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Prevalence and Antimicrobial Resistance in *Salmonella* and *Shigella* Species Isolated from out Patients, Jimma University Specialized Hospital, Southwest Ethiopia

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Abstract: Food borne diseases due to unhygienic food handling practices remain a major public health concern across the globe. The problem is severe in developing countries due to limitations in securing optimal hygienic food handling practices. Thus, this study was designed to investigate the prevalence of *Salmonella* and *Shigella* among out-patients in Jimma University Specialized Hospital. Cross-sectional study was conducted involving a total of 176 out patients. Stool specimens from both adult and pediatric out-patients were collected, enriched over night in selenite F broth and then cultured onto xylose lysine deoxycholate (XLD) agar media. After 24hr of incubation, the plates were examined for the presence of presumptive *Salmonella* and *Shigella* colonies; and the pure cultures were further confirmed by biochemical tests. In addition, antibiotic resistance patterns to commonly used antibiotics and growth potential of the isolates in selected foods were assessed. The findings of the current study indicated that prevalence of *Salmonella* and *Shigella* were 19(10.8%) and 2(1.1%), respectively. *Salmonella* spp were resistant to ampicillin (100%) followed by tetracycline (47.4%) and nalidixic acid (26.3%). While *Shigella* spp were highly resistant to ampicillin and tetracycline (100%, each). Multidrug resistance towards maximum of four drugs was observed in both pathogens. In the challenge study, the pathogens grow to their infective dose within 24hr. This study indicated that *Salmonella* and *Shigella* are still a public health problems. Thus, it calls for frequent monitory and evaluation along designing of intervention strategies for at risk population besides awareness developmnet on water sanitation and hygienic food handling practice to minimize the burden posed by the diseases associated with Salmonellosis and Shigellosis.

Key words: Ethiopia · Growth potential · Jimma · Outpatient · *Salmonella* · *Shigella*

INTRODUCTION

Infections associated with *Salmonella* and *Shigella* are among the major global public health problems. More than one billion cases of diarrhea result worldwide due to nontyphoidal *Salmonella* every year leading to 3 million deaths [1]. Ninety-nine percent of the 200 million cases and more than 650,000 deaths per year due to infection with *Shigella* occur commonly in developing countries, primarily among children and young adults [2]. *Salmonella* and *Shigella* cause mild to severe forms of intestinal tract infection commonly associated with consumption of a variety of foods [3].

Salmonella is a leading cause of foodborne illness worldwide and can cause enterocolitis (salmonellosis), enteric fever (typhoid fever) and septicemia with general symptoms of fever, diarrhea, abdominal cramps, nausea, vomiting, chills and prostration. Usually the disease lasts a few days and is self-limited although occasionally the infection can be more serious, with loss of fluid and electrolytes and can be fatal, especially to the sick, infants and the elderly ([1, 2, 4].

Shigella species are limited to the intestinal tract of humans and cause bacillary dysentery leading to watery or bloody diarrhea. Humans appear to be the only normal host reservoir for *Shigella* and they become infected by ingestion of contaminated food and water [5]. It is a highly infectious disease worldwide and its prevalence is the highest in tropical and subtropical regions of the world where living standard is very low and access to safe and adequate drinking water supply and proper excreta disposal system are often very limited or even absent [2, 5].

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Ethiopia, as developing and tropical country, is frequently subjected to salmonellosis and shigellosis [6, 7]. There are several studies on prevalence of *Salmonella* or *Shigella* in Ethiopia, but restricted to health facilities in some age groups; mainly pediatric or adults [8-11]. To date, however, there was no report made on the prevalence of these pathogens in both children and adult out-patients. Thus, this study was designed to determine the prevalence of *Salmonella* and *Shigella* in representative Out-patients in Jimma University Specialized Hospital (JUSH) and to evaluate drug resistance patterns among the isoaltes.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted in Jimma town, located at 353 km southwest of Addis Ababa, the capital city of Ethiopia. The town's geographical locations at 7°41'N latitude, 36°50'E longitude and an average altitude of 1, 780 meter above sea level. The town is generally characterized by warm weather with mean annual maximum and minimum temperature of 30°C and 14 °C, respectively. The annual rainfall ranges between 1138-1690 millimeter. Annually, Jimma University Specialized Hospital provides services for about 9000 in patient and 80,000 out-patient, including clients of diverse socioeconomic and ethnic backgrounds; and bed capacity of 450 and a total of more than 550 staff members (www.. ju.edu.et/jimma-univesity-specialized-hospital-jush).

