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Microbiological assessment and safety of street vended vegetables sold in Mekelle City, Northern Ethiopia

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ABSTRACT

Street vegetables vending has been benefiting both consumers, who are the in low socio economic status, as well as vendors, by creating job opportunities. However, street vegetables are perceived to be a major public health risk due to contamination. The objective of this study was to evaluate the microbiological quality and safety of street vended vegetables in Mekelle city. The study involved collection of socio economic data using structured questionnaire and laboratory analysis for microbial quality and safety. A total of 172 vegetable samples were purchased from different sites and markets of Mekelle City and analyzed for their microbial load following standard microbiological methods, 4.5-6.4 log10 CFU g-1 of vegetable samples had aerobic mesophilic counts. Similarly, 4-4.8 log10 CFU g-1, 4-4.7 log10 CFU g-1and 2-2.8 log10CFU g-1of samples had, *Enterobacteriaceae, staphylococci* and yeast counts respectively. The aerobic mesophilic flora of the vegetable samples was dominated by Bacillus spp. (38%) followed by Enterobacteriaceae spp. (27.5%). *Salmonella* and *S. aureus* were isolated from 24 (13.6%) and 18 (9%) vegetable samples, respectively. Lettuce had high microbial load and Salmonella were most prevalent in Tomato but S. aureus were more prevalent in green pepper.

INTRODUCTION

Food wellbeing is a main community health worry globally. During the last decades, the increasing demand on food safety has inspired research concerning the threat related with consumption of food stuffs contaminated with pathogenic microorganism. A number of investigations have discovered that infectivity of vegetables with pathogens poses a threat in favor of patrons [1,2]. Vegetables are produced in significant quantities both in urban and Periurbanareas.

Vegetable is the tender plant part which is not sweet and may be flavored or spiced with condiments before utilization. Eating of or raw vegetables has been increasing tremendously due to their nutritive importance in human being dietary. Vegetables can be used as salad mixes, side dishes or ingredients in the serving of food. In general, as consumers continue to lead a healthy way of life, there are wide produce improvement probabilities in this branch. Currently, supermarkets and the food services outlets are the primary retail outlets for thisproducts[3].Thus despite their nutritional and safety pro, epidemic of human contagion linked with the consumption of fresh or minimally processed vegetables have increased in recent years[4].

Since vegetables are produced in a natural environment are contaminated by house made wastes,industrial wastes they are vulnerable to human being. Most of diseases associated with fresh vegetables are primarily those conveyed by the fecal oral route are a result of contamination at some point in the processes[5]. Vegetables could be contaminated with bacteria pathogens from human being or animal sources including *Salmonella, Shegella, Escherichia Coli0157:H7*, *listeriaMonocytogenes*, *Staphylococcus aureus* and *Campylobacter*, and resistance pathogens to different antimicrobials[6-8]. As the result, vegetables have been linked with occurrence of food borne illness in many countries.

Plate count of aerobic *mesophilic* microorganisms originate in foodstuff is one of the microbial sign for food quality[9]. These organisms replicate the experience of the sample to any pollution and in general, the existence of favorable conditions for multiplication of microbes. Food born bacterial pathogen commonly detected in fresh vegetables were coliform bacteria, *S. aureus*and *Salmonellaspp*[10]

Coliform are commonly used bacterial indicator of sanitary excellence of foods and water and regarded as sign of microbial pollution and there are common inhabitants of animal and human guts[11]. The existence of these bacteria poses a serious threat to public health Problems.

Ethiopia has greatly branch out agro-ecological zones which are favorable for production of various types of vegetables. Vegetables are mostly grown-up by conventional farmer's in house backyard. About 27% of the vegetable species recorded from home plot in Ethiopia were ate as raw or cooked[6]. Particularly, in the urban parts of the country eating of raw vegetables becomes more common. Vegetable farmers around Mekelle town supply vegetables to the local market but the market place of Mekelle town is not well organized. Vegetables are sold in front of shops besides in the midst of additional commodities and on roadside by avenue hawkers.

