Original Research Article

Infections in Childcare Facility in Benghazi ~~Medical~~ child care Centre

Abstract

Nowadays, as a result of an increasing proportion of families in which parents are in funded jobs, there has been a steady increase in the demand for care of young children. The present study investigated infections in childcare facility and determine the knowledge level of infection control policy among children's parents and staff working in the childcare center in Benghazi Medical Centre in 2017. The study was based on two parts questionnaire and swabs. The Open-Closed questionnaire that was distributed to 55 participants to evaluate the knowledge about infection control policy. The samples were taken by sterile cotton swabs from 39 different places, to know the different types of bacteria that ~~could be exist~~ in the nursery. The results indicated that, the majority of the participants have a good knowledge about infection control policy, but they do not follow it. In addition, the results revealed that, 6 different types of dangerous bacteria which are (*Staphylococcus aureus, Klebsiella pneumonia, pseudomonas Aeruginosa, streptococcus viridians, Corynebacterium, Diphtheria, bacillus, and Enterobacteriaceae Serratia*.). All of the isolate's bacteria were found resistant to at least two antibiotics. Thirteen antibiotics were used in the sensitivity test which are: Cefotaxime, Azithromycin, Tetracycline, *Vancomycin, Cefixime, ceftolozane-tazobactam* test Doxycycline, ~~Septrin~~, Ciprofloxacin, Ampicillin, Cefotazime, *Amikacin, and* Oxacillin. According to this study, 34% of isolates bacteria was (*Staphylococcus aureus*) and the most common diseases were (Influenza and Diarrhea).

Keywords: child, day-care, contaminations, infectious diseases, prevention.

Introduction

As a consequence of the percentage of households where both parents work for a living is rising, there has been a stable increase in the demand for young children care. This is provided by informal arrangements for example care by relatives and friends, and by formal child care.When youngsters congregate, the risk of illness rises wherever they go. This problem is most noticeable in babies and young

children who would typically clean their noses or wash their eyes with their hands before handling toys or interacting with other kids. These kids then touch their noses and rub their eyes, which is how the virus spreads from one child's nose or eyes to another through hands or toys, and the next kid rubs his own nose or eyes. This is one of the reasons why kids get sick a lot in their early years of life because their bodies are building an immunity to infections [(1).]

The scientific literature also recognizes that control measures to reduce transmission of infectious diseases are effective and necessary to minimize the unfavourable consequences for collective health that can result from day care in groups [(2-4)] recommending infection control standards and practices for environments in which children are cared for together [(5-8).]

The higher of infections in children attending child care centres can be reduced by applying infection control policies. Despite this, such policies are unlikely to be put into practice without significant support, in the form of training, important advice and basic information that can be provided for workers in child care centres by the public health and clinical community. In numerous child care facilities, the staff simply cannot care for a sick child due to space or staff limitations. Every childcare facility should have a written set of clear policies which will inform and explain to both staff and parents how they can deal with children who are ill when they arrive at the facility, or who become ill whilst they are in these care facilities. Such policies will provide a rigid framework that will help both staff and parents make decisions when children are ill. Each facility staff member should understand the importance of illness avoidance in their day to day work routines. Practices such as appropriate hand washing, diapering, toileting, and food preparation, will limit the spread of bacteria and viruses and will promote a healthy child care environment [(9)].

There are many factors that influence the risks of introduction and spread of infections in child care settings. These factors include the personal hygiene and health status of the staff who are working in centre and the children (as well as their ages) and the situation of the facility (e.g. environmental sanitation, space and quality, food-handling practices, policies for attendance, and ratio of children to caregivers [(10)]).

Studying day care-associated infectious disease dynamics aids in formulating evidence-based guidelines for disease control, thereby supporting day care centres in their continuous efforts to provide their child population with a safe and hygienic environment. Illness is common in children. While kids have developed resistance to the pathogens that are common in their own homes, they will be exposed to a variety of new pathogens when they are around other children[(11)].

Long stretches of time might be spent by kids in nursery facilities. A child's risk of contracting an infection increases with the amount of time they spend in these environments and the number of other children they interact with. Therefore, while it is never practically possible to completely avoid infection, it is possible to significantly lower the risk. Thankfully, there are a few easy tactics and exercises that can significantly reduce the risk of infection in nursery environments[(12).]

