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PREVENTING TRAVELLERS' DIARRHOEA: HOW TO MAKE DRINKING WATER SAFE

Waterborne disease is common in all parts of the world where there is poor hygiene and sanitation. Traveller's diarrhoea alone, whose principal causes are contaminated food and water, is estimated to affect 20-50% of travellers - or approximately 10 million people per year¹.

The most common source of exposure to disease-causing organisms for travellers is ingestion of contaminated drinking water and food. An estimated 80% of TD cases are caused by bacterial pathogens² (e.g., *E.coli*, *Shigella*, *Salmonella*, *Vibrio cholerae*). Other pathogens are viruses (e.g. hepatitis A & E viruses, caliciviruses, rotaviruses) and protozoa (*Giardia lamblia*, *Cryptosporidium parvum*, *Entamoeba histolytica*, and *Cyclospora*).

Appearance can be deceiving. In some parts of the world, tap or bottled water may not be safe. The information below aims to assist travellers in making sure that the water they drink is safe.

What to do before travelling?

- Check with your local disease prevention agency or your physician for recommended vaccines and medications for the countries which you plan to visit several weeks before you leave. Your physician could also recommend that you visit a specialized travel medicine clinic, if one exists nearby.
- For more detailed advice, please refer to WHO's International Travel and Health: <http://www.who.int/ith/en/>. This guide gives helpful tips on the full range of health risks likely to be encountered at specific destinations and associated with different types of travel – from business, humanitarian and leisure travel to backpacking and adventure tours.
- Take along a medical kit containing water disinfectant agents such as iodine tablets or solution, chlorinating-flocculating products, and/or chlorine bleach tablets. Most of these chemicals can be obtained from local pharmacies or at

¹ CDC

² CDC

stores selling outdoor sports equipment. They are potentially hazardous if used incorrectly and should be used according to manufacturers' instructions.

- If you use a water treatment device, be sure that it has been tested and certified to remove protozoa (*Giardia* and *Cryptosporidium*) by a credible organization, and if a filter, that it has a filter media pore size of 1-micron or less.

Treating Water of Questionable Quality

- Bringing water to a rolling boil is the most effective way to kill all disease-causing pathogens. Let the hot water cool down on its own without adding ice (as one cannot be sure if the ice itself is safe).
- If it is not possible to boil water, chemical disinfection of clear, non-turbid water is effective for killing bacteria and viruses and some protozoa (but not, for example, *Cryptosporidium*). Chlorine and iodine are the chemicals most commonly used for disinfection. A product that combines chlorine disinfection with coagulation-flocculation (i.e., chemical precipitation) should be used, when available, as these products remove significant numbers of protozoa, in addition to killing bacteria and viruses.
- If turbid water (i.e., not clear, or with suspended solid matter) is to be disinfected with chemicals, it should be cleared beforehand by, for example, letting the impurities settle, or by filtering.
- Portable point-of-use (POU) devices tested and rated to remove protozoa and some bacteria are also available. Ceramic, membrane and carbon-block filters are the most common types. Selecting the most appropriate filter pore size is crucial; a size of 1 micron or less for the filter media pore is recommended to ensure removal of *Cryptosporidium* in clear water.
- Unless water is boiled, a combination of technologies (e.g., filtration followed by chemical disinfection or boiling) is recommended, since most POU filtration devices do not remove nor kill viruses. Reverse osmosis (very fine pore filtration that holds back dissolved salts in the water) and ultrafiltration (fine pore filtration that passes dissolved salts but holds back viruses and other microbes) devices can theoretically remove all pathogens.
- Often, after chemical treatment, a carbon filter is used to improve taste and, in the case of iodine treatment, to remove excess iodine.
- See Annex for a table of disinfection methods and their advantages and shortcomings.
- Silver, contrary to widespread perception, is not an effective disinfectant (biocide) and is thus not recommended for water disinfection. Its presence in some filters

is intended only to extend the life of the filter by retarding growth of non-disease causing bacteria that may plug filter pores.

General preventive measures while travelling

- Drink bottled water provided in sealed, tamper-proof containers and bottled by known brands (which, preferably, have been certified by responsible authorities). Hotel personnel and/or host families are often good sources of information about which local brands are safe.
- Hot beverages such as coffee and tea are often made with boiled water and are therefore usually safe. Other beverages should be prepared with safe water (as per above).
- Avoid consumption of homemade or non commercial, unpasteurized juices.
- Carbonated bottled beverages (sodas) and pasteurized or canned juice, sports beverages and pasteurized, boiled or sterilized milk (without ice) are normally free from microorganisms which could cause TD.
- Bottled beer, wine and other alcoholic beverages are also normally safe, although drinking alcoholic beverages may in fact, especially in hot climates, contribute to dehydration unless other safe liquids are consumed.
- Do not eat salads or other uncooked dishes that may have been washed or prepared with unsafe water.
- All food which has not been prepared using proper hygiene practices (c.f. WHO's Five Keys to Safer Food: <http://www.who.int/foodsafety/consumer/5keys/en/index.html>) will increase the risk of travellers contracting diarrhoea - and other foodborne diseases.

Symptoms if one does fall ill

Waterborne disease symptoms vary. Typically, people have one or more of the following: diarrhoea, nausea, vomiting, fever, chills, and aches. Besides mild diarrhoea, other diseases may include typhoid (enteric) fever, amoebic and bacillary dysentery, hepatitis A and E, hemolytic uremic syndrome and others. Symptoms may last for a few hours to several weeks depending on the infectious agent and type of medical intervention. These same signs and symptoms can occur early in the course of many diseases, some of which can be life threatening. If signs and symptoms are severe or get progressively worse, medical attention should be sought.

