

Enterococcus faecalis

faecium

*

(2013 / 2 / 18 2013/ 1 /14)

* **E mail:**drmuhsin68@yahoo.com

E.faecalis

(120)

(240)

)

(120)

(

E.faecium

)

(

.2011

API ID 32 strep

. 20 strep

(%30)

(%43.05)

(%56.94)

.(%12.5) *E.facium*

(%18.1) *E.faecalis*

.

:

Spreading of *Enterococcus faecalis* and *Enterococcus faecium* in Hospitals and Water Environment in Mosul City

Hala Z. Najem

Muhsin A. Essa*

*Department of Biology
College of Science
University of Mosul*

***E mail:**drmuhsin68@yahoo.com

ABSTRACT

This study was performed to determine the prevalence of *Enterococcus faecalis* and *Enterococcus faecium* in hospitals and water environment in Mosul city. 240 specimens were collected during the period from September to December / 2011, 120 specimens were from water environment in addition to 120 specimens from hospitals environment (General Hospital, Ibin-Sena Hospital and Al-Khansaa teaching Hospital). Isolation and identification were done using a number of specific selective media for *Enterococcus* in addition to biochemical and serological tests then conformational tests were done using API 20 Strep and ID32 Strep.

The results illustrated that the genus *Enterococcus* was isolated at 30% of all isolates (56.94 % was from Hospitals and 43.05% was from water environment). The isolated ratio of *E. faecalis* (18.1%) was higher than *E. faecium* (12.5%).

Keywords: *E. faecalis*, *E. faecium*, spread, Mosul.

Lactic acid bacteria

Enterococci

Van Schaik and Willems,)

1984

Streptococci

(2010

16SrRNA

DNA hybridization

(Fisher and Phillips, 2009)

E. faecium *E. faecalis*

(Santagati *et al.*, 2012; Rosvoll, 2012)

E. faecium *E. faecalis*

.....

.(Rosvoll, 2012)

()

E.faecalis .(Ubeda *et al.*, 2010 ; Donelli *et al.*, 2004)

E.faecium

E.faecalis

.(Koneman *et al.*, 2006)

E.faecium *E.faecalis*

-1

1-1

2011

240

60

20

40)

120

2011

120

(

2-1

°121

Autoclave

:

15

2

/

15

Enterococcus Agar (Oxoid)

•

Bile Esculin Azide Agar (Biolab)

•

- Nutrient Agar (Oxoid) •
- Phenol Red Agar Base (Oxoid) •
- Nutrient Gelatin (Oxoid) •

حضرت استنادا الى (Atlas, 2006; MacFaddin, 1980; Cruickshank *et al.*, 1975) وهي:

- Enterococcus presumptive broth •
- Blood agar •
- Phenol red base agar •
- Arginine dihydrolase •

3-1

AreoMex

Na₂S₂O₃ •

pH

100

7.0) (2009

(Collee *et al.*, 1996)

Mastastrep System **4-1**

Mast

Mastastrep

(Group D streptococci) D

API (Analytic Profile Index) **5 -1**

Biomerieux

API 20 strep

ID 32 Strep SystemRapid **6-1**

Biomerieux

ID 32 StrepRapid

-2

1-2

24 °45

Enterococcus presumptive broth

Enterococcus Agar

.....

24 ° 37

Bile esculine azid agar
(Atlas, 2006; Manero and Blanch, 1999)

100

Enterococcus

Enterococcus agar

Bile

48 °37

(Collee, 1996) 24 ° 37

esculin azide agar

Enterococcus agar

(Atlas, 2006;) 24 ° 37

Bile esculin azide agar

° 4

.Manero and blanch, 1999

2- 2

1-2-2

Enterococci

Enterococcus agar

presumptive broth

Bile esculin azide agar

Azide

Bile salt

(Xu *et al.*, 2007; Koneman *et al.*, 2006; Atlas, 2006)

