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Antibiotic susceptibility profile of bacteria isolated from fomites in some day care centres in Ile-Ife, Nigeria

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This study was conducted by carrying out the isolation, identification and determination of the sensitivity profile to antibiotics in bacteria isolated from fomites in some day care centres in Ile-Ife, Osun State, Nigeria. A total of one hundred and twenty-four fomites were collected from selected seventeen day care centers within Ile-Ife. These were cultured on nutrient agar plates incubated at 37°C for 24 h using streak plate technique. Preliminary identification of bacterial isolates was performed using cultural, colonial and morphological characteristics of isolates on the agar plates such as relative size, colour, texture, consistency, pigment, elevation, edge and shape. Bacterial isolates were further characterized by physiological characteristics through biochemical reactions of the bacterial isolates to some reagents and media with reference to the Bergey's Manual of Determinative Bacteriology. Isolates were further identified with Microbact identification test kit. The antibiotype of the isolates was determined by the Kirby-Bauer's disk diffusion technique. Detection of extended spectrum beta-lactamase was done phenotypically by the double disc synergy test. Resistance to antibiotics varied greatly among the isolates. Resistance to cefuroxime, augmentin, cephalexin and ampicillin was notably high in *Bacillus* sp, *Staphylococcus* sp, *Corynebacterium* sp and *Staphylococcus aureus* from fomites. Meanwhile, all Enterobacteriaceae were susceptible to meropenem, ciprofloxacin, augmentin, trimethroprim, gentamycin, cotrimoxazole, chloramphenicol and ofloxacin. Multiple antibiotic resistance (MAR) was generally high among the Gram positive isolates with diversity of MAR patterns.

Key words: Fomites, bacteria, disk diffusion technique, antibiotic resistance.

INTRODUCTION

Day care can be defined as a facility, personal or relative(s) home, which provide care for infants and toddlers and preschoolers (Shahidul and Nasreen, 2015). Day care is also taking care of a child or multiple children at a time by nannies or babysitters, teachers, or other providers. Microorganisms are ubiquitous. They are found on the floor where the children play, toys, air, etc. Most of these microorganisms are *Proteus* sp, *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus* sp. *Bacillus* sp. and *Streptococcus*

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Table 1. Frequency and percentage distribution of the bacterial isolated from fomites in day care centers in Ile-Ife.

Bacterial Isolates (n=132)	No. of occurrence	Percentage
Staphylococcus aureus	7	5.30
Staphylococcus sp	18	13.64
Bacillus sp	54	40.90
Corynebacterium xerosis	29	21.97
Corynebacterium kutsceri	19	14.39
Enterobacter cloacae	1	0.76
Enterobacter agglomerans	1	0.76
Others	1	0.76
Providencia rettgeri	1	0.76
Proteus sp	1	0.76
Total	132	100

n = Total number of isolates.

faecalis (Olaitan and Adeleke, 2006). Fomites are non-living materials or surfaces which could harbor or spread fecal pathogens (Timothy et al., 2013). Inanimate objects (fomites) are known to transmit human pathogens via direct, surface-to-mouth, contacts, or indirectly, by contaminated fingers and oral transmission (Akinrotoye et al., 2018). The fomites includes baby toys, beddings, door handles, showers, toilet, hand lockers especially those found in day care, and restrooms (Bright et al., 2010). It is believed that inanimate objects are carriers of microorganisms emanating within the surrounding environment. These ubiquitous microorganisms could pose a bio-transfer potential that has the potential to be transferred to another substratum where growth is possible, for example on food, inanimate objects or on the human body (Joanna, 2012). The spread of infectious diseases through hand contact has been an area of major concern that should be looked into drastically for possible solutions. Surveys of the day care center environment have found contamination on the surfaces of toys, food areas, and diaper changing areas. The organisms thus picked from fomites can be transferred to another child as the fomites have shown to play a role in the transmission of organisms. This study therefore seek to isolate and determine the antibiotic susceptibility profile of bacteria of public health importance associated with fomites in selected day care centers located in Ile-Ife, Osun State, Nigeria.