Study Design and Population: Cross sectional study design was employed involving out-patient of Jimma University Specialized Hospital. Diarrheal adult and pediatric Out-patients who fulfilled the inclusion criteria (any out-patients visiting the hospital during the study period and had diarrhea) were enrolled in the study. Those out-patients who had taken antibiotic a week prior to data collection time were excluded from the study. Accordingly, a total of 267 out patients who fulfilled the inclusion criteria were enrolled in the study.

Sample Collection and Microbial Analysis: One gram stool sample was collected from each patient using sterilie screw capped tubes containing transport media [9ml buffered peptone water (Oxoid, UK)] and transported to Jimma University, Research and Postgraduate Laboratory for microbial analysis. After 24 hrs incubation at 37°C, 1ml of the sample was transferred into 10ml selenite F broth (Oxoid, UK) and incubated. A loopful of culture was transferred onto xylose-lysine-desoxychocolate agar (XLD) (Oxoid, UK) and incubated. The typical colonies were then further characterized based on colony morphology (*Shigella* appears as pink to red colonies on XLD, while *Salmonella* appears as red with black center). the cell morphology of pure culture was assessed by Gram staining. The morphological study includes cell shape, cell arrangement, presence or absence of endospore and motility. The isolates Gram reaction was further confirmed with the rapid KOH method proposed by Gregerson. The isolates capability of catalase production, hence formation of bubbles, was checked using a 3% H_2O_2 solution.

For identification of *Shigella* and *Salmonella* spp., all suspected colonies were inoculated into appropriate biochemical media including Triple Sugar Iron Agar (TSIA), Lysine Iron Agar (LIA), Urea Agar (UA), Simmon's Citrate Agar (SCA) and Sulfide Indole Motility (SIM) medium.

Antimicrobial Sensitivity Test: Antimicrobial susceptibility of 19 *Salmonella* spp and 2 *Shigella* spp were carried out by disc diffusion method using Mueller-Hinton agar and nine commonly used commercial antibiotics. The standard antibiotic discs (and their potency) used in the current study included: Ampicillin (10 μgml^{-1}), Nalidixic Acid (30 μgml^{-1}), amikacin (30 μgml^{-1}), Tetracycline (30 μgml^{-1}), chloramphenicol (30 μgml^{-1}), Norfloxacin (10 μgml^{-1}), Gentamycin (10 μgml^{-1}), Ciprofloxacin (5 μgml^{-1}) and cotrimoxazole (25 μgml^{-1}). A reference strain of *E. Coli* ATCC 25922 was used as quality control.

A standardized suspension of the bacterial isolate was prepared and turbidity of the inoculum was matched with 0.5 McFarland turbidity standard. When culture containing the isolates matched with the standard which was kept dark at room temperature, the culture was swabbed by cotton swab onto the Muller-Hinton Agar (Oxoid) and allowed to dry. Thereafter, the antibiotic discs dispensed using sterile forceps on the medium and incubated at 37°C for 18 hrs and the zones of inhibition was measured. The results of the antimicrobial susceptibility were interpreted based on the guidance of National Committee for Clinical Laboratory Standards and the isolates were classified as sensitive, intermediate, or resistant. Intermediates were considered as resistant for purpose of analysis.

Growth potential of *Salmonella* and *Shigella* isolated from Diarrheal Out-Patients on Selected Food: Growth potential of *Salmonella* and *Shigella* isolated from diarrheal out-patients was assessed on two local food items (gruel, which is made from meat and firfir, made from cereal) frequently utilized by the community. Brifly, 200g of each food item was steamed at 100°C, for a minute. Thenafter, 100 g of each food item was challenged with overnight culture of the isolates to give an inoculum level of 10^2-10^3 cfu/g. The challenged foods were left at ambient temperature for 24 hours. To investigate the initial inoculum level, inoculated foods (10g each) were homogenised separately in 90ml of buffered peptone water; and 0.1 ml of appropriate dilutions were spread plated on XLD agar to count *Salmonella* and *Shigella*. Ten gram Portions of the food samples were further sampled aseptically at 6 hour intervals from 0-24 hours for microbial enumeration.

