



PATIENT & CAREGIVER EDUCATION

Low-Microbial Diet

This information will help you follow a low-microbial diet. Eating a low-microbial diet will lower your risk of getting sick while your immune system is weak, such as when you have leukopenia (a low number of white blood cells), after chemotherapy, radiation therapy, or a bone marrow or stem cell transplant.

The first section of this resource has information on how to keep your food safe. The second section explains what foods and drinks are safe to eat and drink while on a low-microbial diet. Don't make any changes to this diet until you have talked to someone on your healthcare team. This includes your doctor, nurse, nurse practitioner, or dietitian.

People who had an allogeneic or autologous stem cell transplant should follow this diet for the first 100 days after their transplant. Please speak to your healthcare team about whether you need to keep following the diet after the 100-day period is over.

Food Safety Guidelines

About microbes

Microbes are tiny living things such as bacteria, viruses, yeast, and molds. They can get into food by infecting the animal the food comes from. Microbes can also get into food when it's being processed or prepared. When microbes get into foods and you eat the foods without proper preparation, they can cause infections. People with leukopenia are at an especially high risk for infection.

Microbes can attach to foods and grow, but you can't always see, smell, or taste them. They're more likely to grow on:

- Milk and other dairy food items that aren't refrigerated.
- Unpasteurized cheeses (such as Brie, blue cheese, and feta).

- Undercooked and raw eggs and foods that have raw eggs (such as cookie dough and Caesar salad dressing).
- Undercooked or raw meat, poultry, and seafood (including smoked seafood such as smoked salmon and trout).
- Certain fruits and vegetables (see the Fruits and Vegetables list in the “What to Eat on a Low-Microbial Diet” section).
- Unpasteurized or untreated juices (such as fresh-squeezed juices).
- Vegetable sprouts (such as raw alfalfa, soy bean, and radish sprouts).

Buying foods that are safe to eat

- Check containers for the expiration date. Buy and use food before that date.
- Don't buy fruits and vegetables that have cuts, bruises, or mold.
- Don't buy pre-cut fruits and vegetables at the grocery store. Buy whole produce and clean and cut it at home.
- Don't buy canned foods if the can has dents or is swollen.
- Don't buy food in jars if the jar is cracked or the lid isn't tightly closed.
- Don't buy packaged or boxed food that isn't properly sealed.
- Buy only pasteurized dairy products, honey, and fruit and vegetable juices.
- Only buy eggs that are refrigerated. Open the carton to make sure no eggs are broken or cracked.
- Don't buy foods from self-service bulk containers or bins.
- Don't taste free samples.
- Don't buy meats, cheeses, or salads from the deli counter or salad bar.
- Separate ready-to-eat and raw foods. Put raw meat, poultry, seafood, and other raw foods in plastic bags before they go into your shopping cart.

Pick up your milk and other cold and frozen foods at the end of your shopping trip. This decreases the time these items will spend outside of the refrigerator or freezer.

Transporting food safely

- After grocery shopping, go directly home and put your perishable food (food that can go bad quickly) into the refrigerator or freezer right away.
- Never leave perishable foods in a hot car.
 - If you need to make a stop after grocery shopping or if your trip from the grocery store to your home is long, place perishable foods in an insulated bag or cooler with ice or frozen gel packs.

Storing food safely

- Store food right after shopping.
- Put eggs and milk on a shelf inside the refrigerator. Don't store them in the door. The inside of the refrigerator stays cooler than the door area.
- Never leave perishable food out of the refrigerator for more than 1 hour.

Keeping your kitchen clean

- Keep an area of your kitchen clean for preparing and eating food. This will help keep microbes from spreading.
- Use paper towels or a clean cloth to clean kitchen surfaces. Don't use sponges.
- Use an antibacterial cleaning spray to clean surfaces. Look for products that have bleach or ammonia. Examples are Lysol® Food Surface Sanitizer and Clorox® Clean-Up Cleaner.

Using cutting boards and equipment

- Use thick plastic, marble, glass, or ceramic cutting boards. These materials are nonporous, meaning that food or liquid substances can't absorb into them. Don't use cutting boards made from wood or other porous surfaces that can absorb food and liquids.
- Throw out worn or hard-to-clean cutting boards.
- Wash cutting boards and knives with hot soapy water before using them to cut the next food.