In addition, vegetables can be stored in poor quality containers and in house before put on the market for at least one day. This can boost possible infectivity of vegetables with animals and human's feces, soil, dirt and other postharvest pollutant. Practice of using untreated municipal wastewater for irrigation, raw manure as fertilizer and custom of consuming vegetables raw or undercooked are reported to effect in threat of contagion with intestinal parasites in rising nations. Infection with vegetable transmitted vermin and pathogenic bacteria can arise due to work-related contact or during consumption of vegetables which are infected with human or animal excreta devoid of appropriate cleanse and disinfection[4]. Insanitary dirt discarding and lack of its treatment facilities pose potential health hazards through polluting irrigated food crops with vermin in urban and periurban areas of Ethiopia.

Contamination of vegetables are a special concern because Several studies recognized occurrence of intestinal vermin in different parts of Ethiopia through microscopic inspection of stool samples collected from supposed human population particularly Tomato (*Solunumlycopersicum*) Cabbage (*Brassica oleracea l.)* Lettuce (*lactuca Sativa L.)* and green pepper (*Capsicum annum*) [12]

The municipal wastewater of Mekelle City flows through the main canal running from 'Kebelle 18' ('Hadinet') area at the south east of the city, to industrial zone area at its northern periphery and 'Mouha' soft drik (Personal observation during filed visit). 'Mariam Dahan' is located at about 3-4 km from the center towards Northern edge of Mekellecity.farmers living along the length of the wastewater drainage canal in Mekelle city and adjacent to 'Elala' stream in 'Mariam Dahan' and 'Aynalem' village cultivate vegetables for both household consumption and income generation. Therefore, the intention of this study was to investigate microbiological and safety of vegetable sold by street vendors associated with the use of municipal wastewater for irrigation and raw manure as fertilizer on pre-harvest vegetables in Mekelle city.

MATERIAL AND METHODS

Sampling techniques

A random sampling technique was used to address representative of the whole population. The sampling sites were '*Adi-haki'* ', *Yetebaberut*' , and '*Kedemay-weyane*' from the local markets and the samples were regularly collected at three week interval, and analyzed for aerobic mesophilic bacterial count, feacal count and total coliforms.As the study had survey and experimental parts, data was collected using structured questionnaires.

Collection of samples

A total of 172 fresh vegetable samples were purchased from three different sources at different sampling days from local markets namely 'Adihaki', supermarket, 'Kedemayweyane' and 17 kebelle markets of Mekelle City, Northern Ethiopia. The samples consisted of 18 each of tomato (*S.lycopersicum L.*), cabbage (*B.oleracea L.),* lettuce (*L.sativa L.*) and green peppers (*C.annum L.).* The samples were collected using sterile plastic bags aseptically and immediately brought to the Food Science and Post-Harvest Technology Laboratory, Mekelle University for analysis. Microbiological analysis was conducted within 3 hours of sample collection.

Sample and dilution preparation

For sample preparation 25g samples was aseptically removed from each sample, shred in to approximately 2-3 cm pieces using a sterile stainless steel knife and vigorously shaken in 225 ml of sterile 0.1% bacteriological buffer peptone water for 3 min separately to homogenize the sample. The sample was mashed by mortar and pestle, and placed in a test tube containing a peptone water to do the serial dilutions (10^{-1}-10^{-9}).

Preparation of media and isolation of microorganisms

Nutrient agar, MacConkey Agar, *Salmonella-Shigella* agar, Potato dextrose agar, Mannitol salt agar , Plate Count agar and Violet bile red agar were prepared according to Manufacturer's instruction and sterilized by autoclaving at 121°C for 15 min. *Salmonella-Shigella* agar, which does not require autoclaving, was sterilized by boiling for 15 min. MacConkey, *Salmonella-Shigella*agar, and Mannitol salt agar and Violet bile red agar were inoculated with 1 ml of the serial dilutions using the Pour Plate Technique. Potato dextrose agar and nutrient agar wereinoculated with 1 ml of the dilutions using spread plate technique. The plates were allowed to solidify, inverted and incubated at 37ºC for 24 h for colony formation.