One important idea regarding infectious disease is the 'infectious dose*'*, this is the amount of pathogens that are needed to make a person ill. The 'infectious dose' varies from pathogen to pathogen and from person to person, for example: salmonella pathogens. It takes between 1000 and 10,000 cells to make a healthy person ill, but as little as a few hundred to make a small child or elderly person ill. Another example is *Verocytogenic E.coli* it takes less than five of the VTEC (Verocytogenic*E.coli*) pathogens to make healthy adults ill, so it will come as no surprise to know that cases of renal failure and deaths (which are not uncommon in cases of VTEC) are much more likely in small children and elderly people[(13-15)]. The spread of infections in child care centers is facilitated by crowding and microbial contamination of the childcare environment, as well as the unhygienic behaviors and greater susceptibility of young children [(16)].

Child care workers and other adult contacts are also at increased risk of infections such as upper respiratory tract infection, gastroenteritis and hepatitis A. Concern has been expressed about acquisition of cytomegalovirus (CMV) by pregnant carriers, which may cause severe congenital infection, and parvovirus which may be associated with intrauterine death or stillbirth due to fetal hydrops [(17)].

Method

The study was conducted in the child care center of Benghazi Medical Centre (BMC) in Benghazi in 2017.This study a cross-sectional study, it was based on swabs were taken from different places in the childcare center to know the different types of bacteria that could ~~be~~ exist in the nursery.The samples were taken by sterile cotton swabs from 31 different places. The first 10 samples were taken in March 2017 from the following places (the handle out of the main entrance door, playing table in the TV room, chairs, beds, toys, studying tables, and staff office).

The second set of swabs were taken at June 2017 from different places (the handle out of the main entrance door, beds , changing table, toys, carpet, windows, eating table (table 1 and table 2), staff office, broom, wall, chair, building up game, and carpet of the playing room, toilet (tap water1, tap water2, toilet seat 1, toilet seat2)

Results

Cultural and biochemical characterization of bacteria isolated from targeted sites showed the presence of seven species of bacteria, namely: *Klebsiella pneumonia*e,*Pseudomonas aeruginosa, Streptococcus viridians, Staphylococcus aureas , Corynebacterium diphtheria, Bacillus,* ~~*Enterobacteriace*~~ *Serratia*. They were identified as follows:

Identification of Klebsiella pneumonia:

Gram-negative rods gave positive citrate and urease test. It appeared lactose fermented mucoid pink colonies on MacConkey agar (Fig8) and confirmed by TSI media (acid in butt and slant with~~out~~ production of gas and H2S)(fig9)Identification of Pseudomonas aeruginosa:

Gram negative rod, motile, gave large, flat, haemolytic colonies on blood agar (fig10). The isolates have a distinctive smell due to aminoacetophenone production, whereas on MacConkey agar, it showed non-lactose fermenting colonies with yellow-green pigment (fig11) their biochemical reaction gave positive oxidase test (fig12)

Identification of Staphylococcus aureus:

Which appeared as yellow colonies on blood agar (fig13) and gave orange colonies on MacConkey agar (fig14). The identification was by production of

catalase enzyme (fig15) both coagulase test (fig16) and DNAse test showed a positive reaction(fig 17)

Identification of Streptococcus viridians:

Gram positive, diplococci noncapsulated~~er~~ bacteria, facultative anaerobic, producing a green coloration on blood agar (fig 18) or alpha-haemolytic and resistant to (op) optochin antibiotic disc, (fig19).

Identification of Corynebacterium:

Gram positive, aerobic, rod shape (fig 20), cultivated on blood agar (fig 21) with 5% defibrinated sheep blood smooth convex colonies with entire margin cultivation 24 hours, 37°C in an aerobic atmosphere enriched with 5% carbon dioxide[18]. For species differentiation further testing required.