2-2-2

(Koneman *et al.*., 2006; Collee *et al.*, 1996; Williams *et al.*, 1971)

:

Catalase test

•

NaCl % 6.5

•

° 45 ° 10

•

•

•

•

D

3-2-2

D

/ /

Enterococcus

Mast

Mastastrep

Analytic profile Index (API)

4-2-2

/

Biomerieux

API 20 Strep

Enterococci

Streptococci

E.faecium

E.faecalis

Rapid ID 32 Strep System

5-2-2

/

Biomerieux

240

%30

72

(1)

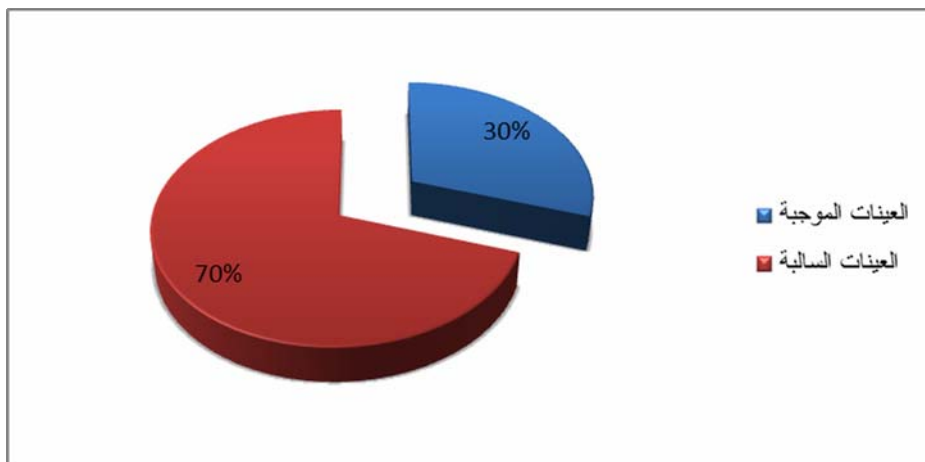
(

)

(2)

(%56.9) 41

(%43.1) 31

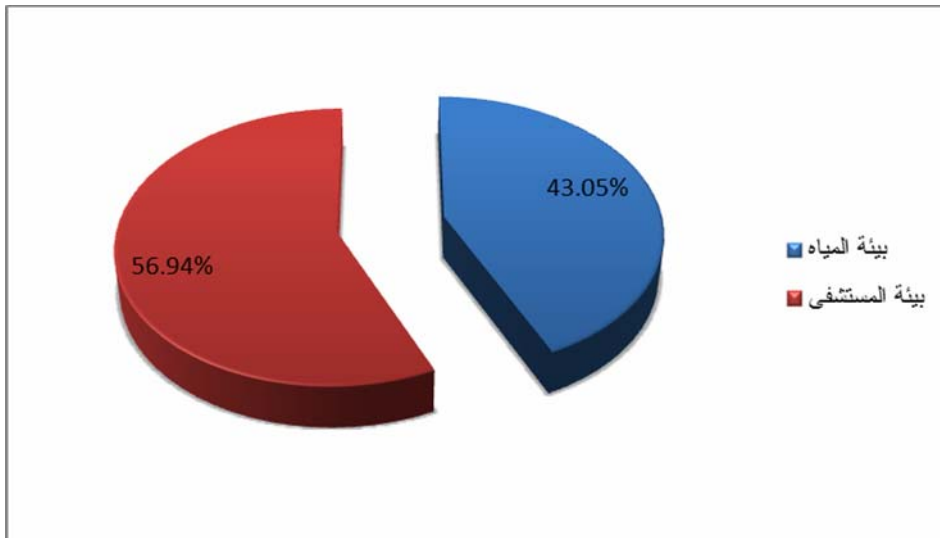


Enterococcus

:1

.....