MATERIALS AND METHODS

Samples were collected from 17 different Day care centers in Ile-Ife, Osun State. Sterile cotton swabs pre moistened with sterile normal saline was rotated around the baby toys, diaper changing tables, chairs, tables, mats, door handles and bed sheets. Preliminary identification of bacterial isolates was performed using cultural, colonial and morphological characteristics of isolates on the agar plates such as relative size, colour, texture, consistency, pigment, elevation, edge and shape (Olutiola et al., 2018). Bacterial isolates were further characterized by physiological characteristics through biochemical reactions of the bacterial isolates to some reagents and media with reference to the Bergey's Manual of Determinative Bacteriology. Isolates were identified to specie level using Microbact identification test kits (Oxoid).

ANTIBIOTIC SUSCEPTIBILITY TEST

Antibiotic susceptibility of the isolates was done using the Kirby-Bauer's disk diffusion method as described by Bauer et al. (1966) and interpreted according to the guidelines of Clinical Laboratory Standard (CLSI, 2013). An 18-24 h old broth culture of the inoculum was standardized (adjusted to 0.5 McFarland Standard - x 10^8 cfu/ml). The prepared standardized inoculum was seeded on the Mueller-Hinton susceptibility agar plates (Lab M, UK) with the aid of sterile swab stick and allowed to dry for 5-10 min. The Gram positive and Gram positive antibiotic disks (combined (Biomark Laboratories, India) containing varying and specific concentrations viz; gentamycin (10 µg), augmentin (30 µg), ceftazidime (30 µg), cephalexin (1.5 µg), cefuroxime (10 µg), erythromycin (5 µg), vancomycin (30 µg) cotrimoxazole (25 µg), ampicillin (10µg), tetracycline (30 µg), ciprofloxacin (5 µg), cefuroxime (10 µg) and ceftazidime (10 µg) and combined (Abtek) containing varying and specific concentrations which include gentamycin (10 µg), ceftazidime (30 µg), cefuroxime (30 µg), tetracycline (10 µg), meropenem (10 µg) cefixime (5 µg) ciprofloxacin (5 µg), trimethoprim (5 µg), nitrofurantoin (300 µg), ofloxacin (5 µg), augmentin (30 µg), Amoxicillin/clavulanic acid (30 µg), cefotaxime (30 µg) and ceftazidime (30 µg)) were used.

RESULTS

Frequency and percentage distribution of the bacterial isolated from fomites, in day care centers in Ile-Ife

Table 1 shows the overall distribution of bacteria isolated from fomites in day care centers. The distribution of the isolates recovered includes: *Staphylococcus aureus* 7

Table 2. Antibiotic susceptibility profile of the isolates cultured from fomites in day care centers in Ile-Ife.