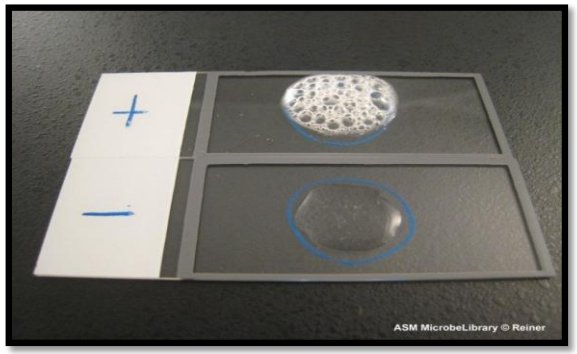
Identification of Bacillus

Bacillus is a genus of Gram-positive, rod-shaped bacteria (figure 22) and a member of the phylum Firmicutes, showed gray non hemolytic ~~raphe~~ colonies on blood agar (figure 23). *Bacillus* species can be obligate aerobes (oxygen reliant), or facultative anaerobes (having the ability to be aerobic or anaerobic). They will test positive for the enzymecatalase when there has been oxygen used or present [18-20]. Ubiquitous in nature, *Bacillus* includes both free-living (non-parasitic) and parasitic pathogenic species, they grow in Sheep blood agar (SBA) Colonies are non-haemolytic, flat or slightly convex with irregular edges and ground-glass appearance. There are often comma-shaped projections from the colony edge producing a "Medusa-head" colony.No growth on MacConkey agar.

Identification of Serratia.spp :

Genus of Gram-negative, facultatively anaerobic, red pigment on MacConkey agar fig (24), endospore forming [22]rod-shaped bacteria of the *Enterobacteriaceae*family. The most common and pathogenic of the species in the genus, *S. marcescens*, this normally the only pathogen and usually causes nosocomial infections. However, rare strains of *S. plymuthica*, *S. liquefaciens*, *S. rubidaea*, and *S. odoriferae* have caused diseases through infection [23] *S. marcescens* is typically found in showers, toilet bowls, and around wetted tiles.Members of this genus produce characteristic

red pigment, prodigiosin, and can be distinguished from other members of the *Enterobacteriaceae* family by their unique production of three enzymes: DNAse, lipase, and gelatinase[23] .



