



March 30, 2006

**Food Safety Contacts
Directors of Health Protection**

Re: Food Quality Sampling Program – 2004

EXECUTIVE SUMMARY

In 2004, Health Authorities submitted a total of 540 samples to the BC Centre for Disease Control for examination under the Food Quality Sampling Program. Samples were tested for 5 indicator bacteria and sanitary quality was assessed using the guidelines listed in Table 1⁽¹⁾.

Table 1: Sanitary Quality Guidelines for Ready to Eat Foods

| | |
|------------------------------------|--------------------|
| Aerobic plate count | < 100,000 per gram |
| Total coliform count | < 1000 per gram |
| Fecal coliform count | < 3 per gram |
| <i>Escherichia coli</i> count | < 3 per gram |
| <i>Staphylococcus aureus</i> count | < 100 per gram |

COOKED RTE FOOD CATEGORIES SAMPLED (%)

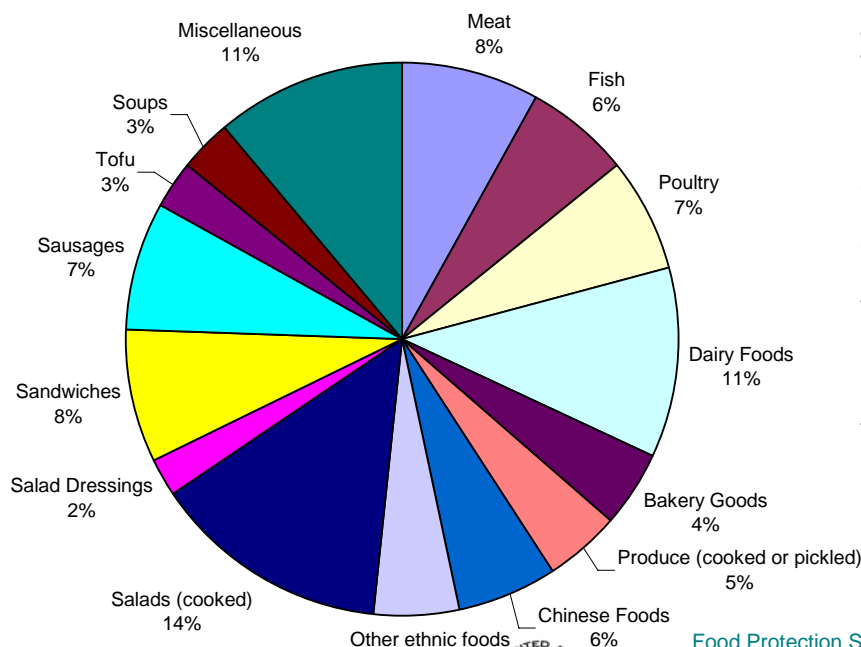


Figure 1: Percentage Breakdowns of Food Categories Sampled for Cooked Ready-to-eat Foods
January 1, 2004 to December 31, 2004

Cooked, ready-to-eat foods accounted for 476 samples (89.3%), and were classified into one of 15 categories. The percentage breakdown of food types sampled is shown in Figure 1. Three food categories: dairy goods, cooked salads, and miscellaneous foods accounted for 36% of the samples.

Food Protection Services
Tel 604.660.5357
Main Floor, 655 12th Ave W
Fax 604.660.6628
Vancouver, British Columbia
Canada V5Z 4R4

604.660.5357
604.660.6628
www.bccdc.org



Of the 476 samples examined, 302 (63.4%) were within the guidelines for all five indicator bacteria, while 164 (34%) exceeded one or more guidelines. Fecal coliforms in excess of the guidelines were detected in 25 samples (5.2%), of these, *E. coli* bacteria were detected in 4 samples. Other details are summarized in Table 2.

Comparison of Cooked and Raw RTE Foods Sanitary Levels

There were 64 samples of raw RTE (ready to eat) foods classified as fresh salads, produce, sushi and unpasteurized juices. Of the 64 samples, 23 (36%) met all five guidelines, while 35 (55%) exceeded one or more quality guidelines. A comparison of any value exceeding the guidelines and *E. coli* are shown for these foods alongside the summary data of cooked RTE foods in Figure 2 (at right).