Name of organism	Antibiotics	No of isolates	Sensitive (%)	Intermediate (%)	Resistance (%)
	Cotrimoxazole (25 µg)	7	6(85.7)	0	1(14.3)
	Cefuroxime (10 µg)	7	3(42.86)	0	4(57.14)
	Gentamycin (10 µg)	7	7(100)	0	0
	Ciprofloxacin (5 µg)	7	7(100)	0	0
	Ampicillin (30 µg)	7	1(14.3)	0	6(85.7)
Staphylococcus aureus	Erythromycin (5 µg)	7	3(42.86)	2(28.57)	2(28.57)
	Tetracyline (30 µg)	7	6(85.7)	1(14.3)	0
	Augmentin (30 µg)	7	1(14.3)	0	6(85.7)
	Cephalexin (1.5 µg)	7	2(28.57)	0	5(71.43)
	Ceftaxidime (10 µg)	7	3(42.86)	0	4(57.14)
	Vancomycin (30 µg)	7	3(42.86)	0	4(57.14)
	Cotrimoxazole (25 µg)	18	11(61.11)	0	7(38.89)
	Cefuroxime (10 µg)	18	2(11.11)	2(11.11)	14(77.78)
	Gentamycin (10 µg)	18	17(94.44)	1(5.56)	0
	Ciprofloxacin (5 µg)	18	18(100)	0	0
	Ampicillin (30 µg)	18	2(11.11)	0	16(88.89)
***Staphylococcus* sp.**	Erythromycin (5 µg)	18	6(33.33)	4(22.22)	8(44.44)
	Tetracyline (30 µg)	18	9(50)	3(16.67)	6(33.33)
	Augmentin (30 µg)	18	3(16.67)	0	15(83.33)
	Cephalexin (1.5 µg)	18	5(27.78)	0	13(72.22)
	Ceftaxidime (10 µg)	18	4(22.22)	1(5.56)	13(72.22)
	Vancomycin (30 µg)	18	5(27.79)	0	13(72.22)
	Cotrimoxazole (25 µg)	54	39(72.22)	1(1.85)	14(25.93)
	Cefuroxime (10 µg)	54	1(1.85)	0	53(98.15)
	Gentamycin (10 µg)	54	51(94.44)	0	3(5.56)
	Ciprofloxacin (5µg)	54	51(94.44)	1(1.85)	2(3.70)
	Ampicillin (30 µg)	54	1(1.85)	0	53(98.15)
***Bacillus* sp.**	Erythromycin (5 µg)	54	25(46.29)	24(44.44)	5(9.30)
	Tetracyline (30 µg)	54	33(61.11)	5(9.26)	16(29.63)
	Augmentin (30 µg)	54	1(1.85)	0	53(98.15)
	Cephalexin (1.5 µg)	54	9(16.67)	0	45(83.33)
	Ceftaxidime(10 µg)	54	10(18.52)	0	44(81.48)
	Vancomycin(30 µg)	54	39(72.22)	0	15(27.78)
	Cotrimoxazole (25 µg)	48	33(68.75)	0	15(31.25)
	Cefuroxime (10 µg)	48	4(8.33)	0	44(91.67)
	Gentamycin (10 µg)	48	38(79.17)	2(4.17))	8(16.66)
	Ciprofloxacin (5 µg)	48	41(85.41)	2(4.17)	5(10.42)
	Ampicillin (30 µg)	48	2(4.17)	0	46(95.83)
	Erythromycin (5 µg)	48	12(25)	8(16.67)	28(58.33)
	Tetracyline (30 µg)	48	27(56.25)	6(12.5)	15(31.25)
***Corynebacterium* sp.**	Augmentin (30 µg)	48	6(12.50)	0	42(87.50)
	Cephalexin (1.5 µg)	48	41(85.42%)	0	7(14.58)
	Ceftaxidime (10 µg)	48	6(12.5)	0	42(87.5)
	Vancomycin (30 µg)	48	18(37.5)	0	30(62.5)
	Cotrimoxazole (30µg)	5	5(100)	0	0
	Chloramphenicol (30 µg)	5	5(100)	0	0
Enterobacteriaceae	Gentamycin (10 µg)	5	5(100)	0	0
	Cefotaxime (5 µg)	5	5(100)	0	0

Table 2. Cont'd.

	Ofloxacin (5 µg)	5	5(100)	0	0
	Augmentin (30 µg)	5	5(100)	0	0
	Nitrofurantion (300 µg)	5	4(80)	1(20)	0
	Ciprofloxacin (5 µg)	5	5(100)	0	0
	Tetracycline (30 µg)	5	2(40)	2(40)	1(20)
	Trimethoprim (5 µg)	5	3(60)	0	2(40)
	Meropenem (10 µ)g	5	5(100)	0	0

(5.30 %), *Staphylococcus* sp 18 (13.64%), *Bacillus* sp 54 (40.90%), *Corynebacterium xerosis* 29 (21.97%), *Corynebacterium kutsceri* 19 (14.39%), *Enterobacter clocae* 1 (0.76 %), *Enterobacter agglomerans* 1 (0.76%), other Enterobacteriacae 1 (0.76%), *Providencia rettgeri* 1 (0.76%) and *Proteus* sp 1 (0.76%).

Antibiotic susceptibility profile of the bacterial isolates cultured from fomites in day care centers in Ile-Ife

Table 2 shows the antibiotic susceptibility profiles of the bacterial isolates cultured from fomites. Resistance of bacterial isolates to antibiotics varies greatly. *Staphylococcus aureus* was resistant to ampicillin (85.7%), augmentin (85.7%), ceftazidime (57.14%), vancomycin (57.14%) and cephalexin (71.43%). However, the organism was sensitive to gentamycin (100%), ciprofloxacin (100%), cotrimoxazole (85.7%) and tetracycline (85.7%). Meanwhile, *Staphylococcus* sp was resistant to ampicillin (88.89%), augmentin (83.3%), ceftazidime (72.22%), cefuroxime (77.78%) and vancomycin (72.22%). However, *Staphylococcus* sp was sensitive to ciprofloxacin (100%), gentamycin (94.44%), cotrimoxazole (61.11%) and tetracycline (50%). *Bacillus* sp was resistant to cefuroxime (98.15%), ampicillin (98.15%) and augmentin (98.15%). However, the organism was sensitive to gentamycin (94.44%), ciprofloxacin (94.44%), tetracycline (61.11%) and cotrimoxazole (72.22%). The resistance profile of *Corynebacterium* sp, is as follows: cefuroxime (91.67%), ampicillin (95.83%), ceftaxidime (87.50%) and augmentin (87.50%). However, the organisms were susceptible to gentamycin (79.17%), ciprofloxacin (85.41%) and cotrimoxazole (68.75%). All Enterobacteriaceae were 100% susceptible to cotrimoxazole, gentamycin, cefotaxime, ofloxacin, augmentin, meropenem and ciprofloxacin.

