## Antibiotics susceptibility patterns of bacterial isolates from clinical samples in Thamar, Yemen.

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**Abstract**

This study was designed to determine the antimicrobial sensitivity patterns of some bacterial isolates from patients visited different hospitals and medical laboratories in Thamar city, Yemen. One hundred -twenty four bacterial isolates were isolated from various clinical samples namely blood (62), urine (38), stool (35) and analyzed using standard microbiology technique in the Department of Biotechnology and food technology, Faculty of Agriculture and Veterinary Medicine ,Thamar University. Pathogenic bacteria were identified by their colonial morphology, Gram staining, appropriate biochemical test and API20E. Among the 135 different clinical samples collected 124 Pathogenic bacteria were isolated which includes; *Salmonella typhi*(33)*, Salmonella. paratyphi*(13)*, Escherichia coli* (34), *Klebsiella pneumoniae.* (22), *Shigella Spp.*(11), *Salmonella Sp.*(6), *Citrbacteir freundi*(3*), Enterobacter Sp.*(2). Antibiotics susceptibility studies showed that all *Salmonella typhi* isolates were high resistance to rates Lincomycin,Tetracycline whereas most of them were resistance to ,Rifampicin(87.5%) and Nalidixic acid(50%). Intermediate resistance was observed to Ciprofloxacin(72.7%) and Norfloxacin(62.5%) while, All pathogenic isolates were susceptible to Amoxicillin, Doxycycline,Streptomycin, Gentamycin. All *Salmonella paratyphi* isolates showed resistance to Lincomycin, Tetracycline, Streptomycin(84.6%) and Nalidixic acid(76.9%) but susceptible (100%) to Amoxicillin, Doxycycline and Gentamycin(84.6%). All *Escherchia coli* isolates showed high resistance to Ampicillin,Erythromycin, Lincomycin, Amoxicillin and ,Rifampicin whereas, (67.6%) of them were resistance to Ciprofloxacin, Tetracycline, Doxycycline , Streptomycin, Gentamycin(58.8%) and Nalidixic acid(50%). All *Klebsiella pneumoniae* isolates showed high resistance to Erythromycin, Lincomycin ,Rifampicin , Streptomycin and (72.7%) to Amoxicillin and Ciprofloxacin. All *Shigella Sp.* isolates showed high resistance to Erythromycin, Lincomycin, Rifampicinand Gentamycin, also to Tetracycline(90.9%), Ampicillin(81.8%),Amoxicillin(72.7%) but less resistance to Doxycycline(54.5%). Most of *Shigella Sp.* isolates were susceptible to Norfloxacin(72.7%) and Ciprofloxacin(63.6%). All non-typhoid *Salmonella Sp.* isolates were multi drug resistant to the antibiotics tested. High rates of drug resistance were found in most of the isolates studied and this could be attributed to their prevailing usage and abuse in the area under study. These results suggest that multi-drug resistance among clinical pathogens is common and significant in Yemen and call for nationwide surveillance programme to monitor microbial trends and antimicrobial resistance patterns in Yemen.

**Keywords:** Pathogenic bacteria, antibiotic susceptibility and clinical samples.

### Introduction

Resistance to commonly-prescribed antibiotics is an expanding global problem and has been observed in both developed and developing countries (Finch, 1998. Farrar, 1985, Rahal *et.al*.,1997 and Tenvor and Hughes, 1996) . Resistance has emerged even to newer, more-potent antimicrobial agents( Parry, 1989). A number of epidemics have recently occurred caused by multiply resistant microorganisms. The widespread use of broad-spectrum antibiotics has led to the emergence of nosocomial infections caused by drug resistant microbes (Courvalin and Weber, 2005; Chikere *et al*., 2008). In Yemen typhoid fever and bacterial infections of the urinary and gastrointestinal tract are common and represent a frequent cause of morbidity in outpatients as well as a frequent cause of nosocomial infections in many hospitals.

Most infections are treated on an empirical basis. Clinical experience has indicated the presence of numerous cases resistant to conventional chemotherapy. Microbial resistance rates to commonly prescribed antibiotics have increased recently (Power, 2004).

Updated knowledge of the prevailing causal bacteria and their susceptibility patterns is important for the proper selection and use of antimicrobial drugs and for the development of an appropriate prescribing policy. Furthermore, history has taught us that if we do not use antibiotics carefully, they will lose their efficacy. As a response to these challenges, the present study was designed to determine the antibiotic sensitivity pattern of pathogenic bacteria isolated from hospitalized patients in Thamar city,Yemen.