Al- (2011) %27 (2011) Yassery
%16.7
(Chabuck *et al.*, 2011) %3.5
(Fisher and Phillips, 2009; Gajan *et al.*, 2008)
Arias) Staphylococci
(*et al.*, 2010)
(Kuhn *et al.*, 1995) fecal flora
(Cetinkaya *et al.*, 2000)



:2

% 43.05

(2009)

.(1986)

%10.4

.(Harwood *et al.*, 2004)

(Karchmer, 2000)

(Frenz *et al.*, 2007)

.(Rathnayak *et al.*, 2011; Xu *et al.*, 2007; Daoust and Litsky, 1975)

°(65-5)

Hostile environment

(10-4.5)

.(Fisher and Phillips, 2009; Klein, 2003)

Bradley and Fraise, 1996; Kearns) Glutaraldehyde

.(*et al.*, 1995

E.faecium *E.faecalis*

(Rathnayak *et al.*, 2011)

1

.(Minervini *et al.*, 2012; Fisher and Phillips, 2009)

Enterococci

.(Xu *et al.*, 2007)

presumptive broth

.(Atlas, 2006)

.....

Enterococcus agar

(1) 1-0.5 *E.faecalis*

(2) *E.faecium*

Bile

.(Daoust and Litsky,1975)

- esculin azide agar

(3)

.(Xu *et al.*, 2007; Weiss *et al.*, 2005)

(4) *E.faecalis*

E.faecium

(5) 6

Madigan *et al.*,)

.(2012; Koneman *et al.*, 2006; Maza *et al.*, 1997

(1)

%40

° 45 ° 10

% 6.5

E.faecium

E.faecalis

E.faecalis

E.faecium

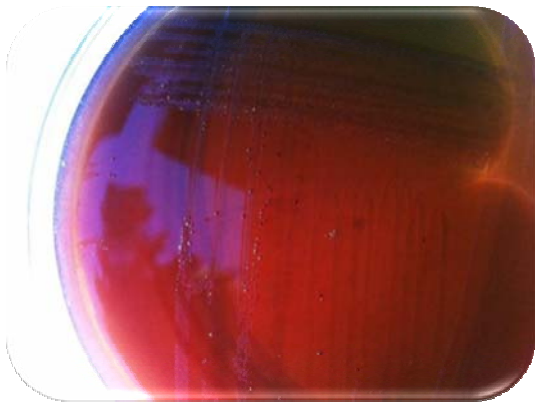
E.faecium

E.faecalis

4

.(Manero and Blanch, 1999)

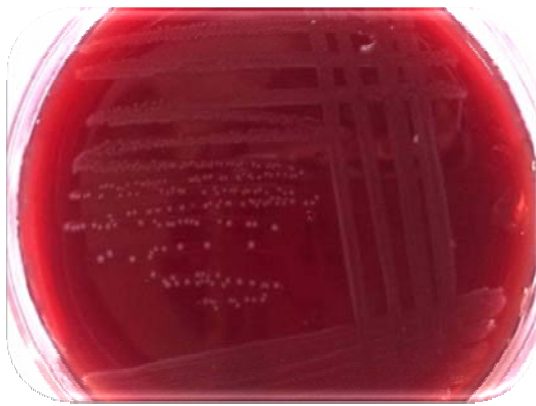
%100



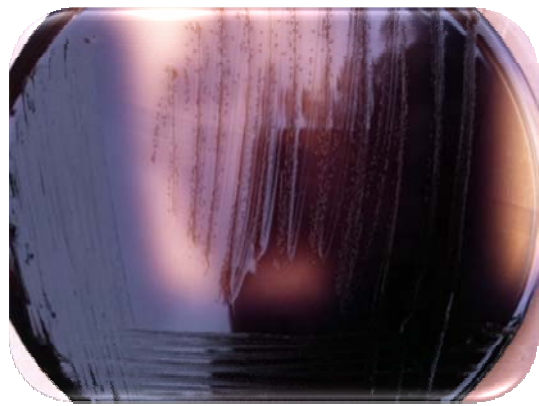
E.faecalis :2
Enterococcus agar



E.faecalis :1
Enterococcus agar



E.faecalis :4
)



E.faecium :3
Bile esculineazide agar



() *E.faecium* :5

.....

