The Risks of Staphylococcus Aureus Strains Isolated from the Playgrounds

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Abstract: Equipment and materials in places open to public and in sport centres have caused to the community-acquired diseases and endanger the human health. In this study, it was aimed to determine the microorganisms in sport complexes threatening the human health and identify the protection methods. For the study, 111 samples were taken from different sport complexes, playgrounds, swimming pools and schools in Kırıkkale. The samples were put into bloody EMB and Sabouraud Medium and wait in incubator of 37 degree. The samples were evaluated after 24, 48 and 72 hours. The reproduced samples were taken into account and the samples that reproduction was not seen were thrown after 72 hours. Microorganisms were determined as gram positive and gram negative. In the study, it was observed that there was production in 101 of 111 samples which were taken from the surfaces of equipment and materials in sport complexes and playgrounds. 112 microorganisms were produced from the samples that there was production. In the study, while the most seen microorganism group is Staphylococcus, 40 of the microorganisms belong to the group of Staphylococcus. As a result of the study, one of the microorganisms found in equipment and materials in playgrounds and parks was Staphylococcus aureus, and it was observed that it was sensitive to methicillin (MSSA) as a result of antibiogram. As these kinds of bacteria in the playgrounds were found in this study, it revealed the need of giving more importance to hygiene and prevention methods.
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Introduction

One of the common demands of the human being is to be able to continue the highest quality of life. The first condition of healthy life is adequate nutrition and regular physical activity. Sport can be done randomly by the individuals as leisure time activity, and also the people who want to be followed by experts go to the sport saloons in accordance with a specific plan. Equipment and materials in places open to public and in sport centres have caused to the community-acquired diseases and endanger the human health.

The first study all over the world about the potential microbial danger in sport centres was done by Dr.Kristen A.Goldhammer in USA. In the study, it was stated that respirator viruses would infect the others from the surfaces contacted by carrier person and also there were a lot of bacterium although they were not harmful microorganisms (Goldhammer et al., 2006). It has been confirmed by a good many of studies that sweat and the other body secretions carrying a potential of social danger in the sport centres cause some diseases like hepatitis A, flu, fever blister and cold. So, in our study it was aimed to determine the microorganisms in sport complexes threatening the human health and identify the protection methods. It has been confirmed that every kind of infections may directly or indirectly infect the individuals via sport equipment and on the equipment, there are viruses like herpes, HIV, Epstein-Bar, Scrumpox, Hepatitis B (Sharp, 1994), agents causing various fungal infections (Sharp, 1994; Leski, 2002; Daugherty, 2003; Caputo et al., 2001; Bassiri et al., 2010) and bacteria causing many diseases especially dermatological one.

Today, the number of people doing physical activities regularly has been increasing in order to decrease the disease risks. As a result of this, we have been paying more attention to the hygienic risks related to the usage of sport centres (Polak, 2007; Schindler et al., 2007). personal hygiene means the overall practices made for keeping healthy and keeping body clean and healthy (Özel et al., 2009) like mouth-tooth care, nutrition, toilet habit, foot care, dressing, body care, ear cleaning and hair cleaning (Hancı et al., 2012). When personal hygiene isn't applied adequately in the crowded places, the infection possibility is higher (Güdücüoğlu et al., 2010). So, the infection risk of many diseases will be removed by developing the personal hygiene level (Güleç et al., 2000). Having a shower and washing hands are the two important elements that will prevent the infections when contacting the places aforementioned. The regular cleaning of the materials and tools will decrease the risk of infection from these kinds of materials to children and adults.

Methodology

For the study, 111 samples were taken from different sport complexes, playgrounds, swimming pools and schools in Kırıkkale. These samples were examined in terms of the microorganisms that may be

harmful for human health. Microbiological samples were taken from the surfaces that especially humans contacted. For this reason, equipment used by many people and toys in the playgrounds, especially the parts that handled by many people and contacting to body directly, and water of swimming pools were preferred. The samples taken from determined areas by culture rod with carrying medium were immediately brought to the Laboratory of Infection Illnesses and Clinical Microbiology in Medical Faculty, Kırıkkale University. The samples were put into bloody EMB and Sabouraud Medium and wait in incubator of 37 degree. The samples were evaluated after 24, 48 and 72 hours. The reproduced samples were taken into account and the samples that reproduction was not seen were thrown after 72 hours. Every colony found in the medium was evaluated separately and gram painting was done for every microorganism. Microorganisms were determined as gram positive and gram negative. These microorganisms were identified by using Vitek 2 (Biomerieux, France) device; and by the same device, antibiogram was done to microorganisms with high potential of making people ill.