### Materials and Methods

### Sample collection
Blood Sample were collected aseptically from patients visited of Thamar general hospital and Taiba hospital

in Thamar city**.** A total of 62 blood samples were collected from patients who were suspected of having typhoid fever according to presumptive diagnosis by a medical practitioner. Stool and urine samples were collected aseptically from Patients visited of Thamar general hospital , Taiba hospital,Mussali hospital and Aljarfi,Aziz,Alfa,Bynon medical laboratories in Thamar city. A total of 35 stool sample and 38 urine sample were collected from patients who suffering from diarrhea and urinary tract infection(UTI). All samples were collected in sterile disposable containers and analyzed at laboratory of Biotechnology and food technology Dept. Faculty of Agriculture and Veterinary Medicine ,Thamar University.

**Sample preparation and enrichment**
 2 ml of blood samples were inoculated onto tubes contained fluid thioglycolate medium(Himedia,India**)** and incubated for 48 hr  at 37 ℃ for enrichment of *Salmonella Spp.***.** Stool samples and urine samples were inoculated onto tubes contained peptone water and incubated for 24 hr  at 37℃.

**Isolation**
The tubes were examined daily for evidence of bacteria growth, including
Turbidity. Subcultures were as follows: from each positive blood tube, First: a loopfull was transferred to MacConkey agar , Salmonella-Shigella agar(S.S agar) and Xylose lysine desoxycholate agar (Himedia,India ), streaked, incubated for 24-48 hours at 37 ℃. Stool samples were cultured on MacConkey agar and Salmonella-Shigella agar(S.S agar) and  incubated for 48 hours at 37 ℃.  Urine samples were cultured on blood agar, Salmonella-Shigella agar(S.S agar)and MacConkey agar and incubated for 48 hours at 37 ℃. The isolates were stained by Gram stain and examined by light microscope(Collee *et.al*.,1996).

**Identification**
 124Isolates from cases with significant bacteria were purified and identified as follows**:**
**Biochemical tests**
Important biochemical tests (Oxidase test, SIM test, Urease test, Methyl Red/ Voges-Proskauer test, Citrate utilization, TSI test,  and Catalase test) were conducted according to(Collee *et.al*.,1996, Baron. and Finegold, 1990 and Forbes *et.al*.2007 ).

**Api20E system**
Identification of isolates was confirmed by biochemical tests on API 20 strips(BioMerieux, France). This system is devised for the biochemical identification of Enterobacteriaceae and other gram negative bacilli. It consists of 20 microtubes containing dehydrated media (each microtube consist of a tube and cupule section). The API 20E system was performed according to the manufacture instructions.

**Antibiotic susceptibility testing**

The most frequently isolates were then subjected to antibiotic sensitivity testing by the disc diffusion method on Mueller-Hinton agar(HIMEDIA,India) according to the National Committee for Clinical Laboratory Standards and Manual of Antimicrobial Susceptibility Testing guidelines (NCCLS, 2002; Cheesbrough, 2006; Coyle, 2005; Okonko *et al*.,2009a,b). Commercially available antimicrobial discs(HIMEDIA,India) were used in the study and included: Nalidixic acid (30 mcg), Doxycycline (30 mcg), Erythromycin (15 mcg), Sterptomycin (25 mcg), Tetracycline 30 mcg), Amoxicillin (30 mg), Ciprofloxacin (5 mcg), Gentamicin (10 mcg), Ampicillin (10mcg), Rifampicin (15 mcg),  , Norfloxacin (10 mcg) and Lincomycin (2 mcg). Plates were incubated at 35 ℃. Zones of inhibition were interpreted as resistant or sensitive using the interpretative chart of the zone diameter of the Kirby – Bauer sensitivity test method as described by Cheesbrough (2006). Interpretation of results was done using the zone of inhibition diameter. Zones of inhibition of _ 18 mm were considered sensitive, 13-17 mm intermediate and < 13 mm resistant (NCCLS, 2002; Cheesbrough, 2006; Coyle, 2005; Okonko *et al*., 2009a, b).

**Results**
   Obtained results showed that out of 135 different clinical samples collected from patients visited different hospitals and medical laboratories in Thamar city, YEMEN. A total of 62 blood samples were collected from patients suffered from typhoid fever. A total of 38 urine samples were collected from cases of urinary tract infections and a total of 35 stool samples were collected from cases of diarrhea. Only 54 patients had positive blood culture and 35 patients had positive urine culture. All isolates were identified by the standard biochemical tests and further
confirmed by API20E(Figure 1.).



