

As part of a continuing effort to comply with federally mandated regulations, the Denver Department of Public Health and Environment is asking all retail food establishments that prepare sushi to demonstrate compliance with existing regulations. Your cooperation will ensure that food is kept safe during receipt, storage, preparation, and service. This information sheet gives background on sushi and the food safety concerns associated with it.

Background

In Japan, the word ‘sushi’ means ‘rice dressed with vinegar.’ However, as we know it here in the United States, sushi is used to describe sticky vinegar rice that is shaped into bite-sized pieces and topped with raw or cooked fish, or formed into a roll with fish, egg, or vegetables and wrapped in seaweed. It is sometimes confused with sashimi, which is delicately sliced raw seafood served with only a dipping sauce.

Sushi began as a method of preserving fish centuries ago, but has since evolved into an artful and unique dining experience. Although sushi uses relatively few ingredients, it is perhaps one of the most well-known examples of the artistry of Japanese cuisine. In Japan, one must train for more than ten years before earning the title of master sushi chef or ‘shokunin.’

Preparation Procedure

Sushi is made with white, short-grained, Japanese rice mixed with a dressing made of rice vinegar, sugar, salt, nori (a type of seaweed), and sake. Once it is cooked, it is cooled to body temperature before being used. There are regional variations in the preparation of sushi rice. Most of the variations are in the rice vinegar dressing; some contain more salt, others are made with more sugar.

There are dozens of kinds of sushi, some of which are cooked (shrimp, crab, octopus) and others that are served raw. Fish that is commonly used in sushi includes salmon, snapper, tuna, mackerel, and yellowtail. Other seafood includes fish roe, sea urchin, eel, clam, conch, and scallop. Additional ingredients common to sushi menus include quail eggs, avocado, cucumber, mushrooms, and seaweed. Sushi is always served with wasabi (a very spicy green horseradish paste), soy sauce, and pickled ginger.

The five most popular types of sushi seen in American restaurants are nigiri-sushi, maki-sushi, chirashi-sushi, temaki-sushi, and inari-sushi. Nigiri-sushi is little fingers of rice topped with a fillet of raw or cooked fish or shellfish and sometimes dipped in wasabi. Nigiri is generally the most common form of sushi seen. Maki-sushi is rice and seaweed rolls with fish and/or vegetables. Most maki places the seaweed (nori) on the outside, but some, like the California and rainbow rolls, place the seaweed on the inside. It’s reported that the well-known California roll was created by sushi chefs in Los Angeles restaurants in the 1970s for American diners who were squeamish about eating raw fish. The California roll consists of cooked crab, cucumber, and avocado. Chirashi-sushi, which translates as ‘scattered sushi,’ is a bowl or box of sushi rice topped with a variety (usually nine) of sashimi. Temaki-sushi is a hand-rolled cone of sushi rice, fish, and vegetables wrapped in nori (seaweed). Lastly, inari-sushi is fried tofu pouches stuffed with sushi rice.

Sushi may be served in various combinations, depending on what the guest orders. Most sushi restaurants have a bar area where guests can sit in front of a clear partition and observe the master sushi chef preparing various dishes.

Foodborne Illness Risk Factors Associated with Sushi

Food from Unsafe Sources

Fish that is not purchased from an approved source may not be properly acquired or handled prior to shipping and can contain toxins harmful to humans. Two common examples are ciguatera and scombroid toxins.

Ciguatera is an illness caused by eating fish that contain toxins called ciguatoxins, produced by a marine algae microorganism. The toxin is acquired by the fish through the food chain and mostly affects fish that feed close to tropical reefs, including red snapper, grouper, triggerfish, jacks and barracuda. The larger the fish, the more likely they are to contain the toxin. In all, over 400 different kinds of fish have been linked to the disease, even salmon. Cooking the fish does not prevent ciguatera. People who have ciguatera may experience nausea, vomiting, and neurologic symptoms such as tingling fingers or toes. They also may find that cold things feel hot and hot things feel cold. Seafood restaurants should only purchase fish from a supplier who can ensure that the fish are not harvested at or near reefs.

Improper Holding Temperatures

Scombroid toxin is formed when fish has been temperature abused and bacteria present on the fish produce the enzyme histidine decarboxylase, which converts histidine, that is naturally in the fish's flesh, to histamine, which is toxic to humans upon eating the fish. The infective dose (the amount of histamine in the flesh required to cause illness) is not known.