Results

In the study, it was observed that there was production in 101 of 111 samples which were taken from the surfaces of equipment and materials in sport complexes and playgrounds. 112 microorganisms were produced from the samples that there was production. In the study, while the most seen microorganism group was Staphylococcus, 40 of the microorganisms belong to the group of Staphylococcus. As a result of the study, one of the microorganisms found in equipment and materials in playgrounds and parks was Staphylococcus aureus (Table:1), and it was seen that it was sensitive to methicillin (MSSA) as a result of antibiogram (Table 2).

Table 1. One of the microorganisms found in equipment and materials in playgrounds and parks

Patient name: Playground									**January, 14, 2013 10.02 CST**								
Laboratory ID: MMM111									**Organism chosen: Staphylococcus Aureus**								
The information of identification		**Card:** GP							**Lot No:** 242265210			**Expire Date:** March, 19,2014 13.00 CDT					
		Completed: Jan, 12, 2013 19:13 CST							**Status:** End			**Analyse time:** 4.00					
Organism Chosen		99% Probability							**Staphylococcus aureus**								
		Bio-number: 050402062763231							**Harmony:** Perfect identification								
Bio-chemical details																	
2	AMY	-	4	PIPLC	-	5	dXYL	-	8	ADH1	+	9	BGAL	-	11	AGLU	+
13	APPA	-	14	CDEX	-	15	AspA	-	16	BGAR	-	17	AMAN	-	19	PHOS	+
20	LeuA	-	23	ProA	-	24	BGURr	-	25	AGAL	-	26	PyrA	+	27	BGUR	-
28	AlaA	-	29	TyrA	-	30	DSOR	-	31	URE	-	32	POLYB	+	37	dGAL	+
38	dRIB	-	39	ILATk	+	42	LAC	-	44	NAG	+	45	dMAL	+	46	BACI	+
47	NOVO	-	50	NC6.5	+	52	dMAN	+	53	dMNE	+	54	MBdG	+	56	PUL	-
57	dRAF	-	58	O129R	+	59	SAL	-	60	SAC	+	62	dTRE	+	63	ADH2s	-
64	OPTO	+															

Table 2. Sensitive to methicillin (MSSA) as a result of antibiogram

Patient Name: Playground			**January, 16, 2013 11:42 CST**		
Laboratory ID: MMM111			**Organism Chosen:** Staphylococcus Aureus		
The sensitivity information	**Analyse time:** 10,75 hours			**Status:** End	
Antimicrobial	**Amount**	**Commend**	**Antimicrobial**	**Amount**	**Commend**
Cefoxitin Scanning	NEG	-	Inducible Clindamycin Resistant	NEG	-
Penicillin	<= 0,03	S	Erythromycin	<= 0,25	S
Ampicillin			Clindamycin	<= 0,25	S
+Amoxicillin/Clavulanic Acid		S	Linezolid	2	S
+Ampicillin/Sulbactam		S	Teicoplanin	<= 0,5	S
Oxacillin	<= 0,25	S	Vancomycin	1	S
+Cefazolin		S	Tetracycline	<= 1	S
Imipenem	<= 1	S	Tigecycline	<= 0,12	S
Gentamicin High level (synergy)			Fosfomycin	<= 8	S
Streptomycin High level (synergy)			Fusidic acid	<= 0,5	S
Gentamicin	<= 0,5	S	Rifampin	<= 0,5	*1
Ciprofloxacin	1	*1	Trimethoprim/Sulfamethoxazole	<= 10	S
Moxifloxacin	<= 0,25	S			
+= antibiotic widen *= changed by AES **= changed by the user					
AES findings					
Harmony:	Consistent				
Phenotype:	Macrolides/Linkosamides/Streptogramyns		Streptogramyn resistance (SGA-SGB)		

In a study, it was determined that 59 of 114 Staphylococcus aureus strains isolated (41%) was resistant to methicillin (MRSA) and 85 of them (59%) was sensitive to methicillin (MSSA) (Arıdoğan et al., 2004). Some of the staphylococcus don't do infection to the people, but Staphylococcus aureus is a kind of bacteria that may cause very serious infections. Especially, one of the most important points for the treatment of the infections that these bacteria caused is whether it is methicillin resistant or not. Thus, it is a serious danger that the Staphylococcus aureus is found on equipment and materials that people contact in sport complexes and playgrounds where they go for living healthy. Also, as Staphylococcus aureus becomes resistant against antibiotics in a short time, it may cause important troubles in the treatment process (Özdemir et al., 2004).