**Figure (1):** API 20E results for isolated bacteria *Salmonella Typhi.*

   *S.typhi, S. paratyphi,* and *Klebsiella pneumoniae* were the most common pathogens isolated from cases of typhoid fever with the percentage of ٣١(57.4%), ١٣(24.1٪) and ٧(13**%)** respectively, from the total number of blood samples(Table 1). Other  pathogens were isolated in a relatively few number. The most common urinary pathogenic isolates were *E. coIi,* and *Klebsiella pneumonia* with the percentage of ٢٠(57.1%) and ١٣(37.1%) respectively, from the total

number of urine samples. *Escherichia coli*, *Shigella Sp*. and non-typhoid *Salmonella Sp*. were the most common pathogens isolated from cases of diarrhea in this study with the percentage of ١٤(40%),١١(31.4%) and ٤(11.4?%) respectively, from the total number of stool samples**(Table 1).**

*Escherchia coli ,Salmonella typhi* and *Klebsiella pneumonia* were the most frequently isolated bacteria pathogen from clinical samples with a rate of 34(27.4%) ,33(26.6%) and 22(17.7%) respectively, from the total number of clinical samples**( Table 1).**

**Table 1.** Incidence of some pathogenic bacteria in clinical samples.

| Micromicroorganisms | No.(%) | | | |
|---|---|---|---|---|
| | **Blood (n=54)** | **Urine (n=35)** | **Stool (n=35)** | **Total incidenc(observed growth) (n=124)** |
| *Salmonella typhi* | 31(57.4%) | 0(0%) | 2 (5.7%) | 33(26.6%) |
| *Salmonella paratyphi* | 13(24.1%) | 0(0%) | 0(0%) | 13(10.5%) |
| *Escherichia coli* | 0(0%) | 20(57.1%) | 14(40%) | 34(27.4%) |
| *Klebsiella pneumonia* | 7(13%) | 13(37.1%) | 2(5.7%) | 22(17.7%) |
| *Citrbacteir freundi* | 3(5.6%) | 0(0%) | 0(0%) | 3(2.4%) |
| *Enterobacter SPP.* | 0(0%) | 0(0%) | 2(5.7%) | 2(1.6%) |
| *Shigella  SPP.* | 0(0%) | 0(0%) | 11(31.4%) | 11(8.9%) |
| *Salmonella SPP..* | 0(0%) | 2(5.7%) | 4(11.4?%) | 6(4.8%) |

N: number of positive samples.

Susceptibility of bacterial isolates(percentage of isolates showing antibiotic resistance) from patients to antibiotics is shown in **Table (2)**. All 33 *Salmonella typhi* isolates showed high resistance (100%) to Lincomycin and Tetracycline whereas 29(87.5%) and 17(50%) were resistance to ,Rifampicin and Nalidixic acid, respectively. However, All 33 *S.typhi* isolates were susceptible (100%) to Amoxicillin, Doxycycline,Streptomycin and Gentamycin . Among 33 *S. typhi* only 24(72.7%) and 21(62.5%) were Intermediate resistance to Ciprofloxacin and Norfloxacin, respectively compared with 20(66.7%)and12(37.5%) were susceptible to Ampicillin and Nalidixic acid,  respectively .As shown in **Table (2).** all 13 *Salmonella paratyphi* isolates were resistance(100%) to Lincomycin and Tetracycline whereas 11(84.6%) and 10(76.9%) were resistance to Streptomycin and Nalidixic acid, respectively. All 13 *S. paratyphi* isolates were susceptible to Amoxicillin, Doxycycline (100%) and Gentamycin(84.6%). All 34 *Escherchia coli* isolates showed high resistance(100%) to Ampicillin,Erythromycin, Lincomycin, Amoxicillin and ,Rifampicin whereas 23 isolates (67.6%) were resistance to Ciprofloxacin, Tetracycline, Doxycycline and Streptomycin.

