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# Safe preparation of Chinese cold dishes during major conferences: Identifying significant microbial hazards and relevant, perceived barriers

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ABSTRACT

Cold dishes are an essential part of Chinese cuisine offered in Chinese