ABSTRACT

This study aimed to investigate the effect of acetic acid 5% and potassium permanganate 24mg/L on the infective stages of intestinal parasites contaminating raw vegetables in Benha city: Giardia lamblia (G. lamblia), Entamoeba spp. cysts, Enterobius vermicularis (E. vermicularis), Hymenolepis nana (H. nana) and Hymenolepis diminuta (H. diminuta) eggs; beside its effect on raw green vegetables. Parasites, isolated from raw vegetables, were exposed to both acetic acid 5% and potassium permanganate 24mg/L for 20 and 30 minutes. Disinfection effects of the two disinfectants were evaluated by viability assay, using trypan blue stain, and morphological changes as indicated by light and Scanning Electron Microscopy (SEM). Results revealed statistically significant reductions in viability of all examined parasites when exposed to acetic acid 5% for 20 and 30 min., except E. vermicularis eggs as it showed insignificant reduction. Regarding the effect of potassium permanganate 24mg/L, there were statistically significant reductions in the viability of all parasites at 20 and 30 min. except G. lamblia had insignificant reduction at 20 min, this indicating susceptibility of some parasites to both disinfectants. Exposure of raw green vegetables (parsley, lettuce, leek, green onion and watercress) to both types of disinfectants for 20 and 30 minutes show normal taste, smell, and consistency with no color changes except slightly vinegar smell in case of acetic acid. In conclusion, acetic acid 5% and potassium permanganate 24mg/L can reduce viability of infective stages of some intestinal parasites and can be used in washing vegetables to control vegetable transmitted parasites.

INTRODUCTION

Intestinal parasites are widely prevalent in developing countries, probably due to poor sanitation and inadequate personal hygiene. Vegetables may act as passive vehicles for transmission of pathogenic parasites and protozoa which are primarily transmitted through the fecal-oral route (Ebrahimzadeh et al., 2013). High incidence of intestinal parasites has been found in communities that consume raw vegetables, especially where those vegetables are cultivated on farms fertilized with untreated human and animal fertilizers (Srikanth and Naik, 2004).
Isolation of intestinal parasites from different vegetables in many countries has been reported and human infection could be attributed to vegetable consumption (Kłapeć and Borecka, 2012, Ebrahimzadeh et al., 2013).

Vegetables may get exposed to parasite contaminants preharvest (cultivation, irrigation, livestock manure), postharvest handling, storage, transportation, or while processing for consumption (Erkan and Vural, 2008).

Disinfection, is applied to inactivate the microbial pathogens, such as bacteria, viruses, and parasites. Microorganisms, however, differ greatly in their sensitivity to disinfectants (Rice and Ewell 2001).

The helminth eggs have highly resistant biological structures. Their egg shell consists of a variable number of layers each providing mechanical resistance or protection from toxic compounds. They can remain viable for 1-2 months in crops and for many months in soil, fresh water, and sewage, making them the most resistant of all pathogen groups (Brownell and Nelson, 2006).

Protozoa often have an environmentally resistant stage (cysts) which survive over a wide range of pH values and are resistant to osmotic pressures (Smith, 1991).

Acetic acid is usually sold as concentrated acetic acid (95% acetic acid) which is corrosive to the skin and lungs, but the typical dilution (5%) is considered non-toxic and non-irritating. Acetic acid is typically applied by spraying or immersing an item in a diluted solution. Household vinegar is a 4-5% solution of acetic acid (Morley, 2002).

Acidic disinfectants function by destroying the bonds of nucleic acids and precipitating proteins. Acids also change the pH of the environment making it unsuitable to many microorganisms (Maris 1995).

Potassium permanganate (KMnO4) is a salt of potassium used for disinfecting and cleaning wounds and as a general skin antiseptic (Martin, 2003). Solutions of 1:1000 are used as wound and mouth lotions for antiseptic purposes. It is an effective algicide (0.01%) and virucide (1%) but concentrations > 1:10,000 tends to irritate tissues (Saganuwan et al., 2008).

Phospholipids within the cell membrane, containing unsaturated fatty acids, may be susceptible to KMnO4 oxidation, such reaction may induce loss in membrane function and cell death (Abuladze et al., 2009).

Our study aimed to determine the effect of disinfection on some intestinal parasites contaminate raw vegetables distributed in markets of Benha city, Qalubia Governorate, Egypt.

