23	17	20	-
u8/9	21	16	16	20	21	17	-	16	22	-
u8/10	-	21	-	10	23	10	-	18	-	-
u8/11	20	16	20	21	-	17	-	21	-	-
u8/12	-	23	18	20	-	16	-	20	10	-
u8/13	22	23	18	20	-	15	-	21	-	-
u8/14	-	9	10	15	-	-	-	18	-	-
u8/15	25	25	20	18	-	15	-	23	-	25
u8/16	21	-	11	15	-	8	-	15	-	-
u8/17	8	25	22	24	-	20	-	18	10	-
u8/18	12	7	-	14	-	9	-	-	-	-
u8/19	15	24	10	13	-	-	-	10	-	-
u9/1	24	22	18	20	22	17	8	15	27	21
u9/2	25	24	19	17	21	19	12	16	25	22
u9/3	21	25	18	20	25	19	10	14	25	25

Bold numbers: Selected isolates for further study

-, No zone detected

*Group C antibiotic; Supplementaly Report selectively: C, Chloramphenicol 30 µg; CAZ, Ceftazidime 30 µg; K, Kanamycin 30 µg; NET, Netilmicin 30 µg; TE, Tetracycline 30 µg; TOB, Tobramycin 10 µg

**Group U antibiotic; Supplementary for Urine only: CAR, Carbenicillin 100 µg; F/M, Nitrofurantoin 300 µg; NOR, Norfloxaxin 10 µg; TMP, Trimethoprim 5 µg

Table C3 ESBL confirmation test of 101 uropathogenic bacterial isolates

Isolates	Average diameter of inhibition zone (mm) due to					
	CAZ/CLA	CAZ	Difference of CAZ inhibition zone	CTX/CLA	CTX	Difference of CTX inhibition zone
u1/1	23	21	2	22	14	8
u1/2	23	20	3	25	12	13
u1/4	20	14	6	17	8	9
u1/7	22	13	9	22	0	22
u1/8	23	15	8	30	8	22
u1/9	25	22	3	27	15	12
u1/11	22	22	0	26	26	0
u1/12	23	23	0	25	25	0
u1/13	23	20	3	25	10	15
u1/16	22	15	7	25	0	25

Table C3 (continued)

Isolates	Average diameter of inhibition zone (mm) due to					
	CAZ/CLA	CAZ	Difference of CAZ inhibition zone	CTX/CLA	CTX	Difference of CTX inhibition zone
u1/17	26	22	4	25	8	17
u1/19	20	14	6	28	14	14
u1/20	23	21	2	23	14	9
u1/22	23	-*	18	25	0	25
u1/23	20	9	11	22	8	14
u1/24	23	13	10	23	14	9
u1/25	19	8	11	20	0	20
u1/26	23	10	13	24	12	12
u1/27	20	-*	15	20	0	20
u1/30	23	10	13	27	11	16
u2/1	29	28	1	30	29	1
u2/2	23	14	9	25	8	17
u2/3	24	9	15	25	0	25
u2/4	22	7	15	23	0	23
u2/6	22	13	9	27	0	27
u2/7	17	16	1	19	15	4
u2/8	23	16	7	25	0	25
u3/1	22	22	0	23	14	9
u3/3	25	24	1	28	26	2
u3/5	21	21	0	22	15	7
u3/6	25	26	-1	25	25	0
u3/8	24	24	0	24	16	8
u3/9	21	15	6	25	0	25
u3/12	22	22	0	24	25	-1
u3/13	20	11	9	22	0	22
u3/14	25	8	17	22	11	11
u3/15	20	20	0	23	12	11
u4/4	22	14	8	17	14	3
u4/5	21	23	-2	22	15	7
u4/6	20	10	10	27	0	27
u4/10	22	-*	17	21	0	21
u4/11	27	27	0	27	28	-1
u4/12	25	25	0	25	25	0
u4/13	24	24	0	27	27	0
u4/14	22	13	9	25	0	25
u4/17	20	-*	15	25	0	25
u4/18	12	-*	7	10	0	10
u5/1	21	21	0	24	21	3
u5/3	19	9	10	20	8	12
u5/5	15	10	5	15	10	5
u5/7	22	15	7	20	0	20
u5/9	26	24	2	25	26	-1
u5/11	23	13	10	22	0	22
u5/12	25	25	0	25	28	-3