In a study for determining the places where there was staphylococcus in sport complexes, the fitness saloons at universities were examined and staphylococcus aureus bacteria sensitive to methicillin was seen on 10 of 99 samples. It was confirmed with the studies that the surfaces in the sport complexes causes to staphylococcus colonization and infections (Markley et al., 2012). Also in the study done by Oller et al, staphylococcus aureus bacteria in the regions used for training (football and wrestling dressing rooms, weight lifting saloons) was examined before-after cleaning the environment. While this bacteria was seen on 30% of these dressing rooms and weight lifting saloons before the cleaning, after the cleaning it was not seen (Oller et al., 2010).

Discussion

The most important potentials in terms of microbial infection are materials and exercise equipment in the playgrounds and sport complexes (Beam and Buckley, 2006). It is obvious that many organisms like staphylococcus notably Staphylococcus aureus locate to the humid environment as a result of sweating after the effort used by the people playing-exercising with the materials and equipment, then the new microbes transfer after the usage of the other people (Brady et al., 1990; Centres for Disease Control and Prevention, 2003; Kazakova et al., 2005). However, Ryan stated in a study that sport complexes weren't the places causing the infection of Staphylococcus aureus threatening human health. The microorganisms always transferred in this way cause to the infection diseases that directly or indirectly transmitting to the people via respiration (hand-nose, hand-eye contact), digestion (hand-mouth), skin and the other ways (Ryan, 2011).

In a study done by Bilir et al., it was found that 14 of 35 Staphylococcus aureus strains were resistant to methicillin (MRSA) and 21 of them were sensitive to methicillin (MSSA) (Bilir et al., 2010). In another study, MRSA wasn't isolated but MSSA was isolated on two visitors' hands before and after visiting (Hayrunisa, 2012). In our study, MSSA was identified, too.

Staphylococcus are gram positive coccus that include no or little capsule and are motionless, asporous and catalase positive (Mayor et al., 2007). They are durable to external environmental conditions, dryness and high salt concentration. They may colonize on nasopharynx, leather clothes, vagina, rectum, perineum and nose (Staphylococcus aureus). They are one of the microorganisms that are often isolated as the infection factor (Kloos, 1998). They may infect person to person directly and via air. Abscess in tissues, metastatic infections through bacteraemia and toxins cause diseases (Collier et al., 1998; Mandell et al., 2000). While there was a success for the treatment of Staphylococcus aureus infection by using methicillin in 1960, this bacteria has been a problem that causes infections like urinary tract infection, pneumonia etc. due to multiple antibiotic resistance of MRSA strains (Erbay et al., 2002; Ulusoy et al., 2004; ONS, 2005; Erdemir, 2011). Hand washing is the most effective method for being protected from Staphylococcus aureus infections (Dündar and Dündar, 2002). Methicillin resistance may show regional differences and different rates even in the same regions. In the studies done in Turkey, methicillin resistance has been found as 11.5-61% (Değerli et al., 2000). While about 15% of healthy adults is continuously carrier of Staphylococcus aureus, 60% of them is carrier of Staphylococcus aureus at intervals (Murray et al., 2002; Topçu et al., 2002). MRSA prevalence is 40% in our country (Şardan, 2000). MRSA infections that require a process of long term treatment may result in death (Burd et al., 2003)

It has been stated that the death rate originating from MRSA increased 15 folds between 1993 and 2002 (ONS, 2005). The identification and treatment of carriers has an important place for the control of infection. Consequently, carefully monitoring the resistance patterns of Staphylococcus aureus strains is necessary for directing the treatment and arranging the new antibiotic resistances (Arıdoğan et al., 2004).