Multiple antibiotic resistance profile of bacterial isolates from fomites in day care centers in Ile-Ife

The multiple antibiotic resistance patterns were calculated using the MAR index formular. The isolates with MAR index values higher than 0.2 were considered as multiple resistant. The classes of antibiotics used to investigate multiple resistance patterns include penicillins, macrolides, tetracyclines, sulfonamides, amino-glycosides, fluoroquinolones, beta lactams, glycopeptides and cephalosporins. The MAR (index) obtained from bacterial isolates from fomites in day care centers were observed to range from 0.18 to 1.0. The highest observed multiple resistant phenotype was found to exhibit resistance to 9 classes of antibiotics in *Bacillus* sp. All Gram positive strains exhibited different antibiotic resistance profiles with "AUG, AMP, CP, CRX AND CPZ" appearing most frequent. While for Gram negative, *Enterobacter agglomerans* was seen to be resistance to tetracycline and trimethoprim. This is shown in Table 3.

Frequency of ESBL - producing gram negative bacteria

The prevalence of ESBL by the double disk synergy test (DDST) showed that 5 (80%) from fomites were ESBL producing strains (Table 4).

DISCUSSION

Children, especially children in day care centers aged three years and under, have shown to have a high frequency of infectious disease than children cared for elsewhere. This could be because of direct transmission between children, workers, contaminated fomites, contact or respiratory droplet transmission (Ibfelt et al., 2015). An increased prevalence of antibiotic resistant organisms among children attending child care compared with children cared for at home may be expected considering the more frequent use of antibiotics, the gathering of large numbers of susceptible children, and the increased prevalence of infectious diseases in child-care settings (Adedire et al., 2016). The frequency of bacteria isolated from fomites was also very high. It was found to be 132 (27.22%). This corroborates with Risan (2017) who reported that opportunistic pathogens such as bacteria, viruses and fungi can survive on inanimate surfaces for long periods of time and items such as watches, pens, toys, floor, door handles and mobile phones are

Table 3. Multiple Antibiotic Resistance (MAR) Profile of Bacteria Isolates from Fomites in Day Care Centers in Ile-Ife.

Isolate	No. of antibiotics used (b)	No. of resistant isolates (a)	MAR Index a/b	Multiple resistance pattern	No. of MAR Pattern	Frequency	Total no of MAR isolates (%)
	11	2	0.18	AMP, AUG		1	6(4.92)
		3	0.27	AMP, AUG, CP	5	1	
S. aureus		6	0.55	AMP, AUG, CP, CPZ,CRX, VAN		2	
		7	0.64	AMP, AUG, CP, CPZ, CRX, ERY, VAN		1	
		8	0.73	COT, AMP, AUG, CP, CPZ, CRX, ERY, VAN		1	
		2	0.18	GEN, AMP	11	1	16(13.11)
		5	0.45	AMP, AUG, CP, CPZ, CRX		1	
		6	0.55	CRX, AMP, ERY, AUG, CP, VAN		2	
				COT, AMP, ERY, AUG, CP, VAN		1	
				COT, CRX, AMP, AUG, CP, VAN		1	
Staphylococcus sp.				AMP, AUG, CP, CRX, CPZ,VAN		1	
		7	0.64	AMP, AUG, CP, COT, ERY, TET, VAN		1	
				AMP, AUG, CP, CPZ, ERY, TET, VAN		3	
		8	0.73	AMP, AUG, CP.CPZ, CRX, COT, TET, VAN		3	
				AMP, AUG, CP,CPZ,CRX,ERY, TET, VAN		1	
		9	0.81	COT, AMP, AUG, CP,CPZ,CRX,ERY, TET, VAN		1	
		3	0.27	AMP, AUG, CP	23	1	53(43.44)
		4	0.36	AMP, AUG, CPZ, CRX		3	
				AMP, AUG, CRX, TET		2	
				AMP, AUG, CRX, COT		1	
				AMP, AUG, CP, CRX		1	
		5	0.45	AMP, AUG, CP, CRX, CPZ		16	
				AMP, AUG, CRX, TET, VAN		2	
Bacillus sp.				AMP, AUG, CP, CRX, TET,		1	
				AMP, AUG, CP, CRX, COT		1	
		6	0.55	AMP, AUG, CP, COT, CRX, VAN		8	
				AMP, AUG, CP,CRX, TET, VAN		3	
				AMP, AUG, CPZ, CRX, TET, VAN		1	
				AMP, AUG, CP, CPZ, CRX, VAN		1	
				AMP, AUG, CP, CRX, CPZ, ERY		2	
				AMP, AUG, CP, CRX, CPZ, TET		1	
		7	0.64	AMP, AUG, CP,CPZ,CRX, TET, VAN		1	
				AMP, AUG, CP, CPZ,COT, CRX, GEN		1	