**MATERIALS AND METHODS**

**Isolation of different parasites contaminating vegetables:**

Our study was carried out at Parasitology Department, Faculty of Medicine Benha University, during the period from September 2012 to August 2013. Different parasitic stages were isolated from different raw vegetables from Benha markets, Qalubia Governorate, Egypt. Raw vegetable samples (parsley, lettuce, watercress, green onion and leek) were collected and each sample was weighted (200g) and washed in one liter of physio-
logical saline. The washing solutions were left for 10 hours for sedimentation to take place. The top layer were discarded and the remaining washing solution was filtered through a sieve to remove debris and then divided into clean centrifuge tubes and centrifuged at 2000 r.p.m for 15 min (Abougrain et al. 2009). The supernatant were examined by Zinc sulphate flotation technique and the sediment was mixed and examined by simple smear and Iodine stained smear (Garcia 2007).

**Disinfection Effectiveness of acetic acid 5% and potassium permanganate 24mg/L on the detected parasites:**

Positive samples for each individual parasitic infection were collected separately in one container with 15 ml physiological saline and stored at room temperature. So we have five suspension containers for the five positive parasites found, *Entamoeba* spp. cysts, *G. lamblia* cysts, *E. vermicularis* eggs, *H. nana* and *H. diminuta* eggs. Each parasite suspension was mixed well then divided into three equal parts in three tubes. Centrifugation at 1500 r.p.m for five minutes was done for all tubes.

For each parasitic three parts the following was done:-

- 5 ml of 5% acetic acid was added to sediment and supernatant of the first tube (disinfectant-treated parasites).
- 5 ml of 24mg/L potassium permanganate was added to sediment and supernatant of the second tube (disinfectant-treated parasites).
- 5 ml physiological saline was added to the sediment and supernatant of third tube (non-treated control).

After 20 minutes from exposure to disinfectant at room temperature, about 3 ml of the suspension from tube 1 and 2 (disinfectant-treated parasites) were taken in separate tubes, centrifuged at 1500 r.p.m for five minutes. parasites in the sediments and supernatant were washed twice in physiological saline by centrifugation and finally re-suspended in 5ml physiological saline. After 30 minutes from exposure to disinfectant at room temperature we repeat the previous procedure.

By the end of this step we have 5 suspensions for each positive parasite:-

Two treated with acetic acid 5% for 20&30 min., two treated with potassium permanganate 24mg/L for 20&30 min. and one control non-treated, to be examined for:

1. **Viability assay:** slides were prepared and stained by (0.2%) trypan blue (a vital stain) and examined for viability. Living parasites showed dye exclusion activity and appeared clear with light blue color, while dead parasites looked dark blue in colour and the internal structure could not be detected (El-Zawawy et al., 2010).

So, for each positive parasite:

1. Untreated control we examine various numbers of microscopic slides to reach certain total count of parasite eggs or cysts.
2. Other four (disinfectant-treated parasite suspensions) we examine variable number of microscopic slides until we reach the same total count.

Within this total count we calculate number of viable and number of dead parasites separately and the percentage reduction (%R) was calculated (Nada et
al., 2003) for each of the four suspensions as follows: Percent reduction of parasites viability (%R) = a – b/a x 100, where, a = is number of viable parasites in control tubes b = is number of viable parasites in tested tubes.

2. Morphological changes of different parasites induced by acetic acid 5% and potassium permanganate 24mg/L by using light and SEM:

Samples from the sediment and supernatant were examined by light microscopy (by wet and iodine stained smears) (40x and 100x). The ultrastructural changes were studied by scanning electron microscopy (SEM). For the SEM study, samples were fixed in 2% glutaldehyde (1 h at room temperature), post fixed in 2% osmium tetroxide (30 min in the dark), dehydrated in a series of graded alcohol baths, and then subjected to critical-point drying in CO2. Finally the samples were mounted on copper stubs, coated with gold-palladium at a thickness of 200Au, and examined for the change in morphology by scanning electron microscopy JXA-840A Electron Probe Microanalyzer- JEOL-Japan (Stadtländer., 2007)

Effect of disinfectant on physical properties of some raw vegetables:

Samples of parsley, lettuce, leek, green onion and watercress were used in this study, to show the effect of acetic acid 5% and potassium permanganate 24 mg/L on its physical properties. Samples were divided into four portions; the first and second portions were soaked in acetic acid solution 5% for 20 and 30 minutes respectively. While the third and fourth portions were soaked in potassium permanganate solution 24 mg/L for 20 and 30 minutes. After exposure to the disinfectant solutions, the vegetables were removed and washed several times with clean running water, then examined as regards; color, consistency, taste and smell.