In a study done by Goldhammer, it was observed that while weight lifting tools like dumbbells and bars in fitness centres had more viruses, the tools used for aerobic and exercise had less ones. The virus found on exercise tools was rhinovirus (Goldhammer et al., 2006). Rhinoviruses infect by air, hand to hand contact and contact to the surface where it colonizes (Goldmann, 2001; Gwaltney and Hendley, 1982). Rhinoviruses, par influenza viruses, rota viruses and respiratory syncytial viruses may live for a few hours to

a few days on non-viable surfaces (Goldmann, 2001; Hendley et al., 1973; Brady et al., 1990). Also it has been proved by the studies that flu bug (Goldmann, 2001), rhinoviruses, enteroviruses, adenoviruses, herpes viruses, Hepatitis A viruses and shigella (Goldhammer et al., 2006), bacteria like staphylococcus aureus (Goldhammer ark., 2006; Adams, 2001; Likness, 2011; Markley et al., 2012; Sedgwick et al., 2007), streptococcus (Likness, 2011), Enterobacter spp, Citrobacter freundii, Pseudomonas aeruginosa (Hancı et al., 2012) and escherichia coli (Temel et al., 2006) and spores causing fungal infections (Caputo et al., 2001; Bassiri and Khaksar, 2010) may be come across on tools and equipment in the sport centres and playgrounds and also on door handle, toilet taps (Temel et al., 2006) and switches. Apart from these, herpes or fungal infections may infect by sharing the personal equipment and the dressing rooms have been increasing the risk of infections like flu and sore throat originating from airway and infections originating from fungi. The water sports done in natural or chlorinated waters may cause various infections of eye (cojunctivistis and acanthamo ebic keratitis), ear (otitis externa), skin (folliculitis), bowel (giardiasis and cryptosporidiosis), liver and kidney (leptospirosis) and lung (legionellosis) (Sharp, 1994). The natural ecological environment of Legionella type bacteria that can live in natural water for years is water. These bacteria resistant to high level chlorine have been quickly reproduced on the places where water is still such as water tanks and shower-tap heads (Akkaya and Özbal, 2011). While MRSA is common in the hospitals, MRSA on places that is not cleaned and is open to people causes health problems for the individuals interested in games and sport (Stanforth et al., 2010). The two wrestlers in the same team in Indiana, America infected MRSA though they didn't wrestle. The reason of this was reported as the equipment and tools shared (Centres for Disease Control and Prevention, 2003).

For years, it has been know that the organisms like fungi, mould etc. can reproduce on textile materials when there is humidity and heat. Natural fibers like cotton provide the suitable conditions for bacterial growth and so antibacterial/antimicrobial applications gain speed (Balcı and Babaarslan, 2005). Some studies have been done about the clothes apart from the studies done for resolving the problems on textile materials, too. A study done by Ashjaran et al. on a perfume emulator (Ammonyx LO-E) used as foam adjuvant in Lauryl amino oxide detergent has been illustrating the situation. In the study, Escherichia coli, Staphylococcus aerous, Aspergillums, Mucor and Candida pathogens were met on sweatshirts worn by footballer for 14 days, and the number of coli decreased seriously on the sweatshirts washed with ammonyx. As a result, it has been observed that ammonyx has a characteristic that can be used on clothes as antimicrobial (Ashjaran et al., 2010).

In a notice Peker has remarked that people are the source of particle smear and an individual smears 25-30 particles per minute when doing sport. Also he emphasized that cotton clothes pick up 10-15 fold more particles (over 5 micron) than synthetic clothes and he pointed out that most of these microorganisms and bacteria are available on these particles over 5 micron magnitude (Peker, 2007) .

Besides, it mustn't be ignored that individuals spend most of their time indoors and the air of these fields has an important place on public health. Bioaerosol bacteria is the name given to all the organic and biogenic dust originating from the air including fungi, spore, pollen, viruses and their fragments. It has been stated that bioaerosols cause the diseases like hipersensitix pyromania, chronic allergic rhinitis and asthma (Menteşe et al., 2009). As the children aspirate more than adults, they are exposed to the negative effects of air pollution more due to their immature immune systems. So, indoors particularly the playgrounds and the sport complexes should be examined in terms of humidity and the humid regions should be dried. Thus, the reproduction of microorganisms like bacteria, mould or fungi is hindered and the negative effects of them to human health are prevented (Güllü, 2011).