Statistical Analysis

Coefficient of variance (% CV) was calculated and significance of variation in microbial counts within the vegetables samples was analyzed. Mean values of the microbial counts of vegetable samples from different sites and markets were compared using one way of ANOVA and the significance difference between groups were consider at 95% confidence interval ($p<0.05$). In addition, the data obtained from the respondents were analyzed by SAS software Version 9.1.

RESULT

Socio-Demographic Characteristics

A total of 100 farmers and vegetable sellers were interviewed to obtain data on the vegetable sources, transportation, method of cultivation and storage places. There is a significance difference among the respondents, Among100 (64.1%) (Table 1) were females. Forty six percent of the respondents were within an age 30 to 39 years. With respect the educational status, about 44%, 26.2, 16.3%, and 14.1% of the farmers or sellers attended elementary school, secondary school, reading and writing and illiterate respectively (Table 1). Occupationally the respondents (66%) were vegetable sellers and 34.9% were farmers (Table 1). No one of the farmers and vegetable sellers had taken professional training related to safe handling and methods of transportation of vegetables.

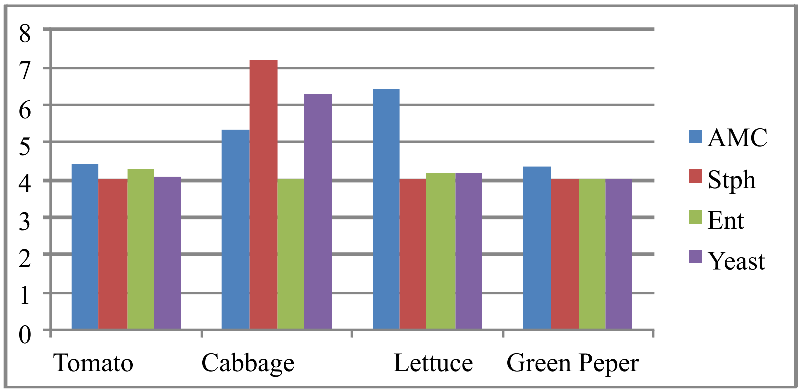

Figure 1 : Mean level of microbial count (log 10 $CFUg^{-1}$) some selected raw vegetables purchased from *KedemayWeyane Sit*, Mekelle City, Northern Ethiopia.

Figure1. AMC; Aerobic Mesophilic Count, Stph ; *Staphylococcus Count,* Ent; *Entrobacteriacea*

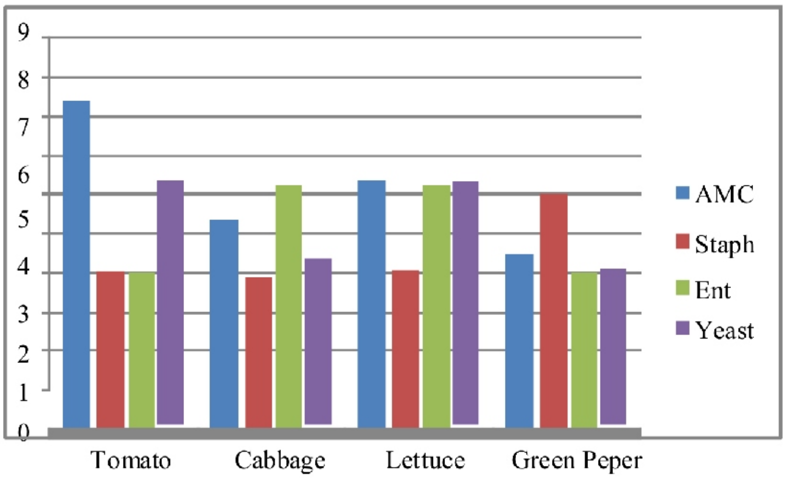

Figure 2 : Mean level of Microbial count (log10CFUg-1) some selected raw vegetables Purchased from *yetebaberutSite*, Mekelle City, Northern Ethiopia