However, 20(58.8%) and 17(50%) isolates were resistance to Gentamycin and Nalidixic acid, respectively. As indicated in **Table (2)**. All, *22 Klebsiella pneumoniae* isolates showed high resistance rate (100%) to Erythromycin, Lincomycin ,Rifampicin and Streptomycin and 16(72.7%) to Amoxicillin and Ciprofloxacin. Also 14(63.6%),12(54.6%) and 11(50%) isolates were resistance to Tetracycline, Nalidixic acid and Doxycycline, respectively. In the current study 11 *Shigella SPP*. isolates showed high resistance (100%) to Erythromycin, Lincomycin, Rifampicin and Gentamycin whereas 10(90.9%),9(81.8%),8(72.7%) and 6(54.5%) isolates were resistance to Tetracycline, Ampicillin, Amoxicillin and Doxycycline, respectively. Among 11 *Shigella SP*. isolates only 8(72.7%) and ٧(63.6%) were  susceptible to Norfloxacin and Ciprofloxacin, respectively. All 6 nontyphoid *Salmonella Spp*. isolates showed resistance (100%) to Erythromycin, Lincomycin, Amoxicillin and Rifampicin whereas 4(66.7%) isolates were resistance to Ampicillin, Tetracycline, Streptomycin and  Gentamycin .While, 3(50%) isolates were resistance to Ciprofloxacin, Nalidixic acid, Doxycycline and Norfloxacin (**Table 2.**).

**Table 2.** Antibiotics sensitivity patterns of some pathogenic isolates from clinical samples.

| Organism | Susceptibility % | N% | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | AMP | E | L | AMC | CIP | TE | RIF | NA | DO | NX | S | GN |
| *Salmonella typhi* | Sensitive | 20(66.7% | 4(12.1%) | 0(0.0%) | 33(100%) | 9(27.3%) | 0(0.0%) | 0(0.0%) | 12(37.5%) | 33(100%) | 8(25%) | 33(100%) | 33(100%) |
| | Intermediate resistance | 13(33.3%) | 15(44%) | 0(0.0%) | 0(0.0%) | 24(72.7%) | 0(0.0%) | 4(12.5%) | 4(12.5%) | 0(0.0%) | 21(62.5%) | 0(0.0%) | 0(0.0%) |
| | Resistant | 0(0.0%) | 14(43.9%) | 33(100%) | 0(0.0%) | 0(0.0%) | 33(100%) | 29(87.5%) | 17(50%) | 0(0.0%) | 4(12.5%) | 0(0.0%) | 0(0.0%) |
| *Salmonella paratyphi* | Sensitive | 9(71.4%) | 0(0.0%) | 0(0.0%) | 13(100%) | 2(15.4%) | 0(0.0%) | 0(0.0%) | 3(23.1%) | 13(100%) | 4(30.8%) | 0(0.0%) | 11(84.6%) |
| | Intermediate resistance | 4(28.6%) | 6(46.2%) | 0(0.0%) | 0(0.0%) | 9(69.2%) | 0(0.0%) | 5(38.5%) | 0(0.0%) | 0(0.0%) | 7(53.9%) | 2(15.4%) | 2(15.4%) |
| | Resistant | 0(0.0%) | 7(53.9%) | 13(100%) | 0(0.0%) | 2(15.4%) | 13(100%) | 8(61.5%) | 10(76.9%) | 0(0.0%) | 2(15.4%) | 11(84.6%) | 0(0.0%) |
| *Escherichia coli* | Sensitive | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 11(32.4%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 14(41.2%) |
| | Intermediate resistance | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 11(32.4%) | 0(0.0%) | 0(0.0%) | 17(50%) | 11(32.4%) | 23(67.6%) | 11(32.4%) | 0(0.0%) |
| | Resistant | 34(100%) | 34(100%) | 34(100%) | 34(100%) | 23(67.6%) | 23(67.7%) | 34(100%) | 17(50%) | 23(67.6%) | 11(32.4%) | 23(67.6%) | 20(58.8%) |
| *Klebsiella pneumoniae* | Sensitive | 6(27.3%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 7(31.8%) | 0(0.0%) | 4(18.2%) | 9(40.9%) | 6(27.3%) | 0(0.0%) | 19(86.4%) |
| | Intermediate resistance | 8(36.4%) | 0(0.0%) | 0(0.0%) | 6(27.3%) | 6(27.3%) | 1(4.6%) | 0(0.0%) | 6(27.3%) | 2(9.1%) | 16(72.7%) | 0(0.0%) | 0(0.0%) |
| | Resistant | 8(36.4%) | 22(100%) | 22(100%) | 16(72.7%) | 16(72.7%) | 14(63.6%) | 22(100%) | 12(54.6%) | 11(50%) | 0(0.0%) | 22(100%) | 3(13.6%) |
| *Shigella SPP.* | Sensitive | 0(0.0%) | 0(0.0%) | 0(0.0%) | 3(27.3%) | 7(63.6%) | 1(9.1%) | 0(0.0%) | 4(36.4%) | 4(36.4%) | 8(72.7%) | 0(0.0%) | 0(0.0%) |
| | Intermediate resistance | 2(18.2%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 4(36.4%) | 0(0.0%) | 0(0.0%) | 3(27.3%) | 1(9.1%) | 8(72.7%) | 8(72.7%) | 0(0.0%) |
| | Resistant | 9(81.8%) | 11(100%) | 11(100%) | 8(72.7%) | 0(0.0%) | 10(90.9%) | 11(100%) | 4(36.4%) | 6(54.5%) | 0(0.0%) | 8(72.7%) | 11(100%) |
| *Salmonella SPP.* | Sensitive | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 2(33.3%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 2(33.3%) | 2(33.3%) |
| | Intermediate resistance | 2(33.3%) | 0(0.0%) | 0(0.0%) | 0(0.0%) | 3(50%) | 0(0.0%) | 0(0.0%) | 3(50%) | 3(50%) | 3(50%) | 0(0.0%) | 0(0.0%) |
| | Resistant | 4(66.7%) | 6(100%) | 6(100%) | 6(100%) | 3(50%) | 4(66.7%) | 6(100%) | 3(50%) | 3(50%) | 3(50%) | 4(66.7%) | 4(66.7%) |