Table C3 (continued)

Isolates	Average diameter of inhibition zone (mm) due to					
	CAZ/CLA	CAZ	Difference of CAZ inhibition zone	CTX/CLA	CTX	Difference of CTX inhibition zone
u5/16	25	24	1	25	24	1
u5/18	24	24	0	26	27	-1
u5/20	23	11	12	25	0	25
u5/22	22	8	14	25	0	25
u5/23	20	-*	15	20	0	20
u6/2	23	24	-1	26	20	6
u6/4	21	13	8	25	14	11
u6/6	22	15	7	27	28	-1
u6/7	20	11	9	21	9	12
u6/8	24	9	15	24	0	24
u6/9	23	12	11	24	8	16
u6/10	21	11	10	26	0	26
u6/11	25	23	2	26	16	10
u6/13	21	8	13	22	0	22
u7/1	23	10	13	27	0	27
u7/2	23	15	8	24	10	14
u7/3	20	13	7	25	15	10
u7/4	23	22	1	23	15	8
u7/5	21	14	7	26	12	14
u7/6	23	18	5	24	8	16
u7/7	22	11	11	24	0	24
u7/8	22	13	9	23	8	15
u7/9	21	11	10	22	0	22
u7/10	20	14	6	26	9	17
u7/11	20	12	8	22	0	22
u7/12	22	17	5	20	10	10
u7/13	21	12	9	23	9	14
u7/14	15	15	0	17	16	1
u7/15	21	10	11	27	15	12
u7/16	25	10	15	27	15	12
u7/17	11	-*	6	11	0	11
u7/18	17	10	7	17	8	9
u7/20	11	-*	6	10	0	10
u8/3	27	21	6	27	13	14
u8/4	23	18	5	23	0	23
u8/5	22	22	0	22	26	-4
u8/6	22	22	0	23	24	-1
u8/7	16	16	0	20	20	0
u8/10	22	22	0	22	14	8
u8/11	21	15	6	21	9	12
u8/12	26	23	3	25	14	11
u8/13	21	21	0	24	27	-3
u8/14	23	10	13	25	0	25
u8/16	20	7	13	24	8	16

Table C3 (continued)

Isolates	Average diameter of inhibition zone (mm) due to					
	CAZ/CLA	CAZ	Difference of CAZ inhibition zone	CTX/CLA	CTX	Difference of CTX inhibition zone
u8/17	25	26	-1	28	28	0
u8/18	21	8	13	22	0	22
u8/19	25	25	0	26	26	0

Bold numbers: Selected isolates for further study

-, No zone detected; *, Diameter of antibiotic disc = 5 mm.

Table C4 Classification of 101 uropathogenic bacterial isolates to resistant groups

Isolates	Average diameter of inhibition zone (mm) due to					
	AMC	CAZ	CDP	CTX	FEP	FOX
u1/1	18	22	-	14	20	25
u1/2	15	21	-	13	16	13
u1/4	10	14	-	-	14	10
u1/7	17	13	-	-	11	10
u1/8	15	15	-	9	15	25
u1/9	17	23	-	15	18	23
u1/11	19	23	23	25	30	20
u1/12	19	25	24	26	15	15
u1/13	16	20	-	-	15	24
u1/16	18	16	-	-	12	20
u1/17	17	21	-	-	13	18
u1/19	15	13	-	13	20	22
u1/20	16	22	-	13	17	14
u1/22	15	-	-	-	-	22
u1/23	14	8	-	-	13	20
u1/24	14	12	-	13	10	21
u1/25	15	-	-	-	10	20
u1/26	14	10	-	11	13	19
u1/27	11	-	-	-	-	10
u1/30	21	10	-	11	17	10
u2/1	18	27	22	29	30	19
u2/2	15	14	-	-	13	22
u2/3	14	9	-	-	10	13
u2/4	17	-	-	-	16	12
u2/6	17	12	-	-	12	22
u2/7	13	16	-	14	26	-
u2/8	20	16	-	-	14	22
u3/1	15	22	-	13	20	14
u3/3	18	24	22	25	26	23
u3/5	15	20	-	14	19	14
u3/6	20	27	22	26	28	25
u3/8	22	24	-	15	20	27
u3/9	17	15	-	-	13	21