Statistical Analysis:

Data were analyzed using Z-test, Chi-Square and FET (Fisher's exact test) by the computer program SPSS (Statistical Package for social science) version 16. A. P value < 0.05 was considered statistically significant (S) while P value > 0.05 statistically insignificant and P value < 0.01 was considered highly significant (HS) in all analyses.

RESULTS & DISCUSSION

Results of the present study demonstrated that acetic acid and potassium permanganate had statistically significant effect on the viability of the infective stages of some intestinal parasites (G. lamblia cysts, Entamoeba spp. cysts, E. vermicularis eggs, H. nana and H. diminuta eggs) that contaminates vegetables. Results were related to the exposure time as the % reduction of the viability 30 min. after exposure was higher than the % reduction 20 min. post exposure.

Variations in susceptibility were revealed; H. diminuta eggs were the most susceptible for acetic acid 5% as viability was (60.8% & 47.8%) at 20 & 30 min respectively, which was highly significant (P<0.001). With % reduction reached (%R1= 37.8% and R2=51.1%). Followed by H. nanna eggs as viability was (58.1% & 54.8%) at 20 & 30 min. respectively which was highly significant (P<0.001). With % reduction reached (%R1= 37.9% and R2=41.4%) (Table 1).
Table (1): Effect of acetic acid 5% on parasites viability after exposure for 20 and 30 minutes

<table>
<thead>
<tr>
<th>Parasites</th>
<th>Control</th>
<th>20 minutes exposure to acetic acid</th>
<th>30 minutes exposure to acetic acid</th>
<th>P value</th>
<th>%R1</th>
<th>%R2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Viable</td>
<td>Dead</td>
<td>Viable</td>
<td>Dead</td>
<td>Viable</td>
<td>Dead</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
<td>%</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td><em>Giardia lamblia</em> cysts</td>
<td>52</td>
<td>96.3</td>
<td>2</td>
<td>3.7</td>
<td>39</td>
<td>72.2</td>
</tr>
<tr>
<td><em>Entamoeba spp.</em> cysts</td>
<td>64</td>
<td>95.5</td>
<td>3</td>
<td>4.5</td>
<td>48</td>
<td>71.6</td>
</tr>
<tr>
<td><em>Eterobius vermicularis</em></td>
<td>37</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>34</td>
<td>91.9</td>
</tr>
<tr>
<td><em>Hymenolepis nana</em> eggs</td>
<td>29</td>
<td>93.5</td>
<td>2</td>
<td>6.5</td>
<td>18</td>
<td>58.1</td>
</tr>
<tr>
<td><em>Hymenolepis diminuta</em></td>
<td>45</td>
<td>97.8</td>
<td>1</td>
<td>2.2</td>
<td>28</td>
<td>60.8</td>
</tr>
</tbody>
</table>

R1: % reduction in viability of some parasites after 20 minutes.
R2: % reduction in viability of some parasites after 30 minutes. FET: Fisher's exact test
No: number of parasites. HS: Highly significant. NS: Not significant
Table (2): Effect of potassium permanganate 24mg/L (KMnO4) on parasites viability after exposure for 20 and 30 minutes.

<table>
<thead>
<tr>
<th>Parasites</th>
<th>Control</th>
<th>20 minutes exposure to KMnO4</th>
<th>30 minutes exposure to KMnO4</th>
<th>FET</th>
<th>P value</th>
<th>R1</th>
<th>FET</th>
<th>P value</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Viable</td>
<td>Dead</td>
<td>Viable</td>
<td>Dead</td>
<td>Viable</td>
<td>Dead</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giarda lamblia cysts</td>
<td>52</td>
<td>2</td>
<td>46</td>
<td>8</td>
<td>8</td>
<td>14.8</td>
<td>2.76</td>
<td>0.097</td>
<td>NS</td>
</tr>
<tr>
<td>Entamoeba spp. cysts</td>
<td>64</td>
<td>3</td>
<td>51</td>
<td>16</td>
<td>23.9</td>
<td>8.83</td>
<td>0.002</td>
<td>HS</td>
<td>20.3</td>
</tr>
<tr>
<td>Entrobias vermicularis eggs</td>
<td>37</td>
<td>100</td>
<td>30</td>
<td>7</td>
<td>18.9</td>
<td>5.68</td>
<td>0.017 S</td>
<td>18.9</td>
<td></td>
</tr>
<tr>
<td>Hymenolepsi nana eggs</td>
<td>29</td>
<td>2</td>
<td>21</td>
<td>10</td>
<td>32.3</td>
<td>5.063</td>
<td>0.024 S</td>
<td>27.6</td>
<td></td>
</tr>
<tr>
<td>Hymenolepsi diminuta eggs</td>
<td>45</td>
<td>1</td>
<td>25</td>
<td>21</td>
<td>45.7</td>
<td>21.57</td>
<td>0.001 HS</td>
<td>44.4</td>
<td></td>
</tr>
</tbody>
</table>