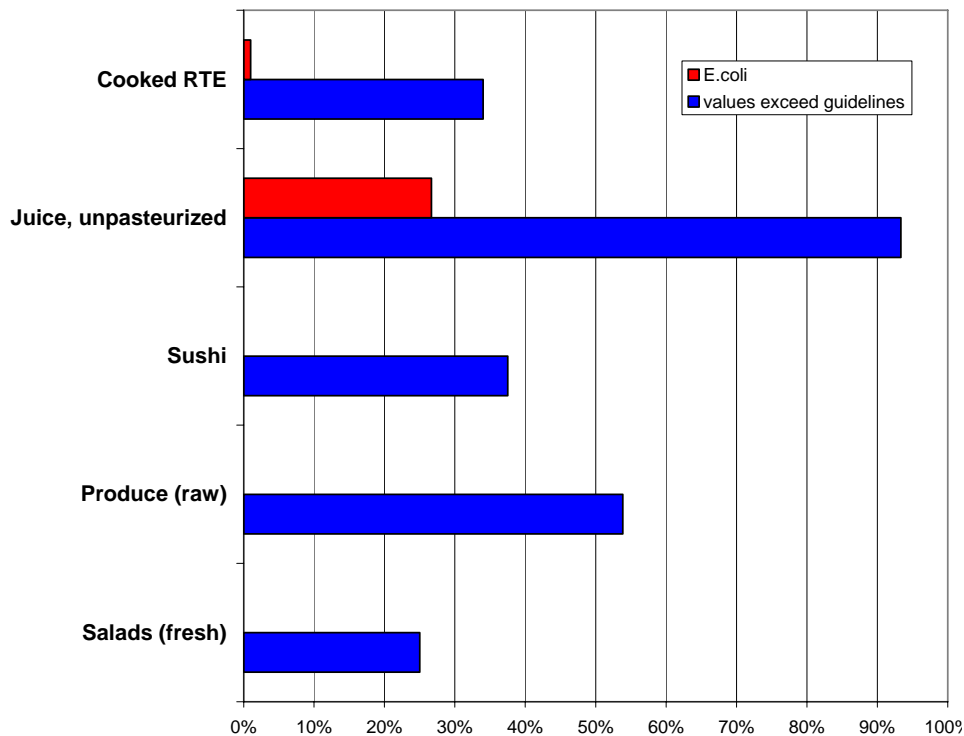


Figure 2: Raw RTE Foods levels exceeding one or more sanitary microbial guidelines

Within this category 93% (14 of 15) of unpasteurized juice samples exceeded one or more guidelines, and *E. coli* bacteria was detected in 4 (27%) of these samples. The data is summarized in Table 3.

The laboratory also examined 46 food samples for pathogens, such as *Bacillus cereus*, *Clostridium perfringens*, *E. coli* 0157:H7 and *Listeria monocytogenes*, and 51 samples for pH and/or Aw (water activity). Aside from low levels of *B. cereus* detected in raw and blanched green beans associated with one food poisoning event, all other food specific pathogen testing was negative.

Water activity (Aw) testing was useful as a tool to determine shelf stability (room temperature holding) of foods, and foods such as cheese pepperoni sticks, fried onions in oil and smoked salmon require refrigeration. pH testing provided evidence that lower pH inhibits growth of *E. coli* in unpasteurized drinks. These results are shown and described in Tables 4 to 8.

RESULTS

Table 2: Food Quality Check Samples Exceeding Guidelines, Cooked Ready to Eat Food
January 1, 2004 to December 31, 2004