Statistical Analysis: Data was analyzed using SPSS soft ware version 16. All values were expressed as mean ± standard deviation and the mean values of counts of *Salmonella* and *Shigella* in the two food samples during challenge study were compared using one way ANOVA. The significance of differences was considered at 95% confidence interval ($p < 0.05$).

Ethical Consideration: The study was ethically approved by Ethical Review Board of College of Natural Sciences. Written consent/assent for children <18 years was obtained from guardians of the study participants prior to sample collection.

RESULTS

Socio-Demographic Characteristics of the Study Participants: A total of 176 diarrheal patients who were attending Outpatients department of Jimma University Specialized Hospital were involved in the study with 100% response rate. Among this, 19(10.8%) and 2(1.1%) were found positive for *Salmonella* and *Shigella* respectively. About 33 (18.8%) were in the age category of <4 years (Table 1). The proportions of female outpatients (52.3%) were higher than males (47.7%) of which 63.6% were urban residents.

Prevalence of Salmonella and Shigella: Frequency of isolation of *Salmonella* was the highest among the age group between 20-24 and 5-9 with 5 positive samples (2.8%) although none isolated from age group above 40 years (Table 2). Only two *Shigella* isolate (1.1%) were encountered among children <4 years. With the available few positive samples, the detection rate of Salmonella was relatively higher among male outpatient 10(5.7%), almost equal rate in rural and urban residents (5.7% and 5.1%, respectively) and unemployed outpatients (8%). The very low positive *Shigella* isolates (1.1%) were encountered among illiterate rural farmers families aged less than 4 years (Table 2).

Antimicrobial Susceptibility Pattern of Salmonella and Shigella spp: All the 19 isolates of *Salmonella* spp were susceptible to ciprofloxacin and norflaxacin followed by gentamycin (94.7%), chloramphenicol (94.7%) and amikacin (89.5%) (Table 3). However, the highest

Table 1: Socio-demographic characteristics of the study participants, Jimma University Specialized Hospital, 2014

Characteristics	Category	No Respondent	Percent (%)
Age	<10	54	30.7
	10-19	39	22.2
	20-29	34	19.3
	30-39	26	14.8
	>39	23	13.1
Education	Illiterate	52	29.6
	1-4	18	10.2
	5-8	21	11.9
	9-12	27	15.3
	>12	58	33.0
Sex	Male	84	47.7
	Female	92	52.3
Residence	Urban	112	63.6
	Rural	64	36.4
Occupation	Unemployed	96	54.5
	Business men	28	15.9
	Farmer	26	14.8
	Civil servant	26	14.8

Table 2: Prevalence of *Salmonella* and *Shigella* against socio-demographic characteristics of the study participants, Jimma University Specialized Hospital, 2014

Characteristics	Alternative	Frequency (%)	Salmonella positive No. (%)	Shigella positive No. (%)
Sex	Male	84(47.7)	10(5.7)	1 (0.6)
	Female	92(52.3)	9(5.1)	1 (0.6)
Residence	Urban	112(63.6)	9(5.1)	0(0.0)
	Rural	64(36.4)	10(5.7)	2(1.1)
	Total	176(100)	19(10.8)	2(1.1)
Age	<10	54	6 (3.4)	2 (0)
	19-Oct	39	3 (1.7)	0 (0)
	20-29	34	7 (3.9)	0(0)
	30-39	26	3 (1.7)	0(0)
	>39	23	0 (0)	0 (0)
	Total	176(100.0)	19(10.8)	2(1.1)
Educational	Illiterate	52(29.6)	7(4.0)	2(1.1)
	1-4	18(10.2)	2(1.1)	0(0.0)
	5-8	21(11.9)	5(2.8)	0(0.0)
	9-12	27(15.3)	1(0.6)	0(0.0)
	>12	58(33.0)	4(2.3)	0(0.0)
	Total	176(100.0)	19(10.8)	2(1.1)
Occupation	Unemployed	96(54.5)	14(8.0)	0(0.0)
	Business men	28(15.9)	3(1.7)	0(0.0)
	Farmer	26(14.8)	2(1.1)	2(1.1)
	Civil servant	26(14.8)	0(0.0)	0(0.0)
	Total	176(100)	19(10.8)	2(1.1)