catalase test Figure 1

Figure 1~~2~~ coagulase test

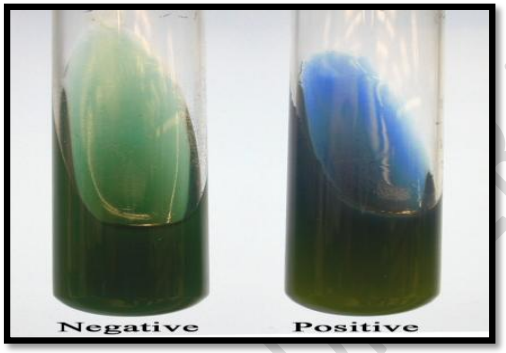


Figure ~~4urease test~~citrate test

Figure 2~~3~~ ~~citrate utilization test~~
urease test

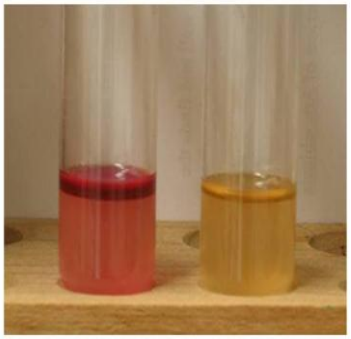


Figure 35 TSI test

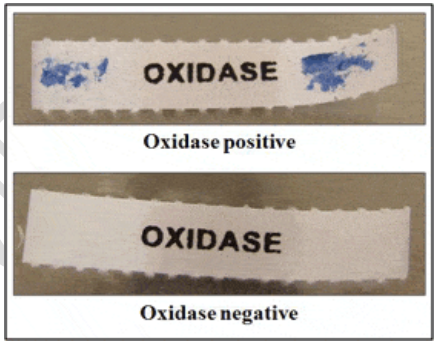


Figure 6 oxidase test

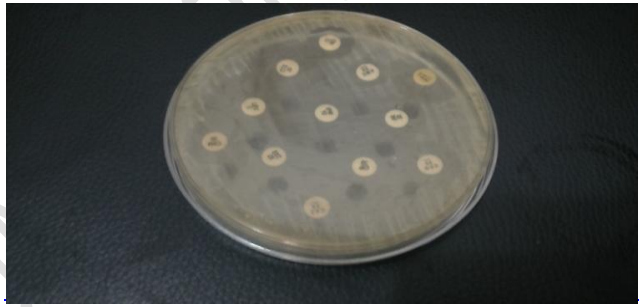


Figure 7 Sensitivity test image shown to be clarified

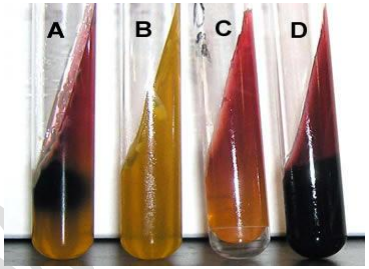
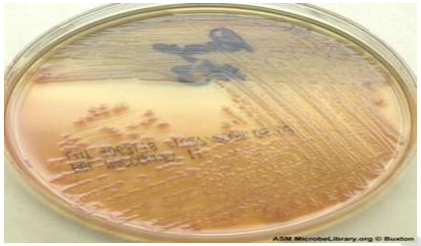
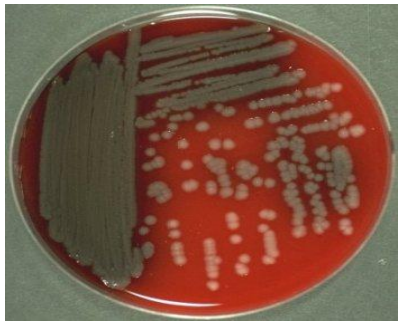


Figure 8 K.pneumoniae on ~~MacConky~~Figure 9 k.pneumoniae on McConkey





~~p~~seudomonas aeruginosa on MacConkey AgarFigure 11

~~10 pseudomonas aeruginosa on blood Agar Figure~~

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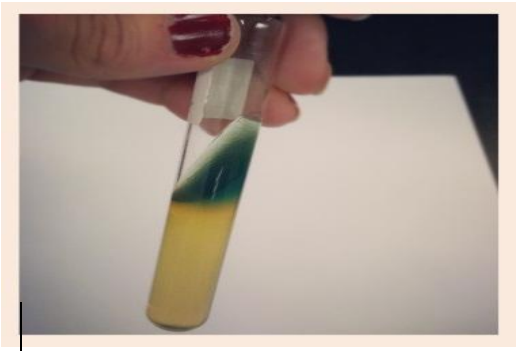
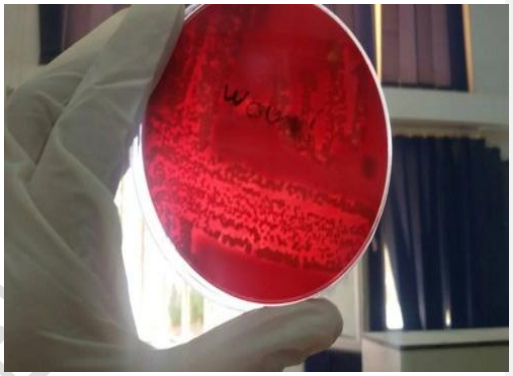