| Food Category | No. tested | Samples exceeding one or more guidelines | | Aerobic plate count > 100,000 per gram | | Total plate count > 1000 per gram | | Fecal coliforms >3 per gram | | <i>E. coli</i> > 3 per gram | | <i>S. aureus</i> > 100 per gram | |
|-----------------------------|------------|--|----|--|----|-----------------------------------|----|-----------------------------|----|-----------------------------|---|---------------------------------|---|
| | | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| Meat | 39 | 14 | 36 | 13 | 33 | 2 | 5 | 1 | 3 | 0 | 0 | 0 | 0 |
| Fish | 28 | 11 | 39 | 11 | 39 | 5 | 18 | 1 | 4 | 1 | 4 | 1 | 4 |
| Poultry | 32 | 8 | 25 | 7 | 22 | 2 | 6 | 2 | 6 | 1 | 3 | 0 | 0 |
| Dairy Foods | 53 | 17 | 32 | 17 | 32 | 2 | 4 | 2 | 4 | 0 | 0 | 0 | 0 |
| Bakery Goods | 21 | 1 | 5 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Produce (cooked or pickled) | 22 | 10 | 45 | 10 | 45 | 6 | 27 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chinese Foods | 27 | 11 | 41 | 11 | 41 | 5 | 19 | 1 | 4 | 0 | 0 | 0 | 0 |
| Other ethnic foods | 24 | 8 | 33 | 8 | 33 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| Salads (cooked) | 66 | 29 | 44 | 23 | 35 | 5 | 8 | 11 | 17 | 2 | 3 | 0 | 0 |
| Salad Dressings | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sandwiches | 38 | 15 | 39 | 12 | 32 | 3 | 8 | 5 | 13 | 0 | 0 | 0 | 0 |
| Sausages | 35 | 20 | 57 | 20 | 57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tofu | 14 | 6 | 43 | 6 | 43 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| Soups | 14 | 1 | 7 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Miscellaneous | 53 | 13 | 25 | 9 | 17 | 1 | 2 | 2 | 4 | 0 | 0 | 1 | 2 |
| TOTAL | 476 | 164 | | 149 | | 33 | | 25 | | 4 | | 2 | |

¹ examples include salsa, pickled carrots

² examples include potato salad, chicken salad

Of the 476 samples examined, 302 (63.4%) were within the guidelines for all five indicator bacteria, while 164 (34%) exceeded one or more guidelines. Fecal coliforms in excess of the guidelines were detected in 25 samples (5.2%), of these, *E. coli* bacteria was detected in 4 samples. Three of the positive *E. coli* results were from one restaurant premise in northern BC. Sampling in May and September 2004 demonstrated chronic sanitation breaches in the preparation of potato salad and turkey. Caution should be used when interpreting sanitation of food based on fecal coliform results, the best indicator for unsanitary conditions is the presence of *E. coli*, a bacteria found only in the gut of warm blooded mammals (see Figure 3 right)

Figure 3:

Fecal coliforms are a subset of bacteria from the family *Enterobacteriaceae*. Enteric bacilli (rods) from this family are characterized by the fermentation of glucose, nitrate reduction and negative oxidase reaction. Fecal coliforms are facultative anaerobic bacilli that ferment lactose with acid and gas production within 48 hrs at 35°C. There are four groups of fecal coliforms:

- Enterobacter
- Citrobacter
- Klebsiella
- *Escherichia*

It is important to remember that many fecal coliforms are found not only in the gut of warm blooded mammals, but also in the gut of insects and reptiles, and therefore become part of the natural soil microbial flora. Depending on the food sample being tested, *E. coli* may be the **best indicator of fecal sanitation problems**.

S. aureus in excess of 100 per gram was detected in two samples from the same source: crab meat pieces, and finished crab and artichoke dip. *S. aureus* is found in marine environments, so this result suggested that either the source crab meat itself was contaminated with this pathogen, or improper shelling (food handling) led to the final contamination of the dip.

Table 3: Food Quality Check Samples Exceeding Guidelines, Raw Ready to Eat Food
January 1, 2004 to December 31, 2004

| Food Category | No. tested | Samples exceeding one or more guidelines | | Aerobic plate count > 100,000 per gram | | Total plate count > 1000 per gram | | Fecal coliforms >3 per gram | | <i>E. coli</i> > 3 per gram | | <i>S. aureus</i> > 100 per gram | |
|-----------------------------|------------|--|----|--|----|-----------------------------------|----|-----------------------------|----|-----------------------------|-----------|---------------------------------|---|
| | | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| Salads (fresh) | 12 | 3 | 25 | 3 | 25 | 2 | 17 | 1 | 8 | 0 | 0 | 0 | 0 |
| Produce (raw) | 13 | 7 | 54 | 6 | 46 | 6 | 46 | 1 | 8 | 0 | 0 | 0 | 0 |
| Sushi | 24 | 9 | 38 | 7 | 29 | 4 | 17 | 3 | 13 | 0 | 0 | 0 | 0 |
| Juice, unpasteurized | 15 | 14 | 93 | 14 | 93 | 10 | 67 | 8 | 53 | 4 | 27 | 0 | 0 |