Table 3: Antimicrobial susceptibility pattern of *Salmonella* and *Shigella* spp isolated from diarrheal Out-patients in Jimma University Specialized Hospital, Jan-Mar, 2014

	Salmonella spp.				*Shigella* spp.		
Antimicrobial agents	Disc potency (μgml^{-1})	Resistance No (%)	Intermediate No (%)	Sensitive No (%)	Resistance No	Intermediate No	Sensitive No
Amikacin	30	-	2(10.5)	17(89.5)	-	1	1
Ciprofloxacin	5	-	-	19(100)	-	-	2
Chloramphenicol	30	1(5.2)	-	18(94.7)	-	1	1
Gentamycin	10	1(5.2)	-	18(94.7)	-	-	2
Cotrimoxazole	25	1(5.2)	5(26.3)	13(68.4)	1	-	1
Norflaxacin	30	-	-	19(100)	-	-	2
Nalidixic acid	30	5(26.3)	4(21.05)	10(52.6)	1	-	1
Ampicillin	10	19(100)	-	-	2	-	-
Tetracycline	30	9(47.4)	3(15.7)	7(36.8)	2	-	-

frequency of resistance was observed for ampicillin (100%) followed by tetracycline (47.4%) and nalidixic acid (26.3%). Regarding *Shigella* spp, the two isolates were susceptible (100%) to ciprofloxacin, norflaxacin and gentamycin although resistance was observed for ampicillin and tetracycline (Table 3).

The MDR profile of *Salmonella* spp indicated that, 42.1% of the isolates were resistant to two antibiotics followed by three (26.3%) and four antibiotics (21.0%) (Table 4). The maximum number of antibiotics resisted by *Salmonella* spp, was four although the highest MDR (26.3%) was observed for combinations of two antibiotics:TE/AMP (resistance to tetracycline and ampicillin). Over all, two antibiotic resistance patterns dominated (42.1%) the multidrug resistance profile of *Salmonella* spp. The two Shigella isolates were resistant to four antibiotics with patterns of either TET/AMP/NAL/SXT or C/TET/AMP/AMK (Table 4).

Growth Potential of *Salmonella* and *Shigella*: Growth potential of *Salmonella* species was analyzed in gruel and firfir, traditional foods, over a period of 24hr.

Table 4: MDR of *Salmonella* spp. and *Shigella* spp isolated from diarrheal out-patients in Jimma University Specialized Hospital, Jan-Mar, 2014

No. of antimicrobial resistance	Salmonella spp.			Shigella spp.	
	Antimicrobial resistance patterns	No. of isolates (%)	Total (%)	Antimicrobial resistance patterns	No. of isolates
Two	TET/AMP	5(26,3)	8(42.1)	-	
	SXT/AMP	1(5.2)		-	
	NAL/AMP	2(10.52)		-	
Three	TET/NAL/AMP	2(10.52)	5(26.3)	-	
	SXT/AMP/TET	2(10.52)		-	
	NAL/SXT/AMP	1(5.2)		-	
Four	NAL/AMP/TET/SXT	1(5.2)	4(21.0)	TET/AMP/NAL/SXT	1
	NAL/TET/AMP/C	1(5.2)		C/TET/AMP/AMK	1
	AMP/SXT/CN/NAL	1(5.2)			
	AMK/AMP/NAL/TET	1(5.2)			

TET-tetracycline, AMP-ampicillin, SXT-cotrimoxazole, NAL-nalidixic acid, C-chloramphenicol, CN-gentamycin, AMK-amikacin, CIP-ciprofloxacin, NOR-norflaxacin.