Treatment

Most diarrhoeal episodes are self-limiting and clear up in a few days. The important thing is to avoid becoming dehydrated. As soon as diarrhoea starts, drink more fluids, such as boiled, bottled or treated water, sports beverages or any other safe fluids like carbonated drinks. Oral rehydration salts may also be used to help the body retain fluids.

While it is always risky drinking water of questionable purity, if a traveller becomes sick with severe diarrhoea and/or vomiting and a safe source of fluids can not be obtained, it is better to drink the best available fluids, even if of questionable purity, than to drink nothing at all.

Anti-diarrhoeal preparations can provide symptomatic relief; however, they do not treat cholera, bacterial dysentery, protozoal, viral and other serious diseases that require specific treatment from a physician.

Special indications for individuals "at risk"

People with weakened immune systems, pregnant women and infants are groups especially at-risk from water-borne disease. *Cryptosporidium*, for example, is a special danger to people with weakened immune systems.

Travellers who fall into this group should make a special effort to boil water and store it in a clean container. This is the surest way to avoid waterborne disease and may be the only reliable source of *Cryptosporidium*-free water. Bottled water certified under national and international water quality standards are generally considered nearly as safe as boiled water.

Iodine use (to disinfect water) over a long period of time is not recommended for pregnant women, those with a history of thyroid disease, and those with known hypersensitivity to iodine. Excess iodine can interfere with the functioning of the thyroid gland. Travellers intending to use iodine daily for all water consumed for more than 3-4 weeks should consult their physician beforehand, and not use it in excessive amounts when treating drinking water.

DISINFECTION METHODS

Method	Recommendation (1 L or 1 Qt of water)	What it DOES	What it does NOT do
<i>Boiling</i>	<ul style="list-style-type: none"> Bring water to a rolling boil and allow to cool 	<ul style="list-style-type: none"> Kills all pathogens 	<ul style="list-style-type: none"> Does not remove turbidity/cloudiness
<p><i>Chlorine compounds</i></p> <ul style="list-style-type: none"> Household bleach (sodium ypochlorite) Sodium dichloroisocyanurate tablet Calcium Hypochlorite 	<ul style="list-style-type: none"> For typical room temperature and water temperature of 25°C (77°F), minimum contact time should be 30 minutes; increase contact time for colder water; e.g. one hour at less than 10° C Prepare according to package instructions Should be added to clear water or after settling or clarification to be most effective Type and typical dosage: <ul style="list-style-type: none"> Household Bleach (5%) – 4 drops Sodium dichloroisocyanurate – 1 tablet (per package directions)-15 mg per liter of clear water Calcium Hypochlorite (1% stock solution) – 4 drops 	<ul style="list-style-type: none"> Very effective for killing most bacteria and viruses. Longer contact time required to kill <i>Giardia</i> cysts especially when water is cold. 	<ul style="list-style-type: none"> Not effective against <i>Cryptosporidium</i> or some other parasites; not as effective as iodine when using turbid water.
<i>Chlorinating-flocculating tablets or sachets</i>	<ul style="list-style-type: none"> Chlorinating-flocculating tablet or sachet (per package directions) 	<ul style="list-style-type: none"> Very effective for killing or removing all waterborne pathogens 	<ul style="list-style-type: none"> Flocculated water must be decanted into a clean container, preferably through a simple fabric filter
<p><i>Iodine</i></p> <ul style="list-style-type: none"> Tincture of iodine (2% solution) Iodine (10% solution) Iodine tablet Iodinated resin <p>Caution: For pregnant women who may be more sensitive, a carbon filter should be used to remove excess iodine after iodine treatment</p>	<ul style="list-style-type: none"> 25°C (77°F) – minimum contact for 30 minutes; increase contact time for colder water not recommended for pregnant women, people with thyroid problems, or for more than a few months continuous use Prepare according to package instructions Type and typical dosage: <ul style="list-style-type: none"> Tincture of iodine 2% solution– 5 drops Iodine 10% Solution – 8 drops Iodine Tablets – 1 or 2 tablets Triiodide or pentaiodide resin – room temperature according to directions and stay within rated capacity 	<ul style="list-style-type: none"> Kills most pathogens; Longer contact time is required to kill <i>Giardia</i> cysts especially when water is cold. Carbon filtration after an iodine resin will remove excess iodine from the water, replace the carbon filter regularly. 	<ul style="list-style-type: none"> Not effective against <i>Cryptosporidium</i>.
<p><i>Portable filtering devices</i></p> <ul style="list-style-type: none"> Ceramic filters Carbon filters. Some carbon block filters will remove cryptosporidia – only if tested and certified for cyst removal. Reverse osmosis and ultrafilter type devices Membrane filter devices 	<ul style="list-style-type: none"> Filter media pore size must be rated at 1 micron (absolute) or less for filtration of clear unsafe water. 	<ul style="list-style-type: none"> 1-micron or less filter pore size will remove <i>Giardia</i> lamblia, <i>Cryptosporidium</i> and other protozoa. Reverse osmosis and ultrafilter devices can remove almost all pathogens 	<ul style="list-style-type: none"> Most bacteria and viruses will not be removed. Many carbon-block filters do not remove pathogens, other than possibly protozoa, even if carbon is impregnated with silver. They must have a a specified pore size and be certified for microbe removal

- To make a 1% stock solution of calcium hypochlorite, add to one liter of water, 28 grams if chlorine content is 35%, or 15.4 gram if 65%, or 14.3 grams if 70%.