- As an extra precaution, you can also wash your cutting boards with a kitchen sanitizer. Rinse off the sanitizer with hot water before using the cutting board.
- Use separate cutting boards for fresh produce and for raw meat, fish, seafood, or poultry.
- Never place cooked food on a cutting board or plate that previously held raw food.

Handling food safely

- Wash your hands thoroughly with soap and warm water for 20 seconds:
 - Before preparing or eating food
 - After preparing raw poultry, meat, fish, or seafood
 - After handling garbage
- Thoroughly rinse fresh fruits and vegetables. Never use bleach or detergent to wash produce.
 - To properly wash produce, run under warm tap water and scrub skin with a clean vegetable brush.
 - Even if you plan to peel a fruit or vegetable, wash the skin and rind before cutting or peeling (for example, bananas, oranges, melons, and avocados).
- Separate and thoroughly wash all salad greens. Re-wash all produce even if it's "pre-washed".
- Thaw foods by using one of the following methods:
 - Put the food item in the refrigerator 1 day before cooking.
 - Use the defrost setting on a microwave. Cook right away.
- Keep your refrigerator at a temperature of 33 °F to 40 °F (0.6 °C to 4.4 °C). Keep your freezer at a temperature of 0 °F (-17.8 °C) or below.
- Don't eat hamburgers and other meat products if the meat looks undercooked. Cook the meat until it's grey and the juices run clear.
- Cook fish until it flakes and shellfish until it's cooked-through and opaque.

- Cook egg whites and yolks until they're firm.
- Use a food thermometer to check that all foods are cooked to the minimum internal temperatures listed in the chart below. Check the temperature at the center of the thickest part of the food.
- Don't share food with other people.
- Always remember: when in doubt, throw it out!

Food	Safe Minimum Internal Temperatures
Egg and Egg Dishes	
Eggs	Cook until yolk and white are firm
Egg dishes	160 °F (71 °C)
Egg sauces	160 °F (71 °C)
Ground Meat and Meat Mixtures	
Turkey and chicken	165 °F (74 °C)
Beef, hamburgers, veal, lamb, and pork	160 °F (71 °C)
Fresh Beef, Veal, and Lamb	
Well done	170 °F (77 °C)
Fresh Pork	
Well done	170 °F (77 °C)
Ham	
Raw or fresh	160 °F (71 °C)
Precooked, cured ham	140 °F (60 °C)
Poultry	
All products	165 °F (74 °C)
Seafood (Fish and Shellfish)	
All (raw or fresh)	145 °F (63 °C)

Eating leftovers

- Refrigerate leftovers in shallow containers right after eating.
- Reheat the following leftovers to an internal temperature of at least 165 °F (74 °C) for at least 15 seconds:
 - Poultry
 - Stuffed meat, poultry, or fish
 - Ground meat
 - Pork, beef, veal, and lamb
 - Hard-boiled eggs
- When reheating leftovers in the microwave, stir, cover, and rotate the food so that it heats evenly.
- Sauces, soups, and gravies should be reheated by bringing them to a boil.
- Be sure to let the food cool so you don't burn your mouth.
- Eat reheated leftovers within 1 hour of reheating.
- Don't eat leftovers more than 2 days old.
- Don't eat any food that has already been reheated once.

What to Eat on a Low-Microbial Diet

Breads, Grains, and Cereals

What to eat	What to avoid
<ul style="list-style-type: none">• All breads, rolls, bagels, English muffins, waffles, French toast, muffins, pancakes, and sweet rolls• Potato chips, corn chips, tortilla chips, popcorn, and pretzels• Any cooked or ready-to-eat cereal purchased prepackaged from a store• Rice, pasta, and other cooked grains	<ul style="list-style-type: none">• Undercooked or raw brewer's yeast