The prior condition for establishing a hygienic environment is air conditioning and ventilation. The air conditioning system for the places mentioned in our study makes the air clean and helps for prevention from microorganisms, smell and dust (Peker, 2007). Because isolated microorganisms are among the factors often causing infections, it has been concluded that playgrounds should be used in control with some rules and cleaned. As we encountered these kinds of bacteria in the playgrounds, the study revealed the need of giving more importance to hygiene and prevention methods.

References

1. Adams, BB. (2001). Sports dermatology, Dermatology Nursing, 13(5): 347-363.
2. Akkaya Zahide, Özbal Yusuf. (2011). "Legionella Research in water tanks of different Buildings in Kayseri.", The Journal of Health Sciences, 20(1):9-17.
3. Ashjaran, A., Ghazi-saeidi, R., Yazdanshenas, E. and Rashidi, A. (2010). Investigation On The Antimicrobial Effect Of Ammonyx On Some Pathogenic Microbes Observed On Sweatshirt Sport, World Academy of Science, Engineering and Technology, 64: 65-68.
4. Aslıhan Arıdoğan, Leman Atasever, Çiğdem Bal. (2004). Antibiotic resistance of Staphylococcus

aureus Strains isolated from clinical Samples. The Journal of Turkish Microbial Cem 34:20-23.

