

Contamination rate of commonly consumed fresh vegetables and fruits with parasites of medically importance in Wolkite and Butajira Towns of Gurage Zone, Southern Ethiopia

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ABSTRACT

Intestinal parasitic infections are among the most common on causes of disease in humans, responsible for considerable morbidity and mortality. Commonly consumed raw vegetables and fruits are among the ways through which humans become infected with parasites of medical importance. A prospective cross-sectional study with an aim of describing the parasite contamination rate of raw fresh vegetables and fruits sold at the central open-aired market of Butajira and Wolkite towns, in southern Ethiopia was conducted on a total of 270 fresh vegetable and fruits samples. Standardized parasitological techniques were employed to detect diagnostic stages of parasites. 98 out of the 270 (36.3%) samples were found positive for intestinal parasites. Remarkably, twenty eight out of the forty five cabbage samples analyzed, 62.2%, were found to be contaminated with parasites of medical importance, registering the highest level of contamination. On the contrary Avocado was found to be the least contaminated produce with contamination rate of 17.7% (8/45). Significant association was observed between the kind of vegetables analyzed and existence of parasites ($p=0.002$). This study identified high rate of contamination in commonly consumed vegetables and fruits. The authors believe that the role fruits and vegetables paly in the transmission of intestinal parasitic infections to humans is un questionable. Substantial attention is needed from all relevant bodies to tackle this problem.

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1. INTRODUCTION

Soil transmitted helminthic and protozoan infections represents a large and serious public health problem in poor countries. It is estimated that around 3.5 billion people are affected worldwide [1]. Studies show that Infections with medically intestinal helminths and protozoans are closely linked with conditions of poverty, unsafe water, crowded living conditions, lack of sanitation and hygiene [2, 3]. Food borne diseases are a major cause of morbidity and continue to be a common and serious threat to public

health all over the world; as fresh vegetables are eaten raw or lightly cooked to preserve the taste and their nutrient content, this act as a potential source of various foodborne infections and disease outbreaks [4].

Findings from Studies conducted in Egypt; Libya; Saudi Arabia; Iraq, Iran, the Philippines, and Ethiopia have stressed that fruits and vegetables, particularly which are consumed raw and unwashed, play a significant role in the transmission of medically important parasites [5-14]. Globally, Outbreaks resulting from consumption of raw vegetables contaminated with parasites have been reported from both rich and poor countries [15-17]. Poor hygienic practices related to planting, harvesting, packing, transportation, and storage, fruits and vegetables can expose vegetables and fruits to be contaminated with parasites of clinical significance [14].

In spite of the fact that there exists an increased advocate for the consumptions of fresh fruits and vegetables worldwide, it is greatly threatened by an upsurge of parasitic contamination. Despite a marked improvement in sanitation, Ethiopians still suffer from poor sanitation and low standard living conditions which exposes them to an increased risk of acquiring parasitic infections. To the best of our knowledge, there is no published document about the level of parasitological contamination of fruits and vegetables in our study area. Therefore, this study was designed to determine the level of parasitic contamination of selected fruits and vegetables and associated factors in this location.

2. RESEARCH METHOD

2.1. Study area

Gurage Zone is one of the administrative zones of Ethiopia which is found in Southern Nations, Nationalities, and Peoples' Region. Wolkite, with a total population of 28,866.00 is currently the administrative city of the Zone. Geographically the town lies 1910 and 1935 meters above sea level. Whereas, Butajira, with a total population of 33,406, is the largest city in this zone and the former administrative center. The town lies 2131 meters above sea level.

2.2. Sample collection and analysis

The are 270 vegetable samples of 6 different types, 45 each, such as carrot, cabbage, lettuce, tomato, green pepper and avocado were collected from central markets of the two towns. Each vegetable sample was chopped into pieces and weighted to 200 grams. Chopped samples were washed in separate beakers in 500 mL of normal saline for detaching any parasitic stages. After the washing solution was left to stand for twelve hours, 15 mL of the sediment was transferred to a centrifuge tube, so as to remove undesirable matters. Finally, the tube was centrifuged at 3000 rpm for five minutes [18], the supernatant was decanted and the sediment was agitated and examined under a compound Olympus light microscope.

2.3. Data analysis

Data was analyzed by using SPSS software version 16 (IBM, Chicago, IL, USA). A P-value of equal to or less than 0.05 was considered statistically significant. The Pearson's Chi-square test (χ^2) was used for comparing rate of parasitic contamination among different categories.

2.4. Ethical issue

All who were present during the data collection period were briefed about the study objectives and samples were collected only from those who agreed to participate.

3. RESULTS AND DISCUSSION

Among 270 samples analyzed, 98 were found to be infested with at least one and at most seven different types of parasites Table 1; the total contamination rate was 36.3%. Helminthes such as *A. lumbricoides*, *Toxocara* spp., *Hymenolepis* spps, *I. belli*, and protozoans such as *G. intestinalis* and *E. histolytica/dispar* were the parasites detected Table 2. Greater than one parasite species were observed in all samples. Significant association was observed between the kind of vegetables analyzed and existence of parasites ($P = 0.002$) a shown in Table 3.