E.faecium *E.faecalis*

:1

D															
										°10	°45	NaCl %6.5		%40	
+	×	×	×	+	+	-	×	-	+	+	+	+	-	+	<i>E.faecalis</i>
+	+	-	+	×	+	+	-	V	+	+	+	+	-	+	<i>E.faecium</i>

+
-
V
×

API 20

Rapid ID 32 Strep

(7 6)

strep

Leucine aminopeptidase Arginin dihydrolase Pyrrolidonyl arylamidase β-Glucosidase

Voges

Alkaline phosphatase

proskauer

E.faecium

E.feacalis

E.faecium *E.faecalis*

.(Koneman *et al.*, 2006 ; Brigante *et al.*, 2006 ; Yemisen *et al.*, 2009 ; Laukova *et al.*, 2011)

E.faecalis

Mastastrep

(8)

(Lancefield group D antigen) D

E.faecium

.(Fisher and Phillips, 2009)

(%18.1) 13

E.faecium (%12.5) 9 *E.faecalis*
E.faecalis (3)

%27.36

E.faecalis

E.faecalis

(1986) %2.55 *E.faecium*

(2009) %10.4

E.faecium

E.faecalis

Salem-Bekhit *et al.*, 2012; Chajicka-Wierzchowska *et al.*,)

E.faecalis

(2004)

Harwood

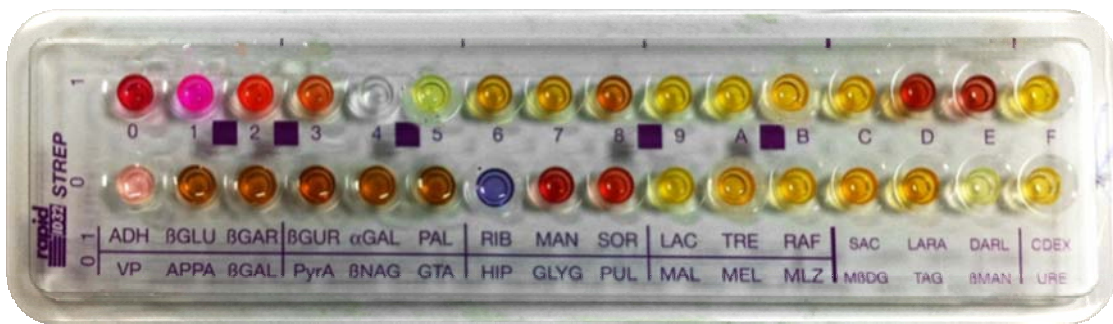
(2012; Park *et al.*, 2007

.%19.5 *E.faecium*

%42

E.faecalis

(Fisher and Phillips, 2009)