5. Balcı Huriser, Babaarslan Osman (2005). "The Effect of Antibacterial End Process to 100% Cotton Clothes", The Congress of Textile Technologies and Textile Machines 11-12 November, Gaziantep.
6. Bassiri-Jahromi, S., Khaksar, A.A. (2010). Prevalence of cutaneous fungal infections among sports-active individuals, Annals of Tropical Medicine and Public Health, 3(2): 53-57.
7. Beam JW., Buckley B. (2006). Community-Acquired Methicillin Resistant Staphylococcus Aureus: Prevalance And Risk Factors., J Athl Train, 41(3): 337-340.
8. Bilir YA, Yaşar KK, Pehlivanoğlu F, Gürsoy S and Şengöz G. (2010). The Distribution of Macrolide-Lincosamide Resistance Phenotype in 100 Staphylococcus strain. The Congress of 25th ANKEM Antibiotic and Chemotherapy. Turkish Republic of Northern Cyprus, 28 April-02 May. The Journal of ANKEM. (Appendix 1)24: 50.
9. Brady MT., Evans J., Cuartas J. (1990). Survival And Disinfection Of Parainfluenza Viruses On Environmental Surfaces, American Journal of Infection Control, 18: 18-23.
10. Burd M, Humphreys H, Glynn G (2003). Control and the prevention of methicillin-resistant Staphylococcus aureus in hospitals in Ireland: North/South Study of MRSA in Ireland 1999. Journal Hospital Infection 53: 297-303.
11. Caputo R., De Boulle K., Del Rosso J., Nowicki R. (2001). Prevalence of Superficial Fungal Infections Among Sports-Active Individuals: Results from the Achilles Survey, a Review of the Literature, Journal of the European Academy of Dermatology and Venereology, 15(4): 312-316.
12. Centers for Disease Control and Prevention. (2003). Methicillin-Resistant Staphylococcus Aureus Infections among Competitive Sports Participants: Colorado, Indiana, Pennsylvania, and Los Angeles Country, 2000-2003, Morbidity and Mortality Weekly Report, 52(33): 793-795.
13. Daugherty, TM. (2003). Sport dermatology: what certified athletic trainers and therapists need to know, Athletic Therapy Today, 8(3): 46-48.
14. Değerli K., Özbakkaloğlu B., Sürücüoğlu S., Sezgin C., Kurutepe S. (2000). Sensitivity of Staphylococcus aureus strains isolated from clinical samples to Various Antimicrobials. The Journal of Infec. 14: 87.
15. Dündar Volkan, Dündar Devrim Öztürk. (2002). Infection Diseases and Microbiology, Ed: Topçu AW, Söyletir G, Doğanay Mehmet. Nobel Tıp Kitabevleri, Volume 2: 1507-1516.
16. Erbay A, Ergönül Ö, Esener H. (2002). The resistances of hospital-acquired and methicillin resistant staphylococcus aureus, Acinetobacter spp. and pseudomonas aeruginosa strains against various disinfectants. The Journal of Hospital Infections, 6:4, 191-194.
17. Erdemir Firdevs, Akman Arzu, Uysal Gülzade, Polater Esra, Çırlak Ahu. (2011). New-redefined Infections and Control of them. The Journal of Nursing High School, Ege University, 27(1): 47-60.
18. Goldhammer AK., Dooley PD., Ayala E., Zera W., Hill LB. (2006). Prospective Study of Bacterial and Viral Contamination of Exercise Equipment, Clin J Sport Med., January, 16(1): 34-38.
19. Goldmann, DA. (2001). Epidemiology and prevention of pediatric viral respiratory infections in health-care institutions, Emerging Infectious Disease Journal, 7: 249-253.
20. Güdücüoğlu Hüseyin, Parlak Mehmet, Çiçek Mutalip, Yaman Görkem, Öztürk Öznur, Çıkman Aytekin, Berktaş Mustafa. (2010). "The research of Bowel Parasites on the students in Van Mustafa Cengiz Primary School", The Journal of Turkey Parasitology, 34(3): 172-175.
21. Güleç Mahir, Topbaş Murat, Kır Tayfun, Hasde Metin. (2000), "Hand washing habits of two primary school students who have different socio economic level in Ankara", The Journal of Turkish Hygiene, 57(2): 71-75.
22. Güllü Gülen. (2011). "Indoor air quality of schools has been threatening the health of children…" Education on Science, 135: 42-47.
23. Gwaltney, JM., Hendley, JO. (1982). Transmission of experimental rhinovirus infection by contaminated surfaces, American Journal of Epidemiology, 116: 828-833.
24. Hancı Hayrunisa, Ayyıldız Ahmet, Çelebi Demet. (2012). "The comparison of guests' hand floras before-after visit in the hospitals", Atatürk University, The Journal of Veterinarian Sciences, 7(2): 113-121.
25. Hendley, JO., Wenzel, RP., Gwaltney, JM. (1973). Transmission of rhinovirus colds by self-inoculation, The New England Journal of Medicine, 288: 1361-1364.
26. Kazakova SV., Hageman JC., Matava M., Srinivasan A., Phelan L., Garfinkel B., Boo T., Mcallister S., Anderson J., Jensen B., Dodson D., Lonsway D., Mcdougal LK., Arduino M., Fraser VJ., Killgore G., Tenover FC., Cody S., Jernigan DB. (2005). A Clone of Methicillin-Resistant Staphylococcus Aureus among Professional Football Players., New England Journal of Medicine, Feb, 3, 352(5): 468-475.
27. Kloos, WE. Staphylococcus. In: Collier L, Balcows A, Sussman M(eds). Topley Wilson's Microbiology and Microbial Infections. New York: Oxford University Press; 1998: 577.
28. Leski, MJ. (2002). Common dermatological conditions in sports: a review of environmental, traumatic, and infectious causes, Athletic Therapy Today, 7(3): 8-15.
29. Likness, LP. (2011). Common dermatologic infections in athletes and return-to-play guidelines,