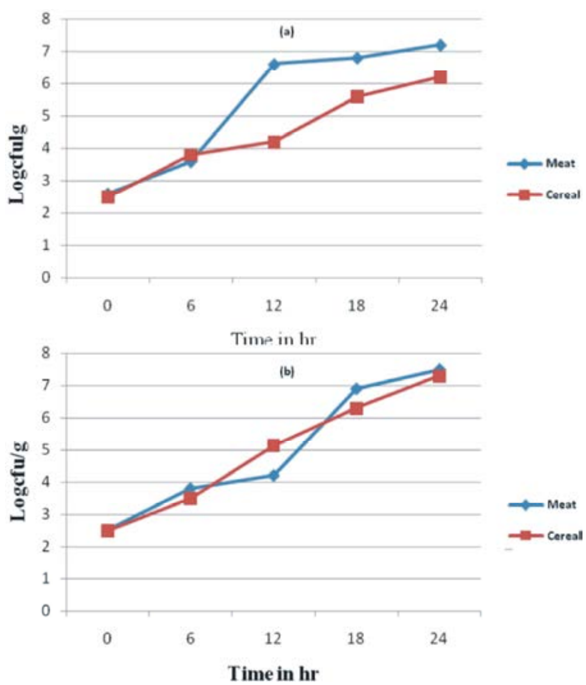

Fig. 1: The growth potential of species of *Salmonella* (a) and *Shigella* (b) isolated from diarrheal out-patients on meat and cereal products, Jimma University Specialized hospital, in selected foods, 2014

During the first 6hr, nearly similar growth was observed in both food items (Figure 1a). Then after, the growth rate was increased by 3 log cfu/g in gruel (3.6-6.6 log cfu/g) with relatively slow growth rate (3.8-4.2 log cfu/g) in firfir until 12hr. Finally, *Salmonella* count as high as 7.2 log cfu/g and 6.2 log cfu/g were observed in gruel and firfir, respectively, at the end of 24hr storage

Similarly, the growth potential of *Shigella* spp was assessed in the same food items (gruel and firfir) as that of *Salmonella*.The growth rate was higher in the gruel (2.51-3.8 logcfu/g) than in the firfir (2.5-3.5logcfu/g) in the first 6hr (Figure 1b). The growth rate increased by 1.5logcfu/g(3.5-5.14logcfu/g) in firfir within 12hrs and 3log cfu/g (3.8-6.9 logcfu/g) in gruel within 18hrs.The maximum growth of 7.5 log cfu/g (gruel) and 7.3 log cfu/g (firfir) were observed within 24hr (Figure 1b).

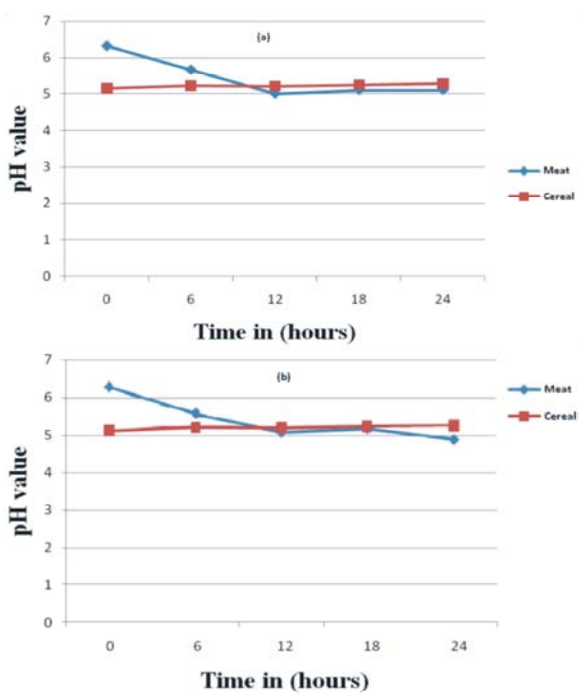

Figure 2-pH-values of meat and cereal products challenged with species of *Salmonella* (a) and *Shigella* (b) isolated from diarrheal out-patients, Jimma University Specialized Hospital, 2014.