AMP = Ampicillin, E = Erythromycin, L = Lincomycin, AMC=Amoxicillin, CIP= Ciprofloxacin , TE=Tetracycline, RIF=Rifampicin, NA = Nalidixic acid, Do= Doxycycline, NX = Norfloxacin, S = Streptomycin GN = Gentamicin.

## DISCUSSION

Antimicrobial chemotherapy has conferred huge benefits to human health as a variety of micromicroorganisms that were elucidated to cause infectious diseases are controlled by the proper use of antibiotics. In the 20th century the discovery of antibiotic was viewed that all infectious disease will be conquered in the near future (Power,2004). However, in response to the development of antimicrobial agents, micromicroorganisms, that have acquired resistance to drugs through a variety of mechanisms have emerged and continue to plague human beings. The primary factor responsible for the development and spread of bacterial resistance is the injudicious use of antimicrobial agents(Urassa et.al.,1997).In Yemen, infectious diseases caused by drug resistant bacteria are one of the most important problems in daily clinical practices as observed in the present study. The data generally reflect the seriousness of the antimicrobial resistance among bacterial pathogens in Yemen. Our findings showed that out of 124 bacteria isolated, *E. coli* (34) and *Salmonella typhi* (33)) are the most frequently isolated organism, followed by *Klebsiella pneumoniae* (22), *Salmonella paratyphi* (13), *Shigella Sp.*(11) and non-typhoid *Salmonella Sp.*(6). *Salmonella typhi* was the commonest Gram-negative microorganisms from blood while *E. coli* and *Klebsiella pneumoniae* were the most commonest bacteria from urine also *E. coli* and *Shigella Sp.* were the most commonest bacteria from stool. This finding is in line with the work of Iffat *et al.*, 2011; he showed that *E. coli* was the most frequently isolated organism from urine sample.

All the isolates displayed variable resistance and sensitivity to the antibiotics tested as detailed as shown in **Table 2**. Strains of *Salmonella typhi* showed high resistance rate to Lincomycin,Tetracycline, Rifampicin and Nalidixic, Ciprofloxacin and Norfloxacin but were susceptible to Amoxicillin, Doxycycline,Streptomycin and Gentamycin as shown in **table 2**. Obtained results showed that *Salmonella paratyphi* isolates were resistance (100%) to Lincomycin and Tetracycline whereas 11(84.6%) and 10(76.9%) were resistance to Streptomycin and Nalidixic acid but were susceptible to Amoxicillin, Doxycycline and Gentamycin. A study conducted by Krishnan *et al* 2009. reported that among 359 isolates, the resistance was found against Ampicillin (100%), Ciprofloxacin (0.27%),Nalidixic acid (100%),and Erythromycin (17.82%) .Notable results were found with Gentamycin, since no resistance was observed . Krishnan *et al.,* (2009) also observed that 70 and 30% of the isolates were *Salmonella* enterica serovar *typhi* and *paratyphi*, respectively among which highly sensitive to Ampicillin(84%) this findings can be correlated with ours but not exactly. The obtained results also correspond and differ with other studies carried out by other researchers (Bhan *et.al.*,2005,