Table C4 (continued)

Isolates	Average diameter of inhibition zone (mm) due to					
	AMC	CAZ	CDP	CTX	FEP	FOX
u3/13	13	11	-	-	10	21
u3/14	13	-	-	10	12	20
u3/15	13	20	-	11	13	18
u4/4	11	15	-	16	20	-
u4/5	19	23	-	14	19	23
u4/6	19	10	-	-	9	14
u4/10	14	-	-	-	-	18
u4/11	19	26	23	28	27	24
u4/12	15	25	20	25	26	18
u4/13	17	23	21	26	26	20
u4/14	15	13	-	-	10	14
u4/17	17	-	-	-	12	22
u4/18	10	-	-	-	16	-
u5/1	14	22	12	21	23	24
u5/3	12	8	-	-	11	20
u5/5	9	12	-	11	17	-
u5/7	14	15	-	-	-	17
u5/9	18	24	22	25	25	22
u5/11	18	11	-	-	-	18
u5/12	19	25	23	28	28	25
u5/16	18	24	22	23	25	22
u5/18	16	24	20	28	26	22
u5/20	17	11	-	-	-	21
u5/22	15	8	-	-	11	22
u5/23	11	-	-	-	-	10
u6/2	20	25	20	19	27	20
u6/4	17	13	-	13	18	19
u6/6	17	16	22	27	25	21
u6/7	16	9	-	8	12	20
u6/8	11	9	-	-	9	20
u6/9	17	12	-	-	12	20
u6/10	18	11	-	-	10	22
u6/11	17	23	-	15	21	23
u6/13	15	-	-	-	10	21
u7/1	16	11	-	-	13	20
u7/2	16	14	-	10	14	25
u7/3	20	21	-	14	16	23
u7/4	20	21	8	15	15	25
u7/5	18	14	-	12	12	12
u7/6	16	18	-	-	11	22
u7/7	13	11	-	-	11	23
u7/8	19	13	-	-	13	24
u7/9	13	10	-	-	-	14
u7/10	15	15	-	10	15	24
u7/11	17	12	-	-	10	20
u7/12	17	18	-	8	12	20

Table C4 (continued)

Isolates	Average diameter of inhibition zone (mm) due to					
	AMC	CAZ	CDP	CTX	FEP	FOX
u7/13	17	13	-	10	13	23
u7/14	11	14	-	15	22	18
u7/15	20	9	8	14	22	19
u7/16	13	10	-	13	15	18
u7/17	10	-	-	-	17	-
u7/18	10	10	-	-	10	8
u7/20	-	-	-	-	15	10
u8/3	16	22	-	12	15	20
u8/4	15	19	-	-	10	18
u8/5	19	23	20	26	28	18
u8/6	15	23	18	25	20	15
u8/7	9	16	-	20	27	10
u8/10	17	21	-	14	18	24
u8/11	18	16	-	9	15	14
u8/12	19	24	-	14	17	24
u8/13	16	22	22	27	26	24
u8/14	13	10	-	-	10	14
u8/16	13	-	-	-	10	21
u8/17	22	25	25	30	20	22
u8/18	14	8	-	-	10	19
u8/19	20	24	24	27	25	22

Bold numbers: Selected isolates for further study

-, No detected zone

AMC, Amoxicillin/ clavulanic acid 30 µg; CAZ, Ceftazidime 30 µg; CPD, Cepodoxim 10 µg; CTX, Cefotaxime 30 µg; FEP, Cefepime 30 µg; FOX, Cefoxitin 30 µg

Group 1, derepressed AmpC producers (resistant or intermediate susceptible to FOX and resistant to CTX), had a negative FOX - CTX antagonist test and negative ESBL;

Group 2, partially derepressed AmpC isolates were resistant or intermediate susceptible to FOX and resistant to CTX, had a positive FOX - CTX antagonist test and negative ESBL;

Group 3, (partly) derepressed AmpC producers with ESBL production were resistant to FOX and CTX, had a negative FOX - CTX antagonist test and produce ESBL;