Figure2. AMC; Aerobic Mesophilic Count, Stph ; Staphylococcus Count, Ent; Entrobacteriaceae

Table 3 : Socio Demographic characteristic of farmers and sellers in Mekelle City, Northern Ethiopia

Characteristics		Number of respondents(n=100)	
		Frequency	Percent (%)
Sex	Male	33	35.9%
	Female	59	64.1%
	20-29	24	26.1%
	30-39	43	46.7%
Age	40-49	15	16.3%
	>50	10	10.9%
Educational status	Illitrate	13	14.1%
	Read & write	15	16.3%
	Elementary school	40	43.5%
	Secondary school	24	26.1%
Occupation	Farmer	32	34.9%
	Vegetable sellers-	60	65.1%

Table 3 : Mean Microbiological count (log 10 cfug-1)of selected vegetables purchased from street vended markets from Mekelle City, Northern Ethiopia

Vegetables								
Microbial Group	Lettuce		Tomato		Green Pepper		Cabbage	
	Mean ±S.D		Mean ±S.D		Mean ±S.D		Mean ±S.D	
AMC	6.358±0.06		6.356±1.6		4.341±0.03		5.321±0.00631	
Staphyloccocci	4.062±0.107		4.100±0.0885		4.765±1.190		4.767±1.2	
Entrobacteriaceae	4.837±1.177		4.087±0.150		4±0		4.776±1.231	
Yeast Count	2.810±1.2		2.5±1.2		2.1±0.07		2.5±1.3	

AMC; Aerobic Mesophilic Count, S.D; Standard Deviation

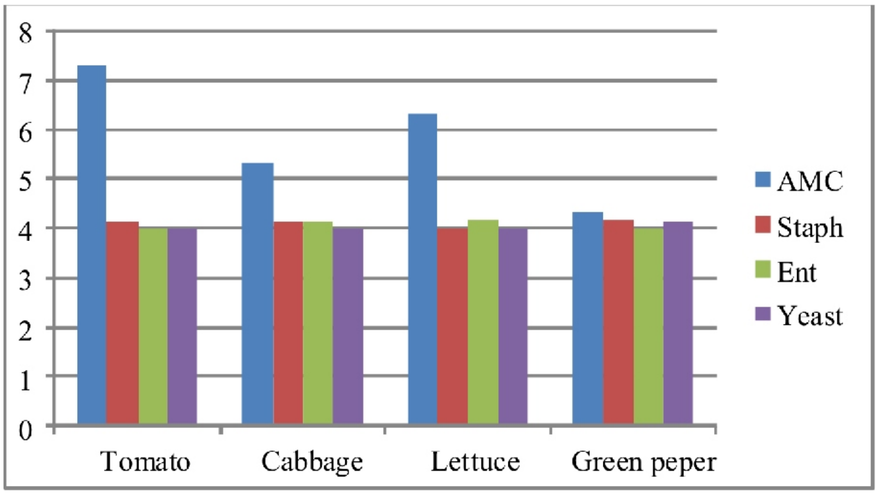

Figure 3 : Mean level of Microbial count Some selected raw vegetables Purchased from *Adi-haki* Site, Mekelle City, Northern Ethiopia

Figure 3. AMC; Aerobic Mesophilic Count, Stph; Staphylococcus Count, Ent; Entrobacteriaceae

General vegetables farm and management conditions

The general characteristics of farm and management conditions of vegetables sold in Mekelle city is summarized in (Table 2) .Vegetables sold in Mekelle city were 100% cultivated in traditional farming methods by rural farmers. About 66% of the farmers wereengaged in vegetable cultivation may be attributed to high demand of the products in the nearby markets.Farmers were useduntreated wastewater from city drainage canal and '*Elala*' stream in Mekelle city and '*Mariam Dahan'* village, respectively, using motor pumps; then the water is flooded through channels to the vegetables probably causing potential risk of attachment of parasitic contaminants on upper as well as to lower surfaces of the vegetables. In the study areas, about 7% of the farmers claimed to use untreated sewage as fertilizer; this has been substantiated by our personal observation of sanitary vehicles inundating sewage on vegetables based on farmers' request.