pH values of the challenged food samples varied over the period of 24hrs of storage. At the beginning (0hr), the pH value of gruel (6.32) was greater than that of firfir (5.14).Then after, the pH value of gruel was reduced from 5.66 to 5.00 between 6 to 12hr where as that of firfir increase from 5.14 to 5.22. Finally it slightly rised up and reached 5.1 for gruel and 5.28 for firfir (Figure 2a). Likewise, in Shigella challenged foods, at 0 hr of inoculation the pH of gruel (6.32) was greater than the pH of firfir (5.14). Gradually a slight pH reduction was observed in gruel up to 24hr while the same for firfir with only minor fluctuation(5.23 to 5.22) between 6 and 12hr and slightly increase and reach to 5.28 at the end of 24hr (Figure 2b).

DISCUSSION

There are reports on widespread occurrence and distribution of *Salmonella* and *Shigella* in Ethiopia [8, 9, 11]. Recently, the number of *Salmonella* and *Shigella* related out breaks in humans has still increased considerably in the the same country [11]. Accurate estimates of the burden of diarrheal diseases caused by Salmonella species and other foodborne pathogens are needed to effectively set public health goals and allocate resources to reduce disease burden. A ccordingly, our finding indicated that, of the total 176 diarrheal Out-patients, 10.8% were positive for *Salmonella* and 1.1% were positive for *Shigella*. The prevalence rate of *Salmonella* in this study is agreement with the earlier studies reported as 10.7% (Andualem and Geyid, 2005), 11.5% [9], 13.6% and 10.5% [10, 11] but lower than a study reported as 15.4% and higher than the 7.2% prevalence report by Awole *et al*. [8].

In this study, the prevalence rate of *Shigella,* was much lower than what was reported by Ashenafi (9%) and Asrat *et al* (11.7%) from Tikur Anbessa, Ethio-Swedish Cchildren's hospital and a report by Reda *et al*. [9] (6.7%) from Harar, Ethiopia. The low isolation rate of *Shigella* in this study is comparable with the very recent report (2.3%) made from among diarrheal children in Jimma Health Center [10]. The low prevalence of the target pathogens, specially *Shigella,* in the current study could be attributed to improved awareness of the community about personal and environmental hygiene from the continuous interventions being made by different sakeholders including the Health Science students of Jimma University through the educational program called Community Based Education.

Several studies showed possible differences in the frequency of isolation of *Salmonella* and *Shigella* infection among different age groups [11]. Accordingly, the highest isolation rate of *Salmonella* was observed in the age group between 20-24 (26.3%) and 5-9 (26.3%) as supported by earlier reports made from Ethiopia by Mache and Mengistu *et al*. [11]. To the contrary, *Shigella* species were encountered only in the age group below five. This is in agreement with reports from different parts of the world including Ethiopia. Therefore, shigellosis occurs worldwide but is most common among pediatric age group in under developed tropical countries including Ethiopia. Community based data on shigellosis are incomplete but most hospital data suggested that the case-fatality rate is the highest among children less than 5 years particularly if there is malnutrition. In epidemic shigellosis, the rate is as high as 3.9% in children under age of 1 and 19.3% for infants less than 4 month of age.The case fatality declines with increase in age. Understanding the prevalence rate among different age groups is important to target intervention and preventive measures based on their age group.

In relation to educational status and frequency of isolation, this study indicated that there was high isolation rate of *Salmonella* and *Shigella* among the illiterate, with 36.8% and 100% isolation rates, respectively. This result is comparable with earlier study made by Aziz *et al*. Education is vital to create awareness in the community with regard to the mechanism of management of infectious diarrhea and control of other factors that leads to this disease. Poor environmental sanitation, malnutrition, inadequate water supply, poverty and limited education are the major factors implicated in the occurrence, spread and severity of diarrheal disease [12-21].