¹ examples include green salad, greek salad

² examples include raw carrots, bean sprouts

One sample of fresh salad, one sample of raw produce and 3 sushi samples did not meet the fecal coliform sanitation guidelines, however, no *E. coli* was detected in these samples. Unpasteurized juices tested (wheat grass and sugar cane juice) failed one or more guidelines in 93% (14 of 15) samples, and *E. coli* was detected in 4 (23%) of the samples. It is likely that the source of contamination was the raw ingredients (wheat grass, sugar cane) that had no disinfection treatment prior to being used in making these beverages.

Table 4: Food Quality Sampling Results for Specific Pathogens
January 1, 2004 to December 31, 2004

| Food Category | Organism | No. tested | < 100 pg ¹ ND ² | Range |
|--|--|------------|--|--------------------|
| Meats, Dairy | <i>Bacillus cereus</i> | 4 | 0 | L10 |
| Rice, noodles | <i>Bacillus cereus</i> | 14 | 0 | L10 to 40 per gram |
| Lentils, green beans (raw, blanched), preserved lemonaioli | <i>Bacillus cereus</i> | 5 | 1 | L10 to 158 |
| Chicken, curry, saag, coleslaw and mixed vegetables | <i>Clostridium perfringens</i> , <i>E. coli</i> 0157:H7 and <i>Salmonella</i> spp. | 7 | 0 | L10 |
| Hot and cold smoked fish | <i>Listeria</i> spp. | 16 | 0 | L10 |

¹ Guidelines <100 per gram for *B. cereus*, *C. perfringens*

² ND = none detected for *Salmonella* and *Listeria* spp.

Specific pathogen sampling is conducted on foods to check processing sanitation (for eg, with sausages and smoked fish) and in support and follow-up of food poisoning outbreak investigations. All samples tested in 2004 met guidelines except for a sample of blanched green beans. *B. cereus* was also found in the raw green beans (at 70 CFU per gram) and bagged mixed green salad in the food outbreak investigation (data not shown in table).

Table 5: pH and Aw results for Sushi and Sushi Rice
January 1, 2004 to December 31, 2004

| Product | pH | | Aw (water activity) | |
|-----------------|------------|--------|---------------------|--------|
| | # of Tests | Result | # of Tests | Result |
| Sushi Rice | 4 | < 4.60 | 4 | > 0.92 |
| Sushi Rice | 3 | > 4.60 | 2 | > 0.92 |
| California Roll | 2 | > 4.60 | 2 | |

According to USFDA Evaluation and Definition of Potentially Hazardous Foods ⁽²⁾, a pH of 4.6 will control spore forming pathogens, and below 4.2 will control vegetative pathogens. No sushi rice samples tested met the criteria of a pH of 4.2 or below, and limited sampling of water activity in these samples confirmed that the water activity was greater than 0.92. Using the cut-off criteria of pH=4.6, four of the sushi rice samples were acidic enough to prevent growth of spore forming pathogens (such as *B. cereus*). Both California roll samples and 2 samples of sushi rice were considered potentially hazardous foods (PHF's).