The vegetables farmers used different materials to harvest the produce including sack (58%) hand basket (42.4%) and plastic bags (26.1%). The harvested vegetables were stored at different places before selling. 63% of the vegetables were stored in store room However 37% of the respondents stored vegetables simply on the floor in the vegetable farms (Table 2).

Vegetables were transported from farm to market by different means of transportation. Donkeys were mostly used (80%), car (5%) and human back (15%). 74% of the respondents transported vegetables in sack container while 26.1% of the vegetable farmers and sellers used plastic bags. 75% of respondents were placed vegetables on the bed in front of the shop at free place for sell, 24% of vegetable sellers vended vegetables on street without using bed. However, only 1% of respondents used plastics to vend vegetables on floor. Vegetables were not availed to the consumers as soon as harvested .Therefore 37% of the sellers stored vegetables for up to three days. Whereas 34.8% stored for more than three days before sold to consumer. Over 58% of the respondents consumed without heat treatment. However, 13% consumed vegetables with and without heating (Table 2).

Microbial Count of Raw Vegetables

This study attempted to determine the percentage of vegetable contamination with aerobic mesophilic bacteria (AMB), Entrobacteriaceae ,staphyloccoci and Yeast count as well as their microbial loads through aerobic mesophilic bacteria counts (AMB), Entrobacteriaceae, staphyloccoci and yeast count. The microbial load of vegetable sampled in this study was varied with site, types and markets. The mean microbial count of selected vegetables sold at Mekelle City is shown in Table 3. Accordingly

Table 4 : Mean level of Microbial count(log 10 CFUg-1) of some selected raw vegetables Purchased from *'Kedamyweyane'* , *'Yetebaberut', Adi-Haki'*, Mekelle City, and Northern Ethiopia

Ven ding Site	Mean level of Microbial count(log 10 CFUg$^{-1)}$															
	Tomato				Cabbage				Lettuce				Green Pepper			
	AM C	Stp h	En t	Yea st	AM C	Stph	Ent	Yeast	AMC	Stph	Ent	Yeast	AMC	Stph	Ent	Yeast
'K W'	4.4	4	4.3	4.1	5.3	7.2	4	6.3	6.4	4.0	4.2	4.2	4.4	4	4	4
'YB	846	4.2	4	6.2	5.3	4	6.2	4.2	6.3	4.22	6.2	6.2	4.5	6.1	4	4
'AH	7.3	4.1	4	4	5.3	4.1	4.1	4	6.3	4	4.2	4	4.3	4.2	4	4.1

Table 5 : Dominant bacteria in some selected vegetables purchased from Vended Markets at Mekelle City, Northern Ethiopia.

Sample Type	Number of Isolates	Number of different bacterial isolate (%)			
		Entrobactereae	Staphylococcus	Proteus	Bacillus
Tomato	200	60(30)	40(20)	30(15)	70(35)
Cabbage	180	50(27.8)	30(16.7)	10(5.6)	90(50)
Lettuce	200	60(30)	40(20)	15(7.5)	85(42.5)
Green Pepper	250	55(22)	100(40)	20(8)	75(30)
Total	830				

high aerobic mesopholic count(6.4 log10 CFUg^{-1}), followed by Entrobacteriaceae (4.8 log10 CFUg^{-1}) and Staphyloccocci (4.7 log10 CFUg^{-1}) were the third Dominant microbial count but yeast were the least dominant microbial count (<2.8 log10 CFUg^{-1}). High aerobic Mesophilic count was recorded in Letuce (6.4 log10 CFUg^{-1}) while the minimum was in green pepper (4.341log10 CFUg^{-1}).