~~Figure 12 pseudomonas aurginosa on oxidase test~~



-Figure 13 s.aureues on blood agar

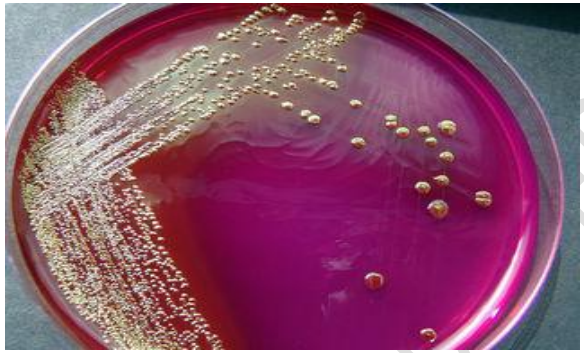


Figure 14 s.aureus on Maconcky agarFigu~~r~~e 15~~ s.aureus on catalase~~

Figure 16 s.aureus on coagulase

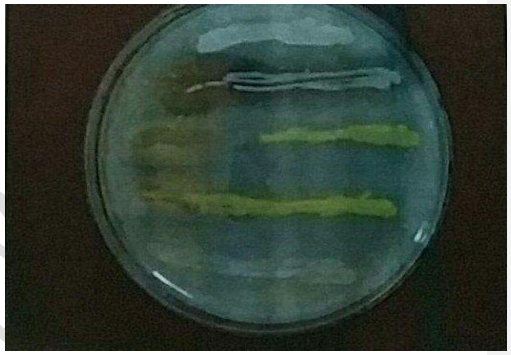


Figure 17 s.aureues on DNA test

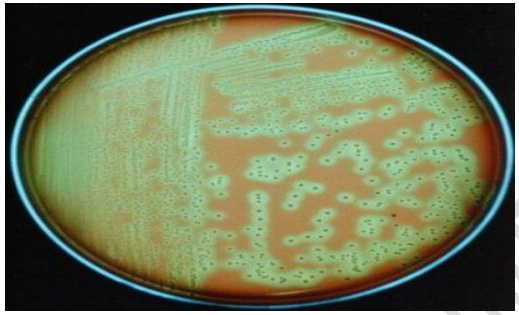


Figure 18 viridans on blood agar

Figure 19 viridans resistant to(op)optochin antibiotic

Figure 20 ~~cornebacterium on blood agar~~

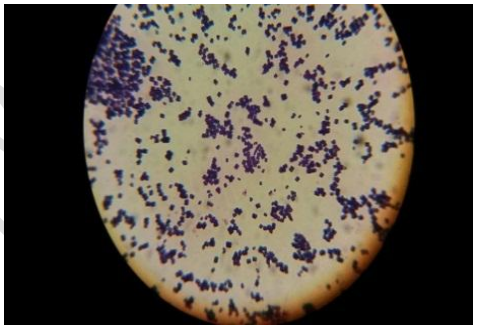


Figure 21 cornebcterium on microscope

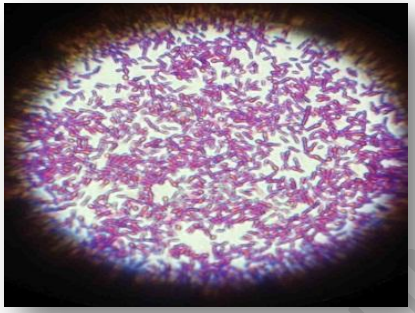


Figure 22 ~~bacillus on microscope~~ Figure 23 bacillus on blood agar

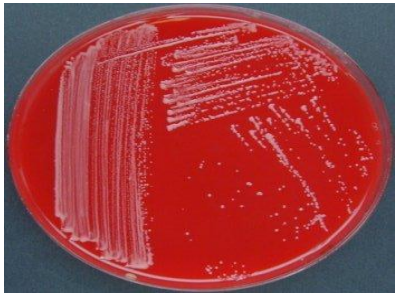


figure 24 ~~serratia on McCon~~

Table(1):Table of antibiotic resistance

Isolate Bacteria	DO+	SXT	Cip	IMP	CAZ	CIX	AZM	TE	VA+	FOX	CT_	AK	OX+	OP+	D+N	R	S
Bacillus Spp	R	R	S	S	R	R	R	R	R	R	R	S	R	_	_	60	20
Bacillus	K	R	S	S	R	R	R	R	R	R	R	S	R	_	_	60	20
~~Diphteria~~ Corynebacterium Spp	R	R	S	S	R	R	R	S	R	R	R	R	S	_	_	33.3	46.7
~~Staph~~	S	S	S	S	S	S	S	S	S	S	S	S	S	_	_	80	20
S.aureus	S	R	S	S	S	S	R	R	R	R	R	S	S		_	40	40
Bacillus	R	R	S	S	R	R	S	S	R	R	S	S	S	_	_	33.3	46.7
~~S.aureus~~	S	S	S	S	R	R	S	R	S	R	S	S	S	_	_	20	60
K.pneumane	-	S	S	S	R	S	R	R	R	_	R	R	_	_	_	33.3	20
S.viridan~~see~~	S	R	S	S	S	S	R	R	R	R	S	S	R	R	_	46.7	46.7