Due to selective pressure created by the use of antimicrobials in food processing animals, the risk of antimicrobial resistance among food borne pathogens has increased. Mobile elements such as plasmids and transposons facilitate the rapid spread of antibiotic resistant genes among bacteria. In addition, high rates of antibiotic resistance bacteria may possibly result from inappropriate or uncontrolled use of antibiotics. Therefore, it is necessary to pay attention to hygienic food hundling practice as well as avoiding uncontrolled use of antibiotics. An increase in the antimicrobial resistace in *Salmonella* and *Shigella* make the treatment of infection more challenging. Therefore, epidemiological information and monitory system are necessary to control *Salmonella* and *Shigella* infection in public health sectors.

In agreement with studies conducted by Beyene and Tasew [10], *Shigella* isolates were susceptible to ciprofloxacin, gentamicin and norflaxacin. The resistance of *Shigella* spp towards ampicillin and tetracycline is in agreement with studies conducted by Roma *et al.* who reported high rate of resistance of *Shigella* Spp to ampicillin (93%), erythromycin (90%), tetracycline (90%) and cotrimoxazole (56%). Asrat also reported high rate of resistance of *Shigellla* species to tetracycline (97.3%) and ampicillin (78.7%).

The high level of antibiotic susceptibility of *Salmonella* to ciprofloxacin and norflaxacin is in agreement with aralier studies reported from Ethiopia [10, 11]. The resistance of *Salmonella* towards ampicillin (100%) and Tetracycline (47.4%) was in agreement with report made by Beyene and Tasew [10] where most of the *Salmonella* isolates were resistant to ampicillin. In the current study, multidrug resistance towards four drugs was observed in *Salmonella* and *Shigella*.

The challenge studies revealed that *Salmonella* species reached to the infective dose (5logcfu/g) within 12 and 18hr in gruel and firfir, respectively. The maximum count obtained was 7.2 log cfu/g in gruel and 6.2 log cfu/g in firfir. As compared to the previous study [30], the maximum count obtained in this study was relatively smaller. The reason for this difference can be the acidic nature of the food and the nature of the ingredients from which the food was prepared. For the cause of typhoid an individual should have a minimum oral dose of 10^5 *S. typhimurium* where as at least 10^9 *S. typhimurium* cells are required to cause symptoms of toxic infection. It takes 12-24hr incubation after a person takes contaminated food containing sufficient number of *Salmonella* to manifest disease symptoms such as diarrhea, vomiting and fever. Likewise, *Shigella* species grow to the level of infective doses within 6 to 12hrs. The pathogen could initiate a successful infection at this cell number. The maximum growth observed in the current study was relatively lower as compared to studies reported by Muleta and Ashenafi. The reason for this discrepancy is the relatively acidic nature of gruel at the end of 24hr. Even though the gruel is relatively acidic, *Shigella* manage to grow to the maximum of >7logcfu/g with in 24hr period. This is because the pathogen can manage to grow in low pH food items. Since this food item is frequently utilized by babies, care should be taken when handling the food, extension of the food before use should also be avoided. The maximum growth of *Shigella* species in firfir was almost similar with a very minor increment in gruel. The growth of *Shigella* species in firfir was steady than in gruel. The pathogens reach to its infective dose within 6 to 12hrs. This is in agreement with studies reported by Muleta and Ashenafi.

CONCLUSION

Findings of the current study revealed higher prevalence (10.8%, N= 176) of *Salmonella* species, dominantly among outpatients aged less than five years. The prevalence of *Shigella* (1.1%) was in significant as compared to *Salmonella.* Furthermore, all *Salmonella* spp were resistant to ampicillin although morethan 90% of the isolates were susceptible to ciprofloxacin, norflaxacin, gentamycin and chloramphenicol. Besides other factors, the potential health risks of the observed prevalences of *Salmonella* and *Shigella* was revealed by luxurious growth of both pathogens in the commony used foods in the study area. This calls for designing of strategies for better awareness development among the community on hugienic food and water handling practices besides appropriate control measures. Thus, ressult of the present study will strengthen the knowledge in the field of epidemiology of *Salmonella* and *Shigella* to generate further trials which may help policy makers in planning interventions for the at risk population in the field of water sanitation and hygienic food handling practice. Furthermore, the observed drug resistance in *Salmonella* and *Shigella* can be used as an input by the health institutes for appropriate drug subscription.

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