ID 32 strep

E.faecalis

:6



API 20 strep

E.faecium

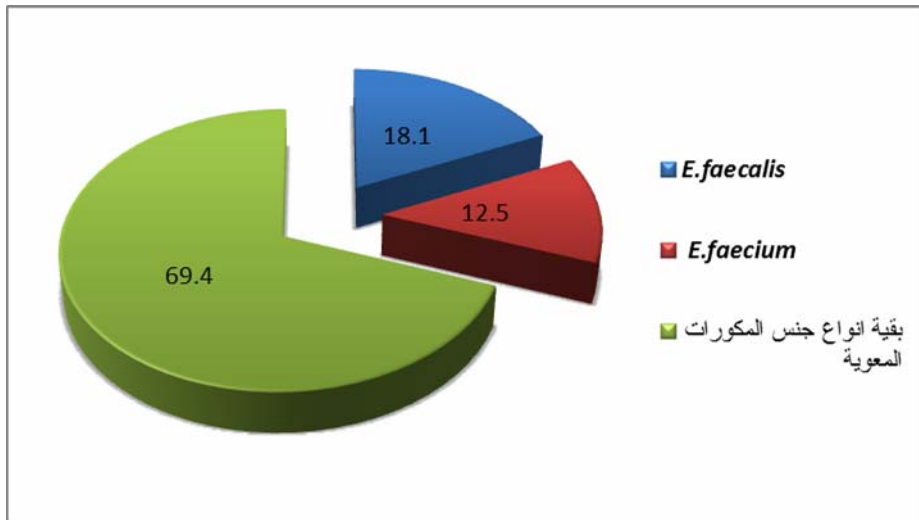
:7

.....



D

:8



E. faecium *E. faecalis*

:3

10

E. faecalis

(2)

E. faecium

7

(Chabuck *et al.*, 2011; Yoong *et al.*, 2004; Del Campo *et al.*, 2001)

E.faecalis (Sood *et al.*, 2008)
 Fisher) *E.faecium*
 (and Phillips, 2009; Gajan *et al.*, 2008

:2

<i>E.faecium</i>	<i>E.faecalis</i>	
2	3	
7	10	

Pseudomonas aeruginosa (2011)
 Quorum sensing
 (2009)
E.coli 0157:H7
 (1986)

- Al-Yassery, K.A.H. (2011). Study of antibiotic susceptibility and virulence determination among *Enterococcus faecalis* isolated from patients with significant bacteriuria in Najaf. Ph.D. Thesis, University of Kufa, Iraq.
- Arias, C.A.; Contreras, G.A.; Murray, B.E. (2010). Management of multidrug-resistant Enterococcal infections. *Clin. Microbiol. Infect.*, **16**,555-562.
- Atlas, R.M. (2006). "Handbook of Microbiological Media for the Examination of Food". 2nd ed. Taylor and Francis Group. LLC, USA.
- Bradley, C.R.; Fraise, A.P. (1996). Heat and chemical resistance of Enterococci. *J. Hosp. Infect.*, **34**,191-196.