K.pneumoniae	_	R	S	S	R	R	S	S	_	R	S	S	_	_	_	26.7	40
Serratia.spp	_	R	S	S	S	R	S	S	_	R	R	R	_	_	_	33.3	33.3
~~S.aurues~~	R	R	S	S	R	R	S	R	S	R	S	S	R	_	_	46.7	40
Serratia.spp	_	R	S	S	R	R	S	S	_	R	R	R	_	_	_	40	26.7
Coagulase Neg.Staph	S	R	S	S	R	R	S	S	S	S	_	S	S	_	S	20	66.7
CN~~S~~	R	R	R	S	R	R	S	R	R	S	_	S	R	_	S	53.3	33.3
K.pneumoniae	_	R	S	S	R	R	R	R	_	R	S	S	_	_	_	40	26.7
~~S.aurues~~	R	S	S	S	S	R	S	R	S	R	_	S	S	_	_	26.7	53.3
Strreptoviridans	S	R	S	S	S	S	S	R	S	R	_	S	S	R	_	26.7	60
K.pneumoniae	_	R	S	S	S	R	S	S	_	R	S	S	_	_	_	20	46.7
Pseudomonas Aerginosa	_	R	S	R	R	R	S	R	_	R	S	S	_	_	_	40	26.7
~~S.aurues~~	S	S	S	S	S	R	S	S	S	S	_	S	S	_	_	6.7	73.3
Bacillus.spp	S	S	S	S	R	R	S	S	S	R	_	S	S	_	_	20	60

Serratia.spp	R	S	S	R	R	R	S	S	_	R	S	S	_	_	_	33.3	40
Bacillus.spp	S	S	S	S	S	R	S	S	S	R	_	S	S	_	_	20	60
S.aurues	S	R	S	S	S	R	S	R	S	R	_	S	R	_	_	33.3	46.7
K.pneumoniae	_	R	S	S	R	R	S	S	_	S	S	S	_	_	_	20	46.7
S.aureus	S	R	S	S	R	R	R	R	S	R	_	S	R	_	_	40	33.3
Serratia	_	R	S	S	R	R	R	R	_	S	S	S	_	_	_	33.3	33.3

S= Sensitive, R= resistant, Do= Doxycycline, SXT=Septrin , Cip= Ciprosloxcin, Imp= Impcillin , Caz= Cefotazime , Cix= Cefotaxime , Azm=Azithromycin, TE= Tetrracycline, *VA+= Vancomycin, Fox= Cefoxtine, CT- =ceftolozane-tazobactam , AK=Amikacin,* OX+= Oxacillin,

levels of antibiotic resistance were obtained among the bacterial isolates and ranged between (6.7% - 80%) the highest ranges of bacteria were 80% S. auruesand 60% Bacillus Spp All the bacterial isolates from the daycare were resistance towards two or more antibiotic.

Discussion

According to the swabs results that were taken from the nursery in Benghazi Medical Center, the highest rates of bacteria were *S.aureus* 34.5%. It was found in (kid's games, carpet nursery, window glass, broom, wall, children's chairs, games installation, bathroom wall, toilet and rug).

*S. aureus*normal flora found in nose, respiratory tract and on the skin, but it is recognized as a common cause of boils and soft tissue infections as well as more serious conditions such as pneumonia or bloodstream infections [(24)]. It also may cause infection in bone, brain and heart [(25)].

Followed by Bacillus. Spp 17.24% the most two bacillus species that considered medically significant are B.anthracis which causes "anthrax" and B.cereus which causes food poisoning [(26)] . These two types of bacteria were found in (children bed, Bed change diapers, carpet nursery, bathroom faucet and External door handle).

In addition, both*K.pneumoniae* and *serratia.spp*have the equal rates with 13.8%. *Serratia* is an opportunistic human pathogen. *K. pneumoniae* is a normal flora in the human intestines, mouth and skin [(27)], but it's well known as an important cause of community-acquired bacterial pneumonia, and most frequent site of infection is in the urinary tract [(28)]. As well as, both of them can cause infections in Blood stream, wounds [(29-30)].

According to the *Centers* for *Disease* Control and Prevention (CDC) there are an estimated 51,000 healthcare-associated *P. aeruginosa* infections every year in the United States healthcare centers [(31)].

Common hospital-associated *P. aeruginosa* infections include Urinary tract infection, wounds and burns and also bloodstream infections [(32)].

Furthermore, *Diphteria.spp* and *S.viridians*with rate 3.4%. It's a pathogenic bacterium, causes (*Diphtheria*).

Although, these occurrences were not too high, the presence of such bacteria in child day care could cause a serious health risk, especially diphtheria. According

to *Centres* for *Disease* Control and Prevention (CDC) it was a major cause of illness and death among children, diphtheria is known as childhood disease and own a comprehensive routine vaccination programs, in developed countries the coverage of vaccination is high, but it's low in some countries as (India, Indonesia). So, the circulation of toxigenic C. diphtheria continues.