As much as microorganisms play important roles in the ecosystem, they also pose lots of threats to healthy living when they are found at the wrong place, above the required number, and their growth and movement are not controlled. As fresh vegetables are eaten raw or lightly cooked to preserve the taste and their nutrient content, this act as a potential source of various foodborne infections and disease outbreaks. The favorable climatic conditions and unsanitary practices that contribute to fecal pollution of water, foodstuffs, and soil has contributed to the wide distribution of intestinal parasites in Ethiopia, like many developing countries [3, 11]. The present study attempted to assess the level of contamination and prevalence

of different intestinal parasites in six different types of fruits and vegetables which are routinely consumed and sold in central markets of Butajira and Wolkite Town, Southern Ethiopia. When compared with studies from other parts of the country and elsewhere a slightly lower rate, 36.3%, of parasitic contamination of edible fruits and vegetables was found in our study areas [14, 15, 18-20].

Table 1. Prevalence rate of parasitic contamination in fruits and vegetables in Wolkite and Butajira Towns

Type of vegetable	Sample analyzed	Number positive [%]	Number of parasite species			
			One [%]	Two [%]	Three [%]	Four [%]
Avocado	45	8 [17.7]	6 [13.3]	1 [2.2]	1 [2.2]	0
Lettuce	45	18 [40.0]	15 [33.3]	2 [4.4]	1 [2.2]	0
Carrot	45	13 [28.9]	8 [17.7]	2 [4.4]	2 [4.4]	1 [2.2]
cabbage	45	28 [62.2]	24 [53.3]	2 [4.4]	1 [2.2]	1 [2.2]
Green pepper	45	16 [35.6]	13 [28.9]	1 [2.2]	1 [2.2]	1 [2.2]
Tomatoes	45	15 [33.3]	103 [35.6]	1 [2.2]	1 [2.2]	0
Total	270	98 [36.3]	169 [62.5]	9 [3.3]	7 [2.6]	3 [1.1]

Table 2. Frequency and prevalence of medically important intestinal parasites in fruits and vegetables Wolkite and Butajira Towns

Parasite species detected	Frequency	Prevalence
<i>Ascaris lumbricoides</i>	34	12.6%
<i>Toxocara</i> spp.	28	10.3%
<i>Hymenolepis nana</i>	30	11.1%
<i>Entamoeba histolytica/dispar</i>	24	8.84%
<i>Giardia intestinalis</i>	22	8.1%
<i>H. diminuta</i>	23	8.5%
<i>H. worm</i>	7	2.6%
Total sample (n=270)		

Table 3. Factors associated with parasitic contamination of fruits and vegetables Wolkite and Butajira Towns

Variable assessed	Result			
	Positive [%]	Total	X ² value	p-value
Vendors educational status				
Formal Education	35 [25.9]	135	17.6	0.003
Illiterate	80 [59.2]	135		
Total	115 [42.6]	270		
Type of produce				
Lettuce	18 [40.0]	45	10.2	0.002
Tomato	15 [33.4]	45		
Green pepper	16 [36.6]	45		
Cabbage	28 [62.2]	45		
Carrot	13 [28.9]	45		
Avocado	8 [17.7]	45		
Total	98 [36.3]	270		
Washed before display				
Yes	77 [67.0]	170	5.9	0.16
No	38 [33.0]	100		
Total	115 [46.2]	270		
Means of display				
On floor	77 [48.1]	160	2.9	0.7154
On table	38 [34.6]	110		
Total	115 [42.6]	270		

The difference in contamination rate which is observed between the present study and previous studies might be attributed to difference in geographical locations, variations in environmental conditions and socioeconomic status of the population. Owing to the difference in above mentioned factors it is expected that the results would differ. Additionally tradition of washing vegetables before display for selling which is observed in our study area might have contributed for a slightly low prevalence observed. Cabbage, lettuce and Green pepper were the most frequently contaminated produces observed in this study with a contamination rate of 62.2%, 40% and 36.6% respectively. With 17.7 % Avocado stands the least contaminated produce. Relatively larger and uneven surfaces, which are the feature of Cabbage and lettuce, might have facilitated the attachment of the parasites to them easily. On the contrary, the smooth surface of tomato might have contributed to lower rate of parasitic attachment there by explaining the relatively lower contamination rate observed in this study [5].

In the present study, *A. lumbricoides* was found to be the most frequent parasite detected with a prevalence rate of 12.6%. Previous studies done in southern Ethiopia, Philippines and Kenya [11, 20] also reported the predominance of the parasite. Universal distribution and the high number of eggs produced by parasite and the resistant nature of the eggs which enables it to survive unfavorable conditions might have contributed for the finding. It is known that the egg has the potential to survive in the absence of oxygen for two years at 5-10°C [21].

H. nana was the second most frequent parasite species observed in the present study with the prevalence of 11.1%. The high prevalence obtained in this study compared with that of study from Jimma (8.3%) and Banha, Egypt (2.8%) might be due to variation in climatic conditions, socioeconomic status and geographical location [18, 22]. With a prevalence of 10.3%, *Toxocara* was the third most frequently detected parasite in this study. The fertility of the female parasite and the nature of the eggs, which may survive for up to ten years resisting harsh environmental conditions might be the reason behind its high prevalence [23, 24]. In the present study it is observed that all kinds of fruits and vegetables included in the study were contaminated with multiple species of medically important parasites. This might indicate the persistence of intestinal parasitic infections in the area [13].

4. CONCLUSION

This study identified high rate of contamination in commonly consumed vegetables and fruits. The authors believe that the role fruits and vegetables play in the transmission of intestinal parasitic infections to humans is unquestionable. Substantial attention is needed from all relevant bodies to tackle this problem. Strategies to reduce the risk of acquiring intestinal parasitic infection from contaminated vegetables such as standard washing before eating raw vegetables are highly recommended.

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