Milk and Dairy Products

What to eat	What to avoid
<p>All pasteurized dairy products, including:</p> <ul style="list-style-type: none"> • Commercially available milk and milk products (such as sour cream and whipped cream) • Yogurts, including those made with live cultures (such as Dannon[®], Chobani[®], and Stonyfield[®]) • Processed pre-packaged cheese slices and spreads, cream cheese, cottage cheese, and ricotta cheese • Commercially packaged pasteurized cheese such as American, cheddar, mozzarella, Monterey jack, Swiss, and Parmesan • Soft cheeses clearly labeled as “made from pasteurized milk,” including goat and feta • Prepackaged ice cream, frozen yogurt, sherbet, popsicles, ice cream bars, puddings, and fresh homemade milkshakes • Commercially sterile, ready-to-feed, and liquid concentrate infant formulas 	<p>All unpasteurized dairy products, including:</p> <ul style="list-style-type: none"> • Raw milk • Homemade eggnog and yogurt • Cheese made from unpasteurized milk, often including soft cheeses such as Brie, farmer’s cheese, Camembert, Mexican-style cheese (such as queso blanco and queso fresco), goat cheese, and some mozzarella cheese. These are okay to eat if cooked until melted. • Mold-ripened cheeses such as Roquefort, Stilton, Gorgonzola, and blue cheese • Avoid eating the rind on cheeses, as it often contains mold (such as Brie) <p>Other dairy products:</p> <ul style="list-style-type: none"> • Soft serve ice cream or yogurt • Unrefrigerated, cream-filled pastry products • Fermented dairy products (such as Kefir) • Cheese sliced at the deli counter • Cheeses that contain chili peppers or other uncooked vegetables

Eggs

What to eat	What to avoid
<ul style="list-style-type: none"> • Well-cooked eggs (firm white and yolk) and pasteurized egg products (such as Egg Beaters[®], powdered eggs, or liquid egg whites) • Pasteurized eggs, like those served at MSK, may be eaten runny. One example is Davidson’s Safest Choice[®] Pasteurized Eggs, which are stamped with a red P. To see if they’re sold in your area, use the store locator at www.safeeggs.com/store-locator 	<ul style="list-style-type: none"> • Undercooked unpasteurized eggs and egg products • Raw eggs and foods containing raw eggs (such as homemade Caesar dressing, freshly made mayonnaise and aioli, and raw cookie dough)

Meat, Meat Substitutes, Poultry, and Seafood

What to eat	What to avoid
<ul style="list-style-type: none"> • Well-cooked meat and poultry (such as pork, beef, lamb, chicken, and turkey) • Thoroughly cooked fish and seafood (such as salmon, tilapia, cod, shrimp, lobster, crab, and canned tuna or salmon). Take extra caution with shellfish that's in the shell (such as lobster) and be sure to cook it fully through until it's opaque. • Cooked tofu or pasteurized or shelf-stable tofu • Cooked fermented products, including miso and tempeh • Commercially prepared hot dogs and pre-sliced deli meats sold in a sealed package (such as salami, bologna, ham, and turkey) that are cooked until steaming hot. Throw away extras within 48 hours of opening. • Well-cooked bacon and sausage • Canned meats and commercially packaged beef or turkey jerky • Canned and shelf-stable smoked fish 	<ul style="list-style-type: none"> • Undercooked or raw meats, poultry, and fish, including rare or medium-rare items • Uncooked or raw tempeh, miso products, and tofu • Freshly sliced deli meats and meats from street vendors • Raw or partially cooked fish and shellfish, including caviar, sashimi, sushi, and ceviche ("lemon-cooked" or cured fish) • Raw or cooked clams, mussels, and oysters • Smoked seafood, such as salmon or trout labeled as "Nova style," "lox," "kippered," "smoked," or "jerky" (unless cooked to 160° F or contained in a cooked dish or casserole) • Refrigerated pâtés and meat spreads • Hard-cured salami in natural wrap

Fruits and Vegetables

What to eat	What to avoid
<ul style="list-style-type: none"> • Well-washed raw fruits and vegetables without cuts, bruises, or mold. Examples include apples, pears, peaches, peppers, salad greens, carrots, cucumbers, and tomatoes. • Well-washed and peeled thick-skinned fruits and vegetables. Examples include citrus fruits, bananas, avocados, mangos, and melons. • Cooked and canned fruits and vegetables • Well-washed frozen fruits and vegetables • Pasteurized juices and frozen concentrates 	<ul style="list-style-type: none"> • Unwashed raw or frozen fruits, vegetables, and herbs • Any raw or frozen "rough-textured" fruits and vegetables that can't be thoroughly washed (such as strawberries, raspberries, blackberries, broccoli, and cauliflower). These are okay if cooked. • Pre-cut fresh fruits and vegetables (such as pre-cut melon) • Unpasteurized and fresh-squeezed fruit and vegetable juices (unless prepared at home) • Fresh fruit or vegetable salsa found in the

<ul style="list-style-type: none"> • Commercially packaged dried fruits • Shelf-stable bottled salsa (refrigerate after opening) • Fresh, well-washed herbs • Dried herbs and spices 	<p>grocery refrigerator case</p> <ul style="list-style-type: none"> • Vegetarian sushi, unless it's homemade, because it may be prepared near raw fish • All uncooked vegetable sprouts (alfalfa, bean, clover, and all others) • Salads from delis or salad bars
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Drinks