In 2013, 4,680 diphtheria cases globally were reported to the world Health Organization (WHO)[33], and also infection maybe occur to kids which vaccines already exist, or they were under the age of vaccination or even has been abandoned.[34]

S.viridians is normally found in mouth, gastrointestinal system, upper respiratory tract and genitourinary tract. The S.viridians normally do not harm healthy people but may cause disease in people with compromised immune systems. One of the diseases is called Endocarditis: the inflammation of the inner lining of the heart. This can damage the heart's valves and lead to heart failure [35].There are some diseases whose risk is increased for children like:

Otitis media, it's one of the most common bacterial infection in childhood, and a common cause of auditory acuity in childhood [36]. Respiratory infections, and are the most common cause of childhood disease and Children who attend daycare are suffering more sever and more in number, Finally the diarrheal diseases, these diseases are an important problem in daycare centers where the microbes are transmitted by direct contact, person to person, or indirectly. Kids who attend daycare have an increased risk of being hospitalized, and also Rotavirus infection is responsible for 20 to 60% of hospital admissions of children due to diarrhea. And Studies show that increased frequency of respiratory disease and diarrhea at daycare centers where hand washing is insufficient, also changingDiaper is considered as a high risk for transmission of enteric pathogens between children and workers at daycare centers [37].**Antimicrobial Susceptibility:**

Among the isolated bacteria there were high levels of them resistant to antibiotics (6.7%-80%). Over the past decades, there were many antimicrobial classes that have been developed. Unfortunately, bacterial resistance against antibiotics has been shown in all its varieties. Some bacteria that were be found in the nursery

and could be develop their resistance to antibiotics are; *S.aureus*(Methicillin-Resistant *S. Aureus)* and Carbapenem-Resistant *Enterobacteriaceae*. According to WHO *S. aureus* (Methicillin-Resistant *S. Aureus* MRSA) can be very serious, where in U.S there were 11,285 Deaths Per year.

In addition, Carbapenem-Resistant *Enterobacteriaceae* is Resistant to nearly all the available antibiotics [(38)]. In addition, the most type of (CRE) is *K. pneumoniae. P.aeruginosa,* may become Multi Drug Resistant (MDR) and its infection is often sever and difficult to treat [(39)].

Through our study we found: the most of mothers are doctors and they have the knowledge about the transmission of infection and spread of bacteria in kindergarten and don't following infection policy and control inside kindergarten such as washing hands and safe preparing food … etc. to protect the children from infection, and also they enter to the center with the same shoes and work clothes. And we found the working team inside the kindergarten using insufficient detergent to kill the bacteria that come from hospital, and also the nursery doesn't provide any educational programs to mothers and worrying them the severity of infection to children.

Conclusion

It has been found that there are several harmful bacteria (*S.aureus , K.pneumonia , P.aeruginosa , S.viridians, C.diphtheria , bacillus and Enterobacteriaceserratia*.) and some of them resistant to different types of antibiotics (Cefotaxime , Azithromycin, Tetrracycline, *Vancomycin, Cefoxtine, ceftolozane-tazobactam*test Doxycycline, Septrin , Ciprosloxcin, Impcillin , Cefotazime,*Amikacin,* Oxacillin) and these harmful bacteria spread inside the child day care and it's have negatively effect on their health especially the nursery is located inside the hospital that makes the possibility of spreading of bacteria more than any another nursery . and we found through the study by asking the working team in nursery and the children's families we found the quality and ideal criteria of cleaning and sterilization completely wasn't found inside the child day care starting from washing hands and sterilization of ground, games, chairs, tables and all the surrounding

environment. So it's necessary to educate the working team inside the kindergarten to teach them information on protection the children from the illnesses and limiting the spread of microbes inside the kindergarten and the cleaning ,sterilization by using alcohol at least three times a day ,and teaching them about good ventilation and renewal the air inside the building very important and prevent the accumulation of microbes . And but a strictly laws for children's families that working in hospital by washing hands, andwe suggest making outside sink for washing hands and aware people to remove shoes before entering nursery because it's may be source of entering the microbes.

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