Table 3. Cont'd.

			AMP, AUG, CP, CPZ, CRX, GEN, TET		1	
			AMP, AUG, CP, CPZ, CRX, GEN, VAN		1	
	8	0.73	AMP, AUG, CP,CPZ, CIP, CRX, ERY, VAN		2	
	9	0.82	AMP, AUG, CP, CPZ, COT, CRX, ERY, GEN, VAN		1	
			AMP, AUG, CP, CPZ, CRX, COT, ERY, TET VAN		1	
	10	0.90	AMP, AUG, CIP, CP, CPZ, CRX, COT, ERY, TET, VAN		1	
	2	0.18	AMP, CRX	26	1	46(37.70)
	3	0.27	AMP, CPZ, CRX		1	
			AMP, AUG, TET		1	
	4	0.36	AMP, AUG, CPZ, CRX		2	
			AMP, AUG, CP, CRX		1	
	5	0.45	AMP, AUG, CP, CPZ,CRX		2	
			AMP, AUG, CPZ, CRX, GEN		1	
			AMP, CP, CPZ,CRX, COT		1	
			AMP, AUG, CPZ, CRX, COT		1	
	6	0.55	AMP, AUG, CP, CRX, COT, VAN		1	
			AMP, CIP, CP, CPZ, COT, ERY		1	
			AMP, AUG, CP, CPZ, CRX, VAN		4	
			AMP, AUG, CP, CPZ, CRX, ERY		2	
Corynebacterium sp.			AMP, AUG, CP, CPZ, CRX, TET		1	
	7	0.64	AMP, AUG, CP, CPZ, CRX, ERY, VAN		8	
			AMP, AUG, CPZ, CRX, ERY, TET, VAN		1	
			AMP, AUG, CP, CPZ, COT, ERY, VAN		1	
	8	0.72	AMP, AUG, CP, CPZ, CRX, ERY, COT, VAN		3	
			AMP, AUG, CP, CPZ, CRX, ERY, TET, VAN		4	
			AMP, AUG, CP, CPZ, CRX, ERY, GEN, VAN		1	
	9	0.82	AMP, AUG, CRX, CP, CPZ, COT, ERY, GEN, VAN		1	
			AMP, AUG, CRX, CP, CPZ, COT, ERY, TET, VAN		1	
			AMP. AUG, CRX, CP, CPZ, COT, ERY, GEN, TET		1	
	10	0.90	AMP, AUG, CRX, CP, CPZ, COT, ERY, GEN, TET, VAN		1	
			AMP, AUG, CRX, CIP CP, CPZ, COT, ERY, TET, VAN		1	
	11	1.00	AMP, AUG, CRX, CIP CP, CPZ, COT, ERY, GEN, TET, VAN		3	
E. agglomerans	2	0.18	TET, TRI	1	1	1(0.82)

TET- Tetracycline, AMP- Ampicillin, AUG- Augmentin, CRX- Cefuroxime, CP- Cephalexin, CH- Chloramphenicol, COT- Cotrimoxazole, ERY- Erythromycin, GEN- Gentamycin, VAN- Vancomycin, CIP- Ciprofloxacin , TRI- Trimethoprim, MAR- Multiple antibiotic resistant, 'a'- number of antibiotics to which the isolates is resistant to, 'b' the number of antibiotic to which the isolates is exposed.