What to drink	What to avoid
<ul style="list-style-type: none"> • Tap water and ice, if your water is from a city water supply or a municipal well serving a highly populated area • Water from private wells or small community wells only if the well is tested daily for bacteria. If the well isn't tested daily, boil the water before using it. • Commercially bottled distilled, spring, and natural waters • Pasteurized fruit and vegetable juices • Bottled, canned, or powdered beverages • Hot coffee • Hot teas using commercially packaged tea bags • Homemade iced tea and iced coffee made from hot brewed (boiling) tea or coffee, as long as you store it in the refrigerator and drink it within 2 days • Pasteurized soy milk and other non-dairy milks (such as almond, rice, and coconut milk) • Commercially made liquid nutritional supplements (such as Ensure[®] and Boost[®]) 	<ul style="list-style-type: none"> • Unpasteurized eggnog, apple cider and other unpasteurized fruit or vegetables juices • Unpasteurized beer (such as microbrewery beers and those that aren't shelf-stable) and wine. Talk with your doctor before consuming any alcoholic beverages. • Fountain soda and other fountain beverages • Tea made with loose leaves, cold brewed tea, sun-tea, kombucha, and mate tea • Iced or cold brewed coffee or tea from restaurants or coffee shops

Nuts

What to eat	What to avoid
<ul style="list-style-type: none"> • Factory-packaged roasted nuts • Factory-packaged raw almonds or hazelnuts (required by law to be pasteurized), or other raw nuts labeled as "pasteurized" 	<ul style="list-style-type: none"> • All nuts that are sold open and in bulk, as in some health food or specialty stores • Unpasteurized raw nuts • Roasted nuts in the shell (such as pistachios or peanuts in the shell)

- Nuts in baked goods
- Commercially packaged nut butters (such as peanut, almond, and soybean)

- Freshly ground peanut butter or nut butters (not commercially packaged)

Condiments and Miscellaneous

What to eat	What to avoid
<ul style="list-style-type: none"> • Salt and sugar • Jellies, syrup, and jams (refrigerate after opening) • Pasteurized or flash pasteurized honey • Packaged ground black pepper, herbs, and spices • Ketchup, mustard, BBQ sauce, and soy sauce, (refrigerate after opening) • Pickles, pickle relish, and olives (refrigerate after opening) • Vinegar • Vegetable oils and shortening • Refrigerated margarine and butter • Commercially made, shelf-stable mayonnaise and salad dressings, including Caesar, blue cheese, and other cheese-based salad dressings (refrigerate after opening) • Cooked gravy and sauces 	<ul style="list-style-type: none"> • Raw or unpasteurized honey and honeycomb • Whole or fresh ground black pepper served tableside at restaurants • Shared condiment containers at restaurants (ask for individual packets) • Fresh salad dressings (stored in grocer's refrigerated case) containing raw eggs or cheeses, such as Caesar salad dressing • Herbal and nutritional supplement preparations

Desserts

What to eat	What to avoid
<ul style="list-style-type: none"> • Refrigerated, commercially made, and homemade cakes, pies, pastries, and pudding • Refrigerated cream-filled pastries • Cookies, both homemade and commercially prepared • Shelf-stable, cream-filled cupcakes and fruit pies • Packaged ice cream and frozen yogurt from the grocery store • Packaged candy and gum 	<ul style="list-style-type: none"> • Unrefrigerated, cream-filled pastry products (not shelf stable) • Soft serve ice cream and frozen yogurt • Ice cream scooped at a restaurant • Unpackaged after-dinner mints (such as those found at diner check-out counters)

Eating Outside the Home and Take-Out

What to eat	What to avoid
<ul style="list-style-type: none">• All foods recommended in previous food groups must come directly off the grill or stove and not be served on steam tables or stored under heat lamps. Examples of foods that are safe to eat include freshly made pizza (not sliced or reheated); hamburger directly off a grill; just-cooked French fries; and whole, just-cooked rotisserie chicken moved directly from rotisserie to package by a gloved employee.• Single-serving condiment packages (no pump serve containers)• Hot black coffee or hot tea from a coffee shop, without mixing by staff or using shared, un-refrigerated milk containers.	<ul style="list-style-type: none">• Any food that isn't freshly made to order• Unpasteurized fruit juices and dairy products (such as juices ordered from a juice bar)• Raw fruits and vegetables and desserts with fresh fruit• Deli meats and cheeses sliced at the deli counter• Salad bars, buffets, smorgasbords, potlucks• Sidewalk vendors• Soft serve ice cream and yogurt• Fast food (such as McDonalds® and Subway®)• Reheated foods

Eating out at restaurants

You can eat out while on a low-microbial diet **unless you had a stem cell transplant**. If you had a stem cell transplant, see the “Guidelines for people who had a bone marrow or stem cell transplant” section below.