No: number of parasites. HS: Highly significant. S: significant. NS: Not significant. FET: Fisher's exact test). R1: % reduction in viability of some parasites after 20 minutes. R2: % reduction in viability of some parasites after 30 minutes.

Table (3): Percentage reduction in viability of some parasites after exposure to acetic acid 5% and potassium permanganate (KMnO4)24mg/L for 20 and 30 minutes.

<table>
<thead>
<tr>
<th>Test</th>
<th>Groups</th>
<th>Mean</th>
<th>± SD</th>
<th>Student t test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid 5%</td>
<td>R1</td>
<td>26.76</td>
<td>12.25</td>
<td>0.532</td>
<td>0.609 NS</td>
</tr>
<tr>
<td></td>
<td>R2</td>
<td>31.6</td>
<td>16.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium permanganate 24mg/L</td>
<td>R1</td>
<td>24.54</td>
<td>12.49</td>
<td>0.802</td>
<td>0.446 NS</td>
</tr>
<tr>
<td></td>
<td>R2</td>
<td>31.7</td>
<td>15.57</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R1: % reduction in viability of some parasites after 20 minutes. R2: % reduction in viability of some parasites after 30 minutes. NS: Not significant.
Fig. (1): Effects of disinfectants on viability of some detected parasites by trypan blue stain

A: Viable *G. lamblia* cyst as detected by trypan blue 0.2% vital stain showed dye exclusion activity and appeared clear with light blue color (X40). B: Dead *G. lamblia* cysts as detected by trypan blue 0.2% vital stain, dead *G. lamblia* cysts looked dark blue in color and the internal structure could not be detected (X40). C: Viable *Entamoeba* spp. cyst as detected by trypan blue 0.2% vital stain showed dye exclusion activity and appeared clear with light blue color (X100). D: Dead *Entamoeba* spp. cyst as detected by trypan blue 0.2% vital stain cysts looked dark blue in color and the internal structure could not be detected (X100). E: Viable *E. vermicularis* egg as detected by trypan blue 0.2% vital stain showed dye exclusion activity and appeared clear with light blue color (X100). F: Dead *E. vermicularis* egg as detected by trypan blue 0.2% vital stain looked dark blue in color and the internal structure could not be detected (X100). G: Viable *H. nana* egg as detected by trypan blue 0.2% vital stain showed dye exclusion activity and appeared clear with light blue color (X100). H: Dead *H. nana* egg as detected by trypan blue 0.2% vital stain looked dark blue in color and the internal structure could not be detected (X100). I: Viable *H. diminuta* egg as detected by trypan blue 0.2% vital stain showed dye exclusion activity and appeared clear with light blue color (X100). J: Dead *H. diminuta* egg as detected by trypan blue 0.2% vital stain looked dark blue in color and the internal structure could not be detected (X100).
Fig. (2): Morphological changes of the detected parasites due to the exposure to disinfection as examined by light microscope (by wet mount and iodine stained smears).