Group 4, strains were susceptible to FOX (18) and had a positive ESBL production, a keyhole phenomenon in the double disc synergy test to at least one of the broad - spectrum cepharosporins surrounding the amoxillin/clavulonic acid disc;

Group 5, inducible AmpC producers were susceptible to FOX (18 mm), had a positive FOX - CTX antagonist test and negative ESBL;

NG, No group classified

Table C5 Determination of MIC of the 61 bacterial isolates toward CAZ

Isolates	Titer	MICs of CAZ for each bacterial isolates (mg/ml)
u1/4	4	25.00
u1/7	4	25.00
u1/8	64	1.56
u1/16	>1024	> 0.10
u1/19	>1024	> 0.10
u1/22	4	25.00
u1/23	**2**	50.00
u1/24	8	12.50
u1/25	16	6.25
u1/26	8	12.50
u1/27	512	0.20
u1/30	128	0.78
u2/2	16	6.25
u2/3	16	6.25
u2/4	**2**	50.00
u2/6	4	25.00
u2/8	16	6.25
u3/9	16	6.25
u3/13	4	25.00
u3/14	**2**	50.00
u4/4	64	1.56
u4/6	4	25.00
u4/8	16	6.25
u4/10	4	25.00
u4/14	8	6.25
u4/17	32	3.13
u5/3	4	25.00
u5/5	64	1.56
u5/7	64	1.56
u5/11	32	3.13
u5/20	512	0.20
u5/22	8	12.50
u5/23	8	12.50
u6/4	512	0.20
u6/7	64	1.56
u6/8	**2**	50.00
u6/9	8	12.50
u6/10	256	0.39
u6/13	16	6.25
u7/1	8	12.50
u7/2	256	0.39
u7/3	>1024	> 0.10
u7/5	>1024	> 0.10
u7/6	512	0.20
u7/7	32	3.13
u7/8	8	12.50
u7/9	8	12.50

Table C5 (continued)

Isolates	Titer	MICs of CAZ for each bacterial isolates (mg/ml)
u7/10	256	0.39
u7/11	16	6.25
u7/12	>1024	> 0.10
u7/13	16	6.25
u7/15	4	25.00
u7/16	16	6.25
u7/17	8	12.50
u7/18	8	12.50
u7/20	32	3.13
u8/4	>1024	> 0.10
u8/11	>1024	> 0.10
u8/14	16	6.25
u8/16	128	0.78
u8/18	4	25.00

Bold numbers : Selected isolates for further study

Table C6 Concentrations of standard β - lactamase and OD at 484 nm by spectrophotometric assay

Final concentrations of standard β - lactamase (μg/ml)	Average OD_{484}
120	0.490
60	0.487
30	0.465
15	0.461
7.5	0.406
3.75	0.341
1.875	0.284
0.938	0.209
0.469	0.134
0.235	0.087
0.000	0.035