Table 6: pH and Aw results for Miscellaneous Food Items
January 1, 2004 to December 31, 2004

| Product | pH | | Aw (water activity) | |
|--|------------|--------|---------------------|---------|
| | # of Tests | Result | # of Tests | Result |
| Pickles, relish, chutneys, picante sauce, salad dressing | 7 | < 4.00 | | |
| Ginger Sauce | 1 | 5.39 | | |
| Nacho cheese sauce | 1 | 5.77 | 1 | 0.978 |
| Fried onions in oil | 1 | 4.7 | 1 | 0.980 |
| Sugar Cane Juice | 2 | < 4.00 | | |
| Sugar Cane Juice | 4 | > 4.60 | | |
| Wheatgrass Juice | 1 | > 4.60 | | |
| Roasted Garlic Bread | 1 | 5.06 | 1 | 0.971 |
| Candies (chocolate covered almonds, pretzels, truffles, fudge) | | | 7 | < 0.800 |

Relishes, sauces, salad dressing and pickles tested in 2004 all had pH results below 4.00 (range 2.42 – 3.88). One ginger sauce, one nacho cheese sauce and one sample of fried onions in oil had pH values above 4.6, making them PHF's (*C. botulinum* spores, if present, have the potential to grow and produce toxin). Four samples of sugar cane juice and both samples of wheatgrass juice had pH above 4.6 as well. Of note, *E.coli* bacteria was present in 4 of these 5 samples (range 4 – 23 per gram). Sugar cane juice samples with pH below 4.6 had less than 3 (no detectable) *E. coli* bacteria present.

Table 7: pH and Aw results for Meat Products
January 1, 2004 to December 31, 2004

| Product | pH | | Aw (water activity) | |
|------------------------------|------------|--------|---------------------|---------------|
| | # of Tests | Result | # of Tests | Result |
| Capicola (Spiced dried meat) | 1 | 5.33 | 1 | 0.903 |
| Cacciatore Cured Pork | 1 | 5.99 | 1 | 0.783 |
| Dry Sausage | 1 | 5.60 | 1 | 0.760 |
| Pork Sausage | 1 | 6.97 | 1 | 0.787 |
| Landaeger Sausage | | | 1 | 0.839 |
| Farmer Sausage | | | 1 | 0.844 |
| Pepperoni Sticks | 1 | 6.88 | 2 | 0.845 – 0.894 |
| Hungarian Farmer Sausage | | | 1 | 0.922 |

Figure 4.
Cured meat products are shelf stable at room temperature when these conditions are met

| pH | Aw |
|-------|--------|
| < 4.6 | > 0.9 |
| > 5.4 | < 0.85 |
| < 5.4 | < 0.9 |

Three meat samples were found with water activity levels above 0.85. Products with water activity above 0.90 must be refrigerated unless the pH is below 4.6, as well, products with pH above 5.4 must be refrigerated unless the water activity is below 0.85, see Figure 4 for summary⁽³⁾. Using these criteria, one sample of pepperoni sticks (cheese flavored) and the Hungarian farmer sausage are considered PHF's requiring refrigeration.

Table 8: pH and Aw results for Fish Products
 January 1, 2004 to December 31, 2004

| Product | pH | | Aw (water activity) | |
|--------------------------------|------------|-------------|---------------------|---------------|
| | # of Tests | Result | # of Tests | Result |
| Hot Smoked Spring Salmon | 2 | 4.82 – 4.83 | 2 | 0.960 – 0.978 |
| Gourmet Smoked Salmon (frozen) | 1 | 5.66 | 1 | 0.886 |
| Sockeye Smoked Salmon | 2 | 5.91 – 6.16 | 2 | 0.988 – 0.989 |
| Cold Smoked Lox (frozen) | 1 | 5.92 | 1 | 0.953 |
| Candied Smoked Salmon (frozen) | 1 | 6.01 | 1 | 0.954 |
| Hot Smoked Sockeye (frozen) | 1 | 6.02 | 1 | 0.964 |

The water activity (above 0.85) is high in all fish products tested, and only two products have a pH below 5.00, but not below 4.60, therefore all products are considered PHF's and require refrigeration.

The Food Quality Sampling Program continues to provide EHOs with an important tool in educating operators on the hazards associated with poor food handling practices. Special thanks to our Food Laboratory and to all the EHOs that have participated in this program. Should you have any questions on this report, please do not hesitate to contact me at (604) 775-0763.

Yours truly,



Lorraine McIntyre, B.Sc., M.Sc.(candidate)
 Food Safety Specialist

cc: Joe Fung
 Judy Isaac-Renton
 Perry Kendall

REFERENCES

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