Fig. (2): A): Marked damage in the egg shell of *H. nana* eggs due to acetic acid 5% exposure for 30 minutes (X40) (by wet mount). B): Irregularities of the egg shell of *H. nana* eggs due to potassium permanganate 24mg/L exposure for 30 minutes (X100) (by wet mount and iodine stained). C): marked damage in the egg shell of *H. diminuta* eggs due to acetic acid 5% exposure for 30 minutes (X40) (by wet mount and iodine stained). D): Irregularities and deformity of the egg shell of *H. diminuta* eggs due to potassium permanganate 24mg/L exposure for 30 minutes (X100) (by wet mount and iodine stained). E): No marked changes of the egg shell of *E. vermicularis* egg after exposure to acetic acid 5% (iodine stained) (X100). F): Deformity of the egg shell of *E. vermicularis* egg after exposure to potassium permanganate 24mg/L (by wet mount) (X100). G): Shrinkage and deformity of the cyst wall of *G. lamblia* cyst due to exposure to acetic acid 5% for 30 minutes (iodine stained) (X100). H): Shrinkage and deformity of the cyst wall of *G. lamblia* cyst due to exposure to potassium permanganate 24mg/L (iodine stained) (X100). I): Dipping of the cyst wall of *Entamoeba* spp. cyst due to exposure to acetic acid 5% for 30 minutes (by iodine stained) (X100). J): Shrinkage of the cyst wall of *Entamoeba* spp. cyst after exposure to potassium permanganate 24mg/L (by iodine stained) (X100 and X40).
Fig.(3): Morphological changes of some detected parasites due to the exposure to disinfection as examined by Scanning Electron Microscopy.

Figure (3): A): *H. nana* egg (30 minutes after exposure to acetic acid 5%) showing rough surface with small protrusions (X1500).
B): *H. nana* egg (30 minutes after exposure to potassium permanganate 24mg/L) showing irregularities of the egg shell (X1500).
C): *E. vermicularis* egg (30 minutes after exposure to acetic acid 5%) showing a smooth surface and slightly swollen (X1500).
D): *Entamoeba* spp. cyst (30 minutes after exposure to acetic acid 5%) showing marked irregularities on the surface (X 10000).
E): *Entamoeba* spp. Cyst (30 minutes after exposure to potassium permanganate 24 mg/L) showing pitting of the surface and protrusions of the cyst wall (X 10000).

NB: During examination of *E. vermicularis* eggs (trated with potassium permanganate 24mg/L) the eggs could not withstand the beam of Scanning Electron Microscopy and ruptured. There was failure of neither capturing *Giardia* cysts nor *Hymenolepis diminuta* treated with acetic acid 5% or potassium permanganate 24mg/L under electron microscope.
The reduction in viability of *G. lamblia* was (72.2% & 66.7%) at 20 & 30 min respectively which was highly significant (P<0.001). With % reduction reached (% R1= 25% and R2= 30.8%). The reduction in viability of *Entamoeba* spp. cysts was (71.6% & 70.1%) at 20 & 30 min respectively which was highly significant (P<0.001), with % reduction reached (% R1= 25% and R2= 26.6%) while *E. vermicularis* eggs were the least susceptible as viability was (91.9%) at both times of exposure which was insignificant (P> 0.05) and the % reduction was (%R1= R2= 8.1%) (Table 1). (Fig. 1) show the effects of disinfectants on viability of some detected parasites by trypan blue stain.

There is no significant statistical difference between the two (%R1 and % R2) percentage reduction in viability of parasites due to acetic acid 5% exposure for 20 and 30 minutes (P value >0.05) (Table 3).

The inactivation of *G. lamblia* cysts by vinegar was investigated by Costa et al. (2009) and the relative viability, which was calculated in relation to controls (maximum excystation percentage), was significantly affected by the vinegar concentration, contact time, and temperature.

There was a previous study on giardiacidal activity of lemon juice, and vinegar on *G. lamblia* cysts which revealed that the mean giardiacidal activity at 4°C after 3 hours for lemon juice and vinegar was (18.9) and (28.4%), and at 24°C, (28.3%) and (40.6%), respectively. The giardiacidal activity of vinegar was more than the other materials, and as exposure time and temperature increased, giardiacidal activity also increased; the highest giardiacidal activity of vinegar was at 3-hours exposure at 24°C (Sadjjadi et al., 2006).

A previous study was done on *E. vermicularis* eggs and found that household vinegar will not completely destroy the eggs. It caused swelling of the outer shell layer of fully developed eggs, but the larvae in these eggs were still mobile after 48 hours. The inner shell membrane is thus impervious to acids (Oelkers, 1950).

The eggs of *Enterobius vermicularis* have five membranes: one inner, lipoidal layer, three middle layers known as membrana lucida, and one outer, albuminous membrane which coats the egg. This membrane makes the eggs sticky, which is important in the life cycle (Garcia and Bruckner., 1997). So this may lead to resistance of the eggs to disinfection.