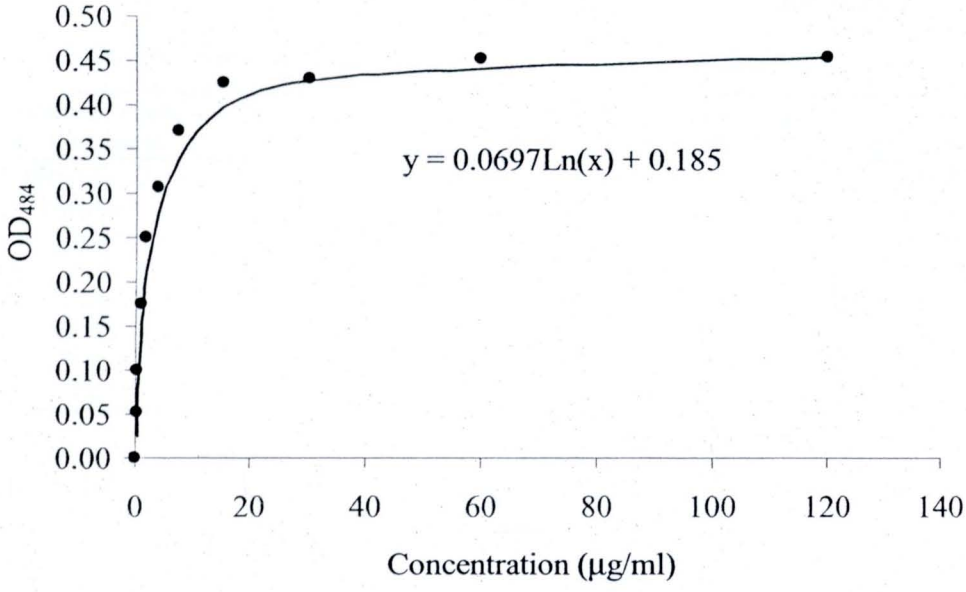

Figure C1 Standard curve of determination of β - lactamase activity

Table C7.1 The minimal concentration of β - lactamase extracted from *E. coli* ATCC 25922 that inhibited the activity of CAZ

Dilution of crude β - lactamase	Average of inhibition zone (mm)		
	Non - induced	CAZ induced	AM induced
PBS pH 7.2	29.0	29.0	29.0
Undilute	29.0	29.0	29.0
d1/2	29.5	29.0	29.0
d1/4	29.0	29.5	29.0
d1/8	29.5	29.0	29.0
d1/16	29.0	29.0	29.5
d1/32	29.0	29.0	29.5
d1/64	29.0	29.5	29.0

Table C7.2 The minimal concentration of β - lactamase extracted from *E. coli* strain u2/4 that inhibited the activity of CAZ

Dilution of crude β - lactamase	Average of inhibition zone (mm)		
	Non - induced	CAZ induced	AM induced
PBS pH 7.2	29.0	29.0	29.0
Undilute	0.0	0.0	0.0
d1/2	0.0	0.0	0.0
d1/4	0.0	10.0	0.0
d1/8	9.0	21.0	8.0
d1/16	20.5	25.0	15.0
d1/32	26.0	26.0	27.5
d1/64	29.0	29.0	29.0

Table C7.3 The minimal concentration of β - lactamase extracted from *E. coli* strain u6/8 that inhibited the activity of CAZ

Dilution of crude β - lactamase	Average of inhibition zone (mm)		
	Non - induced	CAZ induced	AM induced
PBS pH 7.2	29.0	29.0	29.0
Undilute	0.0	0.0	7.0
d1/2	0.0	0.0	22.0
d1/4	7.0	6.5	25.0
d1/8	9.5	19.0	27.0
d1/16	24.0	25.0	28.0
d1/32	25.5	26.0	28.5
d1/64	29.0	29.0	29.0

Table C7.4 The minimal concentration of β - lactamase extracted from *K. pneumoniae* strain u1/23 that inhibited the activity of CAZ

Dilution of crude β - lactamase	Average of inhibition zone (mm)		
	Non - induced	CAZ induced	AM induced
PBS pH 7.2	29.0	29.0	29.0
Undilute	0.0	0.0	0.0
d1/2	25.5	12.0	27.0
d1/4	29.0	27.0	29.0
d1/8	29.0	29.0	29.0
d1/16	29.0	29.0	29.5
d1/32	29.0	29.0	29.0
d1/64	29.0	29.0	29.5

Table C7.5 The minimal concentration of β - lactamase extracted from *K. pneumoniae* strain u3/14 that inhibited the activity of CAZ

Dilution of crude β - lactamase	Average of inhibition zone (mm)		
	Non - induced	CAZ induced	AM induced
PBS pH 7.2	29.0	29.0	29.0
Undilute	0.0	11.0	0.0
d1/2	0.0	25.0	0.0
d1/4	0.0	27.5	21.5
d1/8	7.0	28.0	28.0
d1/16	16.0	29.0	29.0
d1/32	26.0	29.0	29.5
d1/64	29.0	29.5	29.0

APPENDIX D

THE EFFECT OF LACTOBACILLUS CULTURES AND THEIR ACTIVE AGENTS

Table D1 Colony count of the uropathogenic bacteria co - cultured with each *Lactobacillus at* 0, 6, 12 hrs of cultured time