Aerobic mesophilic counts of vegetables analyzed in this study were detected in the range of 6.25 - 6.5, 5.25 -5.35, 4.25-7.35 and 4.25-4-35 log 10 CFU g -1 in letuce, cabbage, tomato and green pepper, respectively. Most of *staphylococci* counts were in the range of 4.0 7.0 log10 CFU g^{-1} . Similarly, a yeast count was in the range of 4 - 4.5 log10 CFU g^{-1}. However, these ranges were varied based on types of markets and sites from which vegetables were purchased. All vegetable samples purchased from 'KedemayWeyane' contained higher aerobic mesophilic bacterial count than other microbial groups (Figure 1).

Highest counts of Entrobacteriaceae were encountered in cabbage and Lettuce samples collected from '*Yetebaberut'* Venders (6.2 log) and lowest from Tomato and Green Peper samples purchased from '*Yetebaberut'* and '*Adi-Haki*' (4 log 10 CFUg^{-1}).

Microbial Analysis of Vegetables

Based on cultural, Morphological and biochemical characteristics of the organisms, a total of 830 bacterial isolated from 192 vegetable samples. A total of four bacterial genera were identified (Table 5). The number and type of microbial groups

Table 6 : Bacteria pathogens detected from raw vegetables, Mekelle City, Northern Ethiopia.

Sample Type	Sample Size(192)	Number of Salmonella positive samples (%)	Number of S.aureus positive sample (%)
Tomato	43	6(14)	3(0.7)
Lettuce	43	8(19)	4(9.3)
Cabbage	43	6(12)	5(12)
Green Peper	43	4(9.3)	6(14)
Total	192	24(13.6)	18(9)

isolated from the different vegetable samples were varied. *Bacillus spp* (50%) was the most frequently isolated group being present in all vegetable types sampled followed by *Entrobacteriaceae* and *staphylococcus spp*. (30%) & (20%) Proteus (15%) was the least isolated. The most dominant bacterial group isolated (table5) from Cabbage samples were bacillus spp. However, Tomato samples were dominated by *Bacillusspp* (30%) followed by Entrobacteriacea.

Frequency of Isolation of *SalmonellaSpp* and *S.aureusspp*

Among 192 samples analyzed 23 (12%) samples were positive for salmonella isolates (Table 6). With Regards to frequency Distribution in each vegetables type, Salmonella isolates were highly prevalent in lettuce (19%). The frequency distribution of *salmonella* in both tomato and Cabbage were 14(%) & (12%) respectively. However green pepper contained the least, salmonella were isolates (9.3%) as compare to Lettuce, Cabbage and Tomato (Table 6).

DISCUSSION

The current study revealed that the possible source of Pre and post- harvest contaminants of vegetables. Mekelle City, Farmers are cultivating vegetables. Following Traditional farming system. Farmers cultivate vegetables During Rainy season, Dry season and throughout the year. Most of the time, they used water from the river and wells as source of water for irrigation purpose. Therefore, river could be the main source for contamination of vegetables during pre-harvest in the field since it could contain sludge from different towns and villages[9]

Pathogens from irrigation water may survive in soil and contaminate vegetable which in turn be transported to consumers with possibility of causing diseases[13].Other possible source of contamination could be animal manure used by farmers to increase the fertility of farm land. In addition, harvesting equipments, storage place, mechanism of transportation to the market, placement in the market, and length of storage before selling could be the source of post- harvest contamination of vegetables.

Extremely high count of aerobic Mesophilic bacteria reflect exposure of the vegetables to contaminants with existence of favorable condition for multiplication of Microorganisms [10] This study showed that the counts of Aerobic Mesophilic bacteria ranged between 4.3 log 10 CFUg^{-1} (Green Pepper) to 6.4 log 10 CFUg^{-1} (Lettuce & Tomato). In agreement with this result[15], reported that the mean aerobic Mesophilic bacteria counts of(Tomato, Cabbage, Lettuce and green Pepper) were 5.3.0,5.7.0, 6.0, and 5.4.0 log 10 CFUg^{-1} Respectively.