- Brigante, G.; Luzzaro, F.; Bettaccini, A.; Lombardi, G.; Meacci, F.; Pini, B.; Stefani, S.; Toniolo, A. (2006). Use of the phoenix automated system for identification of streptococcus and Enterococcus spp. *J. Clin. Microbiol.* **44**(9), 3263-3267.
- Cetinkaya, Y.; Falk, P.; Mayhall, G.C. (2000). Vancomycin resistant Enterococci. *Clin. Microbiol. Rev.*, **3**, 686-707.
- Chabuck, Z.A.; Al-Charrakh, A.H.; Al-Sa'adi, M.A.K. (2011). Prevalence of Vancomycin resistant enterococci in Hilla city, Iraq. *Med. J. Babylon*, 1-13.
- Chajeka-Wierzchowska, W.; Zadernwska, A.; Nalepa, B.; Trokenheim, L.L. (2012). Occurrence and antibiotic resistance of enterococci in ready-to-eat food of animal origin. *Afric. J. Microbiol. Res.*, **6**(39), 677-6780.
- Collee, J.G.; Fraser, A.G.; Marmion, B.P.; Simmons, A. (1996). "Mackie and McCartney Partial Medical Microbiology". 14th ed., Churchill Living Stone Inc., New York.
- Cruickshank, R.; Dugiud, J.P.; Marmion, B.P.; Swain, R.H.A. (1975). "Medical Microbiology". 12th ed. Churchill living stone, Edinburgh. UK.
- Daoust, R.A.; Litsky, W. (1975). Pfizer selective Enterococcus Agar overlay method for the enumeration of fecal streptococci by membrane filtration. *Appl. Microbiol.*, **29**(5), 584-589.
- Del Compo, R.; Tenorio, C.; Jimenez-Diaz, R.; Rubio, C.; Gomez-Lus, R.; Baquero, F.; Torres, C. (2001). Bacteriocin production in vancomycin-resistant and Vancomycin-susceptible Enterococcus isolates of different origins. *Antimicrob. Agents Chemother.*, **45**(3), 905-912.
- Donelli, G.; Paoletti, C.; Baldassarri, L.; Guaglianone, E.; DiRosa, R.; Magi, G.; Spinani, C.; Facinelli, B. (2004). Sex pheromone response, clumping and slime production in Enterococcal strains isolated from occluded biliary stents. *J. Clin. Microbiol.*, **42**(8), 3419-3427.
- Fisher, M.; Phillips, C. (2009). The ecology, epidemiology and virulence of Enterococcus. *Microbiol.*, **155**, 1749-1757.
- Frenz, C.M.; van Belkum, M.J.; Holzappel, W.H.; Abriouel, H.; Galvez, A. (2007). Diversity of Enterococcal bacteriocins and their grouping in a new classification scheme. *FEMS Microbiol. Rev.*, **31**(3), 293-310.
- Gajan, E.B.; Abshov, R.; Aghazadeh, M.; Eslami, H.; Oskouei, S.G.; Nejad, D.M. (2008). Vancomycin-Resistant *Enterococcus faecalis* from a waste water treatment plant in Tabriz, Iran. *Pakistan J. Biol. Sci.*, **11**(20), 2443-2446.
- Harwood, V.J.; Delahoya, N.C.; Ulrich, R.M.; Kramer, M.F. Whitlock, J.E. ; Garey, J.R. (2004). Molecular confirmation of *Enterococcus faecalis* and *E. faecium* from clinical, faecal and environmental sources. *Lett. Appl. Microbiol.*, **38**, 476-482.
- Karchmer, A.W. (2000). Nosocomial bloodstream infection: organisms, risk factors, and implications. *Clin. Infect. Dis.*, **31**, 139-143.
- Kearns, A.M.; Freeman, R.; Lightfoot, N.F. (1995). Nosocomial Enterococci: resistance to heat and sodium hypochlorite. *J. Hosp. Infect.*, **30**, 193-199.
- Klein, G. (2003). Taxonomy, ecology and antibiotic resistance of Enterococci from food and the gastro-intestinal tract. *Int. Food Microbiol.*, **88**(2-3), 123-131.
- Koneman, E.W.; Allen, S.P.; Janda, W.C. (2006). "Color Atlas and Text Book of Diagnostic Microbiology". 6th ed. Lippincott-Williams and Wilkins Publishers, Philadelphia, USA.