Lovely *et.al.*,2012, Stella *et.al.*,2011,Wain *et.al.,*1998). The current study showed a high Ampicillin,Erythromycin, Lincomycin, Amoxicillin , Rifampicin, Ciprofloxacin, Tetracycline, Doxycycline, Streptomycin, Nalidixic acid and Gentamycin resistance especially among *E. coli and Klebsiella pneumoniae* except for *Klebsiella pneumoniae* that is susceptible to Gentamycin. Similar findings regarding drug resistance patterns of *Klebsiella pneumoniae* and *E. coli* have been reported by other researchers (Atif et.al.,2000, Al-nasrawi and Abu almaali.2009 , Almaziny, 2014, Iroha *et.al.*,2013, Eldaif *et.al.*,2015, Patrícia *et.al.*,2017)

Moreover, this study indicates that both *Shigella Spp.* and non-typhoid *Salmonella Spp.* were resistance to the most antibiotics tested. On the average this result shows that more than 50% of the microorganism is resistance to the antibiotics (Table 2.).This pattern is comparable to other studies carried out in some other parts of the world (Godwin *et.al.*,2006, Al-nasrawi and Abu almaali.2009 , Eldaif *et.al.*,2015 , Debas *et.al.*,2011).The overall prevalence of resistance of micromicroorganisms to antimicrobial agents was notably high in the current study, data reflecting the high level of antibiotic resistance in the country as a whole, when compared to other countries. The variation in the sensitivity pattern and high resistant rate to these commonly used drugs could be attributed to the prevailing usage and abuse, and the common attitude of over-the-counter purchase of the drugs in the areas under study. This further suggests a relationship between antibiotic usage and the level of drug resistance encountered in this study. Selection for drug resistance has been associated with an increased and inappropriate use of antibiotics( Ayliffe,1970). There is an inordinate and irrational use of antimicrobial agents in Yemen and in other developing countries. Multiple factors have led to the prevalence of antibiotic resistance:

1) the wide use of antibiotics due to the high prevalence of infectious diseases, 2) a shortage of physicians,3) selective prescribing due to cost constraints and the pressure of pharmaceutical companies' promotional activities, 4) lack of laboratory support in rural areas, and 5) the difficulties in distributing information regarding antibiotic resistance. An important contributing factor is the deliberate self-administration of antibiotics by patients themselves when they are ill with diarrheal diseases( Kunin *et.al.*,1987) .Our findings stress the need for distributing reliable information about antibiotic resistance and for ongoing drug-resistance surveillance. Knowledge of drug resistance in bacteria is indispensable for the proper selection of antimicrobial drugs. Yemen, a poor and underdeveloped country, allots a substantial amount of its health-expenditure allocation to the purchase of drugs, especially antibiotics. Resistance studies assist health authorities in the formulation of their own drug policies. They are also important for the general

practitioner in a remote area who may not have access to microbiology laboratory back-up and hence must depend on the prevailing knowledge of antibiotic-resistant bacteria. Numerous health organizations world-wide donate large amounts of antibiotics to developing countries like the Yemen to treat diarrhea and other diseases at the community level. The composition of such donations should be based on current knowledge of the common local pathogenic bacteria and their susceptibility patterns.

**Conclusion**

High rates of drug resistance were found in most of the isolates studied. In developing countries like Yemen, self-medication is a common practice and this might probably be a major cause of antibiotic resistance in clinical isolates since patients only think of going to the hospitals when they are unable to treat themselves. Inappropriate practices like misuse and abuse of antibiotics and unskilled practitioners can also lead to emergence of resistance in bacteria. Expired antibiotics, self-medication, counterfeit drugs, inadequate hospital control measures can as well promote the development of resistance in clinical isolates. Determining the antimicrobial patterns of the disease causing microorganisms will enable health institutions to restrict the use of antimicrobials and take active measures in preventing the spread of drug resistance in hospitals. However, the insight into the antibiotic susceptibility of clinical isolates profile in any community is very imperative and desirable for effective management of the clinical conditions considering the relative differences in the pattern of susceptibility and resistance of so many pathogens to antibiotics from one locality to another Therefore, it is important for hospitals to improve the processes of care known to impact infection rates. However, the judicious use of antibiotics by health workers and efforts to control procurement and use of antibiotics officially in all localities in Yemen will probably help to limit the increasing rates of multi-drug resistance in pathogens.

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