It's important to choose the restaurant carefully. Local health departments inspect restaurants to make sure that they're clean, and that they follow safe food practices. You can find out how your local restaurants did on a recent health inspection by going to your local Department of Health (DOH) website. To find out about restaurants in New York City, go to the following website: www1.nyc.gov/site/doh/services/restaurant-grades.page

You can also ask your local restaurants about their food safety training rules. When you go out to eat, follow the guidelines below.

- Order all foods to be fully cooked and meats to be well done.
- Don't order foods that may have raw eggs (such as Caesar salad dressing, fresh mayonnaise or aioli, and hollandaise sauce).
- Ask the wait staff if you aren't sure of the ingredients in your meal.

- Don't eat foods from buffets and salad bars.
- Ask that your foods be cooked fresh and not served from steam tables or stored under heat lamps.
- Ask for single-serving condiments, such as ketchup and mustard packets. Open containers may be used by many customers.
- Don't eat soft serve ice cream and soft serve frozen yogurt. The dispensers may contain bacteria if they're not cleaned often.
- Always order a whole or personal pizza. Don't order individual slices, since they're often stored under heat lamps.

Guidelines for people who had a bone marrow or stem cell transplant

People who had an allogeneic or autologous stem cell transplant shouldn't eat out at restaurants for the first 100 days after their transplant. Please speak to someone on your healthcare team if you have any questions or concerns about eating out before or after the 100-day period.

Avoid supplements

Don't take supplements, homeopathic remedies, or herbal products (such as St. John's wort, traditional Chinese medicines) unless discussed with your MSK medical team. Because there are no federal standards for these products in the United States, the way they're processed and stored may pose a health risk. Microbes in these items can also cause an infection. Also, the products themselves could interfere with or change the activity of a prescription medication.

Safe drinking water

Never drink from lakes, rivers, streams, springs, or wells.

If you're unsure if the tap water is safe, check with the local health department or boil or filter the water. Drink bottled water if you think the tap water may not be safe. Note that most water filtration devices will **not** make the water safe if the water supply hasn't been chlorinated.

If you use well water that isn't tested daily for bacteria, you must boil it. Bring the water to a rolling boil for 15 to 20 minutes. Store boiled water in the

refrigerator. Throw away any boiled water that you don't use within 48 hours.

Resources

Use the resources below to find additional information about preventing foodborne illness and the safe handling, storage, and preparation of food.

Government websites with information and news about foodborne illnesses, recalls, and regulations:

- **United States Department of Agriculture (USDA) Food Safety and Inspection Service**
www.fsis.usda.gov
- **U.S. Department of Health & Human Services Food Safety Information**
www.foodsafety.gov
- **U.S. Food & Drug Administration (FDA)**
www.fda.gov/ForConsumers/default.htm
- **Centers for Disease Control and Prevention Food Safety**
www.cdc.gov/foodsafety/

Fight BAC! Partnership for Food Safety Education

A website with practical tips about how to keep food safe.

www.fightbac.org

USDA “Ask Karen”

A web-based question and answer system that allows visitors to read previously asked questions and submit new questions about foodborne illnesses and safe food handling, storage, and preparation.

www.fsis.usda.gov/wps/portal/informational/askkaren

NYC Department of Health and Mental Hygiene Restaurant Inspection Information

A website where you can search for New York City restaurant inspection results and grades.

www1.nyc.gov/site/doh/services/restaurant-grades.page

The Safe Food Information Line

Call this number to contact the U.S. FDA by phone.

888-723-3366

Nutrition services at MSK

Call this number to schedule an appointment with one of MSK's registered dietitians or nutritionists.

212-639-7312

If you have any questions, contact a member of your healthcare team directly. If you're a patient at MSK and you need to reach a provider after 5:00 PM, during the weekend, or on a holiday, call 212-639-2000.

For more resources, visit www.mskcc.org/pe to search our virtual library.

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