Table 4. Frequency of ESBL- producing bacteria isolated from fomites in day care centers in Ile-Ife.

Bacterial isolates	No. of isolates	ESBL positive (%)	ESBL negative (%)
Enterobacter clocae	1	1(1000	0
Enterobacter agglomerans	1	1(100)	0
Other *Enterobacteriaceae* sp.	1	1(100)	0
Providencia rettgeri	1	0	1(100)
Proteus sp.	1	1(100)	0
Total	5	4(80)	1(20)

permanent surfaces for transmission of these types of infections.

The prevalence of bacteria isolated from fomites in increasing order in this study is as follows. *Bacillus* sp 54 (40.90%), *C. xerosis* 29 (21.97%), *C. kutsceri* 19 (14.39%), *Staphylococcus* sp 18 (13.64%), *S. aureus* 7(5.30%), *E. clocae*, *E. agglomerans*, *P. rettgerri* and *Proteus* sp 1 (0.76%). *Bacillus* sp 54 (40.90%), was the highest bacteria recovered from the bacteria isolated from fomites in all the day care centers recruited for the study. This agrees with a study conducted by Ali et al. (2018) who reported *Bacillus* sp (66.66 %) to be the most commonly cultured bacteria from toys in child care centers, in Al-Rass city, Al-Qassim region. The reason for the high occurrence of *bacillus* sp in this study can be attributed to the fact that these microorganisms are spore forming organisms, rugged opportunistic bacilli and could be found easily in the environments. They are capable of forming endospores, which make them resistant to extreme conditions such as pressure, extreme heat or cold, drought, starvation, biocides, and UV irradiation (Gopal et al*.,* 2015).

In this study, the frequency of gram-positive isolates was higher than gram-negative isolates. This is consistent with earlier studies conducted by Ayalew et al. (2019). The various bacteria such as *Bacillus* sp, *Staphylococus aureus*, *Staphylococus* sp, *Klebsiella* sp, *Proteus* sp, *Pseudomonas aeruginosa*, *Serratia* sp, *Escherichia coli* and *Enterobacter* sp isolated in this study are similar to the bacteria isolated by Adedire et al. (2016); except for *Corynebacterium* sp, which was found to be isolated in this study. No Vibrio sp was isolated in this study. The absence of this bacteria in this study corroborate with the findings of Adedire et al. (2016). The high occurrence of Gram positive bacteria over Gram negative bacteria agrees with the findings of Al-Harbi et al. (2017) who reported 80% of Gram positive bacteria and 20% Gram negative bacteria isolated from frequently used fomites in Kuwait. *Staphylococcus aureus* isolated from fomites was susceptible to gentamycin (100%), ciprofloxacin (100%), cotrimoxazole (85.7%) and tetracycline (85.7%) but resistance to ampicillin (85.7%), augmentin (85.7%); while *Bacillus* sp were 98.15% resistant to ampicillin, cefuroxime and augmentin. The results however agrees with the report of Afolabi et al. (2018) who reported 100% resistivity of *Staphylococcus aureus* to augmentin isolated from fomites in crèche. *Corynebacterium* sp were 87.50% and 95.83% to augmentin and ampicillin respectively. All Enterobacteriaceae isolated from fomites were susceptible to augmentin (100%), cefotaxime (100), nitrofurantoin (80%), ofloxacin (100%), gentamycin (100%), ciprofloxacin (100%), meropenem (100%), cotrimoxazole (100%) and chloramphenicol (100%). However; they were resistant to trimethoprim (40%) and tetracycline (20%). This result is different to the findings of Adedire et al. (2016).

The MAR index expressed by the Gram positive isolates was very high in all sampled locations and more than the 0.2 threshold value which is the set value for distinguishing low and high risk contamination (Krumperman, 1983).

Conclusion

Considering the various findings, the result of this study confirms that fomites in day care centers could serve as media for transmission of the disease. The micro-organisms pose health risk for immunocompromised children. These environments must improve the suitable hygiene procedures for protecting the children by ensuring that the workers observe stringent guidelines on proper washing and regular disinfecting of toys and beddings. The study concluded that the incidence of multiple antibiotic resistant bacteria isolated from fomites was high. Hence, this calls for great concern considering its implications in the day care centers studied.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interest

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