Co - culture condition (cells)	Average of the uropathogenic bacteria count (x 10^3 CFU/ml)														
	E. coli									*K. pneumoniae*					
	ATCC 25922			strain u2/4			strain u6/8			strain u1/23			strain u3/14		
	0 hr	6 hr	12 hr	0 hr	6 hr	12 hr	0 hr	6 hr	12 hr	0 hr	6 hr	12 hr	0 hr	6 hr	12 hr
No - Lactobacilli	16.5	140	2150	11	235	2000	11000	130	1550	20.5	200	1500	12.5	120	1900
L541	18.5	0	0	9.5	0	0	9500	0	0	18.5	0	0	13	0	0
LSS	26.5	0	0	14	0	0	11000	0	0	9	0	0	11	0	0
B120	19.5	120	245	19	240	235	13	100	185	16	110	110	12	70	290

Table D2 Colony count of the uropathogenic bacteria co - cultured with crude bacteriocin of each *Lactobacillus* at 0, 6, 12 hrs of cultured time

Co culture condition (Bacteriocin)	Average of the uropathogenic bacteria count (x 10^3 CFU/ml)														
	E. coli									*K. pneumoniae*					
	ATCC 25922			strain u2/4			strain u6/8			strain u1/23			strain u3/14		
	0 hr	6 hr	12 hr	0 hr	6 hr	12 hr	0 hr	6 hr	12 hr	0 hr	6 hr	12 hr	0 hr	6 hr	12 hr
No - bacteriocin	20	265	130	15	230	2400	21.5	150	1150	18	300	1300	13	130	1200
L541	15.5	0	0	20.5	0	0	20.5	0	0	23.5	0	0	23.5	0	0
LSS	16	0	0	35	0	0	13.5	0	0	20.5	0	0	21.5	0	0
B120	13	22	21.5	13	290	275	11.5	165	325	23	230	215	180	175	405
Plantaricin	12	0	0	15.5	0	0	20	0	0	13	0	0	19	0	0
Imipenem	11.5	0	0	22.5	0	0	18	0	0	24.5	0	0	15	0	0

Table D3 The optical density inhibition of bacteriocin toward extracted β - lactamase of the uropathogenic bacteria by spectrophotometric assay

Condition	OD_{486} of inhibition of bacteriocin toward extracted β - lactamase with each induced														
	E. coli									*K. pneumoniae*					
	ATCC 25922			strain u2/4			strain u6/8			strain u1/23			strain u3/14		
	Non	CAZ	AM	Non	CAZ	AM	Non	CAZ	AM	Non	CAZ	AM	Non	CAZ	AM
No - bacteriocin	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
L541	0.001	0.006	0.015	0.025	0.027	0.023	0.014	0.041	0.025	0.001	0.027	0.027	0.017	0.016	0.005
LSS	0.000	0.006	0.013	0.018	0.020	0.013	0.005	0.029	0.012	0.002	0.012	0.012	0.005	0.017	0.002
B120	0.002	0.003	0.002	0.003	0.022	0.000	0.000	0.010	0.016	0.000	0.002	0.002	0.000	0.003	0.000
Plantaricin	0.010	0.011	0.012	0.017	0.054	0.056	0.015	0.046	0.069	0.001	0.041	0.041	0.025	0.070	0.035
Clavulanate	0.012	0.014	0.023	0.039	0.201	0.159	0.026	0.142	0.119	0.004	0.171	0.171	0.035	0.230	0.119

CURRICULUM VITAE

NAME Miss. Krittapak Horcharoen

DATE OF BIRTH February 14, 1983

EDUCATION

2005 Bachelor of Science (Medical Technology), Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, Thailand

PUBLICATIONS AND PRESENTATION

Horcharoen K, Sookkhee S. Antimicrobial activity of *Lactobacillus* against the urovaginal pathogenic bacteria. In: Noparatnaraporn N, editors. STT.33. Proceedings of the 33rd Congress on Science and Technology of Thailand; Nakhon Si- Thammarat, Thailand; 2007. p B2_B0109

Horcharoen K, Sookkhee S, Tharavichitkul P. Antibiotic susceptibility of the multidrug resistant uropathogenic bacteria from Maharaj Nakorn Chiang Mai Hospital. In: Noparatnaraporn N, editors. STT.34. Proceedings of the 34rd Congress on Science and Technology of Thailand; Bangkok, Thailand; 2008. p B2_B0118