In contrary to this, other researchers from the same country for instance[15], reported that AMC counts in various vegetables from the irrigated with Awash water river for lettuce and cabbage were in the range of 1.6-1.7 and 8.0-9.3.0 log 10 CFUg^{-1} respectively. In addition other researchers from different countries reported a varied load aerobic mesophilic counts in various vegetables. For instance[10]from Saudi Arabia reported that aerobic Mesophilic bacteria counts were between 3.3.-8.6 and respectively .More ever, 82% of whole vegetables investigated in Spain revealed aerobic mesophilic bacteria count <7log1ocfu/g [16]. In the present study 60% of aerobic Mesophilic bacteria count was <6 log 10 CFUg^{-1}.

The difference in the counts between this study and previous reports may probably be due to difference in cultivation areas of vegetables, seasonal and climatic variation and /or difference in the microbial quality of manure and irrigation water used hazard analysis and critical control point total management (HACCP-TAM) technical guide lines set the microbial quality standards for raw foods whereby the food containing <4.4.-6.6.,6.7-7.7 and >7.7 log1oCFU/g aerobic plate counts are rated as good ,average poor and spoiled ,respectively[9]. Based on these criteria 43% of each green pepper and Cabbages were regarded as good whereas, 65 and 3 % of lettuce and Tomato samples were rated as average and poor respectively .Thus, the consumption of street vended vegetables with any treatments could potentially leads to certain health problems.

The poor microbial quality lettuce and Tomato could be due to the use of animal manure and river water for irrigation. Lettuce is known to serve as a vehicle of food borne pathogens and toxins of which the principal source of contamination are the cultivation stages, processing and operation for preparation[15] .In agreement with these authors' findings, this study showed that all Lettuce samples collected from different sites and markets in Mekelle City had higher incidence of aerobic organisms than any other vegetables samples collected from the sample collection ($p<0.05$). According, the total aerobic bacterial count on lettuce and tomato ranged from 6.4 -7log 10 CFU/g as compared to Cabbage and Green Pepper. In contrary with[14]reported that AMC counts in Cabbage vegetable from the Irrigated with awash water river were 9.3log 10 CFUg^{-1}. This may be due to the use of animal manure and river water for irrigation.

Total coliform and *Entrobacteriaceae* can be considered as hygiene quality indicators especially for fecal contamination. Their presence could indicate the pathogens might be present due to fecal contamination of human and animal origin or irrigation water. In this study the counts of coliform in all vegetables sample ranged from 2.50 log10 CFUg^{-1} (Tomato) to 6.5 log 10 CFUg^{-1} (Lettuce). In agreement similar study was reported by[14]. In Contrary, the coliform counts of salad Vegetables in related study ranged from 4.3-4.9 log 10 CFUg^{-1}[17]in addition, report from Zambia found in coliform counts from vegetables products between 2.2-5.9 log 10 CFUg^{-1} and[10]from Turkey reported that average total coli form counts of vegetables were between 3.4-4.9 log lo MPN/g. However[9] obtained a range of total count of coliforms on vegetable sample from 3.0 to 6.9 log 10 CFUg^{-1}.In agreement with what was reported by[9], the coli form counts in the current study were less than 6.9 log 10 CFUg^{-1}.

In *Entrobacteriacea* related study were conducted at[14]at Jima town, Ethiopia had reported similar result for instance counts of *Entrobacteriaceae* at levels higher than 4 log 10 CFUg^{-1} and > 4.5 log 10 CFUg^{-1} in Lettuce and green pepper. Similar counts of *Entrobacteriaceae* were reported from vegetables examined in Morrocco. Out of 28 vegetables samples collected from Spain[4] found that 78.6% of the Samples had *Entrobacteriaceae* counts<5log log 10 CFUg^{-1}. In contrast to this 48% of *Entrobacteriaceae* counts in Cabbage Samples and other Vegetables in this study could be attributed to be poor hygiene of vegetables store room, Market Place, Transport containers, Irrigation and animal manure used by rural farmers to increase fertility of the farm land.