The Journal of the American Osteopathic Association, 111(6): 373-379.
30. Markley JD., Edmond MB., Major Y., Bearman G., Stevens MP. (2012). Are Gym Surfaces Reservoirs for Staphylococcus Aureus? A Point Prevalence Survey, American Journal of Infection Control, 40(10): 1008-1009.
31. Mayor L, Ortellado J, Menacho C. (2007) Molecular Characterization of Methicillin-Resistant Staphylococcus aureus Isolates Collected in Asunción, Paraguay Journal of Clinical Microbiology, July 45(7): 2298-2300.
32. Menteşe Sibel, Yousefi Rad Abbas, Arısoy Münevver, Güllü Gülen. (2009). "The Spatial Change of Indoor Biological Pollution and the effect of outdoor", The Congress of IX. National Plant Engineering, 06-09 May, İzmir.
33. Murray PR, Rosenthal KS, Kobayashi GS, Pfaller MA: Medical Microbiology. p 202, 4th ed, Mosby, St Louis (2002).
34. Noble WC. Staphyllococcal Diseases. In: Collier L, Balcows A, Sussman M (eds). Topley Wilson's Microbiology and Microbial Infections. New York: Oxford University Press, 1998: 231.
35. Oller AR., Province L., Curless B. (2010). Staphylococcus Aureus Recovery from Environmental and Human Locations in 2 Collegiate Athletic Teams, Journal of Athletic Training, May/Jun, ProQuest Health & Medical Complete, 45(3): 222-229.
36. ONS. (2005). Deaths involving MRSA. Health Statistics Quarterly, Spring (25). London: Office for National Statistics
37. Özdemir Levent, Kıvanç Özlem, Nur Naim, Kaya Serpil, Çetinkaya Selma, Sümer Zeynep. (2004). "Staphylococcus aureus throat carriage among 14-18-year-old high school students in Sivas and affecting factors", Cumhuriyet University The Journal of Medicine, 26 (1): 9-12.
38. Özel S., Erbil S., Önal E.A., Ayvaz Ö., Gürtekin B., Güngör G. (2009). Knowledge and behaviours of primary school students about personal hygiene, Nobel Medicus, 5(1): 45-48.
39. Peker Tevfik, (2007). "Standard, Regulation and Supervision Gap in Operating Rooms and MMO approach", The Congress of VIII. National Plant Engineering. 25-28 September, İzmir.
40. Polak W. (2007). Biogenous Deposits (Biofilms) In Warm Water Circuits: Their Effect And Control In Swimming Pool And Shower Circuits. In: Dunemann L, Höller C, Editors. Pool And Spa: Proceedings Of The 2nd International Pool And Spa Conference; Mar 13-16; Munich, Germany. Munich: Verein Für Wasser-, Boden- und Lufthygiene, Bavarian Health And Food Safety Authority.
41. Ryan, K.A., Ifandites, C., Bucciarelli, C., Saliba, H., Tuli, S., Black, E. and Thompson, L.A. (2011). Are gymnasium equipment surfaces a source of staphylococcal infections in the community, American Journal of Infection Control, 39(2):148-150.
42. Schindler P., Gerber L., Höller C. (2007). Legionella In Swimming Pools. In: Dunemann L, Höller C, Editors. Pool And Spa: Proceedings Of The 2nd International Pool And Spa Conference; Mar 13-16; Munich, Germany. Munich: Verein Für Wasser-, Boden- Und Lufthygiene, Bavarian Health And Food Safety Authority.
43. Sedgwick, P.E., Dexter, W.W., and Smith, C.T. (2007). Bacterial dermatoses in sports, Clinics in Sports Medicine, 26(3): 383-396.
44. Sharp, JCM. (1994). Infections in sport, British Medical Journal, 308(6945): 1702-1706.
45. Stanforth B., Krause A., Starkey C., Ryan J.T. (2010). Prevalence Of Community Associated Methicillin-Resistant Staphylococcus Aureus In High School Wrestling Environments, Journal Of Environmental Health, January/ February, 72(6): 12-16.
46. Şardan YÇ (2000). Epidemiology and Control of Methicillin resistant Staphylococcus aureus infections. The Journal of Hospital Infections 4: 205-217.
47. Temel Fehminaz, Akın Levent, Vaizoğlu A. Songül, Kara Özgür, Kara Asil, Halas M. Aasım, Gurunaidu S. Samy, Oğur Recai, Tekbaş F. Ömer, Güler Çağatay (2006), "The Evaluation of water, toilets, taps and door handles in a primary school in Altındağ", The Journal of Gulhane, 48: 70-74.
48. Topçu AW, Söyletir G, Doğanay M. (2002): Infection Diseases and Microbiology, Nobel Tıp Kitabevleri, İstanbul, 165:1507.
49. Ulusoy S, Usluer G, Ünal S (2004). Epidemiology and Control of Methicillin resistant Staphylococcus aureus infections in the Hospitals which is a gram Positive Bacteria Infection. Scientific Medicine Publishing, 55-70.
50. Waldvogel FA. Staphylococcus aureus (Including Staphylococcal Toxic Shock). In: Mandel GL, Bennet JE, Dolin R (eds). Mandell, Douglas and Bennett's Principles and Practice of İnfectious Diseases. New York: Churchill Livingstone; 2000: 2069.

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