- Kuhn, I.; Burman, L.G.; Haeggman, S.; Tullus, K.; Murray, B.E. (1995). Biochemical finger printing compared with ribotyping and pulsed-field gel electrophoresis of DNA for epidemiological typing of Enterococci. *J. Clin. Microbiol.*, **33**(11), 2812-2817.
- Laukova, A.; Fraqueza, M.J. Strompfova, V.; Simnova, M.P.; Elias, M.; Barreto, A. (2011). Bacteriocinogenic activity of *Enterococcus faecalis* strains from chourico, traditional sausage produced in southern Portugal. *African J. Microbiol. Res.*, **5**(4), 334-339.
- MacFaddin, J.F.M. (1980). "Biochemical Test for Identification of Medical Bacteria". Williams and Wilkins, Inc., Baltimore, USA.
- Madigan, M.T.; Martinko, J.M.; Stahl, D.A.; Clark, D.P. (2012). "Brock Biology of Microorganisms". 13th ed. Benjamin Cummings. San Francisco, USA.
- Manero, A.; Blanch, A.R. (1999). Identification of *Enterococcus* spp. with a biochemical key. *Appl. Environ. Microbiol.*, **65**(10), 4425-4430.
- Maza, L.M.; Pezzlo, M.T.; Baron, E.J. (1997). "Color Atlas of Diagnostic Microbiology". Mosby, USA.
- Minervini, S.M-F.; Cagno, R.D.; Chammen, N.; Hamdi, M. (2012). Technological, functional and safety aspects of Enterococci in fermented vegetable products: a mini-review. *Ann. Microbiol.*, **62**, 469-481.
- Park, S.Y.; Kim, K.M.; Lee, J.H.; Seo, S.J. ; Lee, I.H. (2007). Extracellular gelatinase of *Enterococcus faecalis* destroys system in insect hemolymph and human serum. *Infect. Immun.*, **75**(4), 1861-1869.
- Rathnayake, I.; Hargreaves, M.; Huygens, F. (2011). SNP diversity of *Enterococcus faecalis* and *Enterococcus faecium* in a south east Queensland waterway. Australia, and associated antibiotic resistance gene profiles. *BMC Microbiol.*, **11**, 201.
- Rosvoll, T.C.S. (2012). Plasmids Resistance and Hospital Adaptation in Enterococci. Ph.D. Thesis, Univ. Tromsø, UIT.
- Salem-Bekhit, M.M.; Moussa, I.M.; Muharram, M.M.; Alanazy, F.K.; Hefini, H.M. (2012). Prevalence and antimicrobial resistance pattern of multidrug resistant Enterococci isolated from clinical specimens. *Indian J. Med. Microbiol.*, **30**(1), 44-51.
- Santagati, M.; Campanile, F.; Stefani, S. (2012). Genomic diversification of Enterococci in nests: the role of the mobilome. *Front Microbiol.*, **3**(95), 1-9.
- Sood, S.; Malhotra, M.; Das, B.K.; Kapil, A. (2008). Enterococcal infections and antimicrobial resistance. *Indian J. Med. Res.*, **128**, 111-121.
- Ubeda, C.; Taur, Y.; Jenq, R.R.; Equida, M.J.; Son, T.; Samstein, M.; Viale, A.; Succi, N. D.; Brink, M.R.M.; Kamboj, M.; Pamer, E.G. (2010). Vancomycin-resistant *Enterococcus* domination of intestinal microbiota is enabled by antibiotic treatment in mice and precedes bloodstream invasion in humans. *J. Clin. Invest.*, **120**(12), 4332-4341.
- vanSchaik, W.; Willems, R.J. (2010). Genome-based insights into the evolution of Enterococci. *Clin. Microbiol. Infect.*, **16**, 527-532.
- Weiss, A.; Domig, K.J.; Kneifel, W. (2005). Comparison of selective media for the enumeration of probiotic Enterococci from animal feed. *Food Technol. Biotechnol.*, **43**(2), 147-155.

- Williams, G.A.; Balzevi, D.J.; Ederer, G.M. (1971). Detection of arginine dihydrolase in nonfermentative gram-negative bacteria by use of thin-layer chromatography. *Appl. Microbiol.*, **22**(66), 1135-1137.
- Xu, J.; Gallert, C.; Winter, J. (2007). Multiple antibiotic resistance of *Enterococcus* isolated from raw or sand-filtered sewage. *Appl. Microbiol. Biotechnol.*, **74**, 493-500.
- Yamisen, M.; Demirel, A.; Mete, B.; Kaygusuz, A.; Mert, A.; Tabak, F.; Ozturk, R. (2009). Comparative in vitro antimicrobial activity resistant *Enterococcus*. *Indian J. Med. Microbiol.*, **27**(4), 373-374.
- Yoong, P.; Schuch, R.; Nelson, D.; Fischetti, V.A. (2004). Identification of broadly active phage lytic enzyme with lethal activity against antibiotic resistant *Enterococcus faecalis* and *Enterococcus faecium*. *Arch. Oral Biol.*, **12**, 669-680.