The contamination of Vegetables with high level of *Staphylococcus* may cause *Staphylococcus* food poisoning. It has been reported that production of enterotoxin occurs when the counts of *S,aureus* reach 6 log 10 CFUg^{-1}. In our study high staphylococcus count was frequently counted between 4-4.8 log

10 CFUg^{-1}in all vegetable samples analyzed. Accordingly, the Frequency of isolation of Staphylococcus in this study was 48 and 49% for Green Pepper and cabbage,respectively. In contrast this[18] reported over 80% of green pepper and Lettuce *staphylococcus* counts ranges between 4-6 log 10 CFUg^{-1}.The relatively low level of staphylococcus count in present study could be due to short period of storage of the vegetables before sell since vegetables were brought to the market from nearby farmers living around Mekelle City.

Similarly, the Yeast counts were between 2.1-2.8 log 10 CFUg^{-1}. Contrary to our observation[19] reported that a count of yeasts in tomato was below detectable level. The level of microbial contamination observed in vegetables of our study may be a reflection of poor storage conditions how long these produce were kept before they were collected. Bacteria on storage materials may transfer to and cross contamination between produce. Different bacteria were identified and number of bacteria isolated from each of the samples was varied. Some of the bacteria isolated in this study may be part of the natural flora of vegetables or contaminants from various sources. *Pseudomonas spp* and *bacillus spp* are part of natural flora are among the most common vegetables spoilage bacteria[10].

The microbial load of different vegetables was varied based on vegetable types, sites of samples collection and market place. It was observed that level of lab between different vegetables were similar (<p0.05). Although significance difference were observed between vegetables in other microbial counts (<p 0.05). Moreover, the high variability of all microbial groups within the samples of each vegetables showed that lack of uniformity in irrigation water , Storage Container and placement in the market before sell, Consistent sanitation Practices. Thus, there is an increased potential for vegetables to become contaminated with pathogenic species during production and processing as there was no system for control of microbial safety of Vegetables.

The presences of *S,aureus*and *Salmonella spp*. In vegetables are dangerous to consumers .Salmonella spp. was isolated from higher number of Lettuce than other vegetable samples. This may be due to having foliar surfaces with many folds and the fragility of leaves[9]. In other reports too *Salmonella spp* was isolated from vegetables particularly Lettuce samples contamination of vegetables with human pathogenic could occur during the growth of the produce using animal manure, Contaminated water or cross contamination during the cutting as the cut of vegetables can harbor and support the growth of food borne pathogenic due to nutrients leakage from plant cellular material[15].

Presence of Salmonella 25 gram of sample examined is regarded as potentially hazardous to consumers, and isunacceptable for consumption[20]. In addition *S. Aureus*was isolated from higher number of green pepper (13.9%). In similar study[14] from Nigeria were reported *S. aureus* was the most frequently isolated pathogens from vegetable samples *S.Aureus* is a dangerous pathogenic and one of the most causative agents of hospital infectious (nosocomial infection) in human beings. Surface of the Vegetables may be contaminated by this organism through human handling and other environmental factors and can be able to survive for several weeks. Thus, Contamination of vegetables during distribution and handling may allow bacterial growth and subsequently of toxins which may represent potential risk to human .Therefore, and use of the right types and concentrations of food grade chemicals for cleaning should be practiced to make the vegetables fit for consumption emergence of drug.

CONCLUSION

There was a lack of awareness on feasible sanitation methods to prevent food borne diseases associated with consumption of fresh vegetables. The possible source of contamination of vegetables could be irrigation water, animal manure used as fertilizers and water used to wash vegetables as most sellers wash or refresh different vegetables before selling them with the same water again and again. All samples analyzed in this study were contaminated with high microbial load. The highest microbial load was recorded in Cabbage followed by Lettuce and Tomato which could be attributed to various preharvest and post- harvest sources of contamination. However, there was significant difference in microbial load between vegetable samples

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