Histamine poisoning, as it is sometimes termed, causes allergic reactions such as itching, rashes, and shortness of breath. The presence of the toxin does not make the fish smell bad or otherwise appear spoiled. Once histamine is present, neither freezing nor cooking the fish will eliminate it. The only control for scombroid toxin is prevention by maintaining proper temperature of the fish from harvest through service. The fish most frequently affected by scombroid poisoning include mackerel, tuna, mahi-mahi, and bluefish. Operators must not only purchase fish from reputable sources, but properly maintain the fish below 41°F after receipt in the establishments to reduce the risk of exposure to scombroid toxin.

To ensure the safety of sushi, raw seafood must be frozen to destroy parasites. Parasitic worms live in many species of fish. When live worms are consumed in raw fish flesh by humans, they can cause acute abdominal pain, and in some cases, must be surgically removed from the stomach lining. Cooking or freezing fish to required temperatures will destroy parasites.

The control measures for a retail establishment are:

- 1) the facility purchases only fish that have been properly frozen, or
- 2) the facility conducts in-house freezing.

Many sushi establishments are acquiring fresh fish that have never been frozen, and therefore have not undergone parasite destruction. It is the restaurant's responsibility to make sure it is done. Most refrigerators in retail facilities are unable to freeze fish to the temperatures required to destroy parasitic worms. Operators who have equipment capable of freezing the fish to proper temperatures must keep records on how long they froze the fish and to what temperature(s) the fish was frozen. These records must be maintained for 90 days. If they cannot prove that they were able to freeze the fish adequately in-house, they must have a written agreement or statement from the supplier stipulating that the fish supplied are frozen to a temperature and for a time capable of destroying parasites. Most tuna species, aquacultured fish such as salmon, and molluscan shellfish are exempt from freezing.

Sushi rice typically includes vinegar and sugar in the recipe. Laboratory tests have indicated that sushi rice made in the traditional method has a pH of 4.2 or less and does not require time-temperature control for safety. As a result, restaurants and markets that make their own sushi rice and wish to hold it at room temperature can do so if they use a standardized recipe and maintain documentation that three samples from three separate batches have been laboratory-verified to have a pH of 4.2 or below. If the establishment does not want to have their sushi rice laboratory-verified, they can use time as a public health control for the rice, which requires that

each batch of rice be identified with the time that is 4 hours past the point in time when the rice was removed from temperature control, and should be used or discarded.

Poor Personal Hygiene

Sushi, even if made with raw fish, is a ready-to-eat product because it is consumed in that form. No bare hand contact is allowed at any point during preparation or service. Sushi chefs must wear protective gloves or use other utensils or implements to prevent contacting sushi with bare hands.

Control Measures

Fish that is served raw must be frozen to destroy parasites in house or at the supplier. Review documentation that raw, raw-marinated, partially cooked, or marinated-partially cooked fish has been:

- Frozen and stored at a temperature of -4°F (-20°C) or below for a minimum of 168 hours (7 days) in a freezer;
- Frozen at -31°F (-35°C) or below until solid and stored at -31°F (-35°F) or below for a minimum of fifteen (15) hours; or
- Frozen at -31°F (-35°C) or below until solid and stored at -4°F (-20°C) or below for a minimum of twenty-four (24) hours.

If fish is frozen in house, check freezers to verify that they can maintain the product at the specified freezing temperatures.

Confirm that fish is stored at 41°F or below prior to service and that prepared sushi is held at 41°F or below, or time as a public health control is implemented with proper documentation.

Verify that sushi rice has a pH of 4.2 or below, is held at 135°F or above, or the facility is using time as a public health control with proper documentation.

Observe the preparation of sushi to ensure that it is prepared with no bare hand contact.

Due to difficulty in cleaning, verify that bamboo mats used to roll sushi are covered/lined with a food grade plastic wrap.

Ascertain whether fish is fresh by checking for the following signs:

- Eyes are clear and not sunken
- Bright red gills
- No slime on fish's body
- Scales do not come off easily
- Belly area is firm and elastic
- No fishy smell

Check for signs of temperature abuse in frozen fish:

- Sour odor
- Off color
- Sunken eyes
- Ice crystals formed on fish
- Paper wrapping is moist, slimy, or discolored