After exposure to potassium permanganate 24 mg/L, variations in susceptibility were revealed; *H. diminuta* eggs were most susceptible as viability was (54.3% & 41.3%) after 20 & 30 min. exposure which was highly significant (P<0.001), with % reduction was (%R1= 44.4% and R2= 57.8%). Followed by *H. nana* eggs as viability was (67.7% and 61.3%) after 20 & 30 min. exposure, which was significant at 20 min (P value >0.05) and highly significant at 30 min. (P<0.001), with % reduction was (%R1= 27.6% and R2= 34.5%). The reduction in viability of *Entamoeba* spp. cysts was (76.1% & 73.1%) after 20 & 30 min. exposure which was highly significant (P<0.001), with % reduction was (%R1= 20.3% and R2= 23.4%). The reduction in viability of *E. vermicularis* eggs was significant at 20 min. as it was (81.1%) and highly significant at 30 min. as the
viability was (78.4%), with % reduction was (%R1= 18.9% and R2=21.6%). G. lambilia cysts were the least susceptible as viability was (85.2%) at 20 min. but it has no statistical significant (P> 0.05) and (75.9%) at 30 min. which was highly significant (P<0.001), % reduction reached (%R1= 11.5% and R2=21.2%) (Table 2), and Fig. (1) show the effects of disinfectants on viability of some detected parasites by trypan blue stain.

There is no significant statistical difference between the two (%R1 and % R2) percentage reduction in viability of some parasites due to potassium permanganate 24mg/L exposure for 20 and 30 minutes (P value >0.05) (Table 3).

There was a previous study on the role of acids detergents and potassium permanganate in clearing salads from metacercariae of Fasciola and results revealed that that washing in running water for 10 minutes detached only 50% of the metacercariae. Citric acid in the concentration of (10 ml/L) commercial vinegar (120 ml/L), liquid soap (12 ml/L) and KMnO4 (24 mg/L) detached all metacercariae after 10 minutes exposure (El-Sayad et al., 1997).

The eggs of H. nana have an oncosphere covered by three basic layers which form the egg shell: the capsule, the outer envelope and the inner envelope. Helminthes eggs are very resistant to chemicals such as nitric acid, acetic acid and formaldehyde, and they can remain viable for months (Marquesz-Navarro et al., 2009).

The difference of the results of many studies on the disinfectants is due to the principal factors that influence disinfection efficiency which includes disinfectant concentration, contact time, temperature and pH (WHO, 2004).

Effects of acetic acid 5% and potassium permanganate 24mg/L on the parasites showed some morphological changes that have been observed by light microscope and Scanning Electron Microscopy. Light microscope showed deformity, marked damage of the eggs shell and shrinkage of the cysts wall (Fig. 2).

By scanning electron microscopy eggs of H.nana 30 minutes after treatment with acetic acid 5%, had rough surface with small protrusions and those treated with potassium permanganate 24mg/L for 30 minutes had irregularities of the egg shell. E. vermicularis eggs treated with acetic acid 5% for 30 minutes had a smooth surface and were slightly swollen. During examination of E. vermicularis eggs (treated with potassium permanganate 24mg/L) the eggs could not withstand the beam of SEM and ruptured. (Fig. 3).

Cysts of Entamoeba spp. treated with acetic acid 5% for 30 minutes had marked irregularities on the surface. Cysts of Entamoeba spp. after exposure to potassium permanganate 24mg/L for 30 minutes have multiple pits on the surface and protrusions of the cyst wall. (Fig. 3).

Exposure of raw green vegetables (parsley, lettuce, leek, green onion and watercress) to both acetic acid 5% and potassium permanganate 24mg/L for (20 and 30 minutes) show normal taste, smell, consistency with no colour changes except slightly vinegar smell in case of acetic acid which is accepted as vinegar is used with different food like salad.
El-Sayad et al. (1997), reported that Vegetable leaves were not softened and remained fresh after washing with acetic acid 5% or KMnO4 24mg/L.

CONCLUSION & RECOMMENDATIONS

Acetic acid 5% and potassium permanganate 24% can reduce viability of infective stages of some intestinal parasites and can be used in washing vegetables to control vegetable transmitted parasites.

Scanning Electron Microscopy (SEM) plays a role on showing the morphological changes of detected parasites on green vegetables before and after exposure to disinfectants

Further studies will be needed to evaluate their effect along more exposure times to confirm their disinfectant properties, also to evaluate their effect on the infectivity of the infective stages of different intestinal parasites by using experimental animals. search for more effective compounds that can be effectively clear the parasitic stages from the freshly eaten raw vegetables.

REFERENCES


تأثير المطهرات على بعض الطفيليات التي تلوث الخضروات النيئة في مدينة بنها

بمحافظة الفقليقية مصر

سامية مصطفى راشد - منى السيد نصر - عزة محمد صالح الدين الهمشري -
مايسية أحمد عراقى - أميرة صلاح الغنام

قسم الطفيليات - كلية الطب - جامعة بنها

الهدف من هذه الدراسة:

هو دراسة تأثير حمض الخليك 5 % وبرمنجنات البوتاسيوم ٢٤ مجم/لتر على حيوية الأطوار المعدية للطفيلات المعوية التي تنتقل بواسطة الخضروات. وهذه الطفيليات تشمل حويصلات الجيارديا لامبيليا والإنتاميبيا وبويضات كل من الديدان الدبسوية والهيميدونيس نانا والهيميدونيس دايمينيوتا. كما تهدف إلى دراسة تأثيرهما على الخواص الفيزيائية للخصروات وذلك بعد مورور ٢٠ و٣٠ دقيقة من التعرض لهاتين المادتين. وتم الكشف عن حيوية الأطوار المختلفة لتلك الطفيليات باستخدام صبغة التربين الزرقاء ٠.٢% والفحص الميكروسكوبى الضوئى للكشف عن حيوية هذه الأطوار المختلفة للطفيلات. كما تم استخدام الميكروسكوب الإلكتروني الماسح للكشف عن حدوث تغيرات في الشكل الخارجي لهذه الأطوار المختلفة للطفيلات.

وكشفت النتائج الآتى:

أدى استخدام حمض الخليك 5% لمدة ٢٠ دقيقة إلى انخفاض نسبة الحيوية لجميع الطفيليات المستخدمة في الدراسة. وكان لهذا الانخفاض دلالة إحصائية باستثناء انخفاض حيوية بويضات الديدان الدبسوية لم يكن له دلالة إحصائية. وبعد مورور ٣٠ دقيقة ازدادت نسبة الانخفاض في حيوية جميع الطفيليات المستخدمة بينما لم تتأثر بويضات الديدان الدبسوية.

كما تبين أن استخدام برمجنات البوتاسيوم ٢٤ مجم/لتر لمدة ٢٠ دقيقة أدى إلى انخفاض نسبة الحيوية لجميع الطفيليات المستخدمه في الدراسة وكان لهذا الانخفاض

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دالة احصائية باستثناء انخفاض حيويّة حويصلات الجيارديا لم يكن انخفاض حيويّة الحويصلات ذو دالة احصائيّه. بينما بعد مرور 30 دقيقة أصبح انخفاض حيويّة الأطوار المختلفه لجميع الطفيليات داله احصائيّه.

كما تبين وجود بعض التغييرات (تعرجات - انكماشات - تشوهات) في الشكل الظاهري للبيوضات والحويصلات نتيجة التعرض لكل من حمض الخلية 5% وبرمنجات البوتاسيوم 24 مجم/لتر والتي تم اكتشافها بواسطة كل من الميكروسكوب الضوئي وكذلك الميكروسكوب الإلكتروني الماسح.

تم اختيار تأثير استخدام كل من حمض الخلية 5% وبرمنجات البوتاسيوم 24 مجم/لتر على الخواص الفيزيائية (المذاق واللون والرائحة) للخضروات المستخدمة في هذه الدراسة (الخس - الجرجير - البقدونس - البصل الأخضر - الكراث) وتبين عدم وجود تغييرات في المذاق أو اللون أو الرائحة عند استخدام برمجات البوتاسيوم بينما الخضروات التي عولجت بحمض بالخليك 5% كان لها رائحة الخل بينما لم يحدث تغيرات في المذاق أو اللون.

ومن النتائج السابقة تبين أنه يمكن استخدام كل من حمض الخلية 5% وبرمنجات البوتاسيوم 24 مجم في عملية غسل الخضروات كطريقة لتقليل العدوى بالأمراض الطفيلية.

4. المجلة المصرية للعلوم الطبية 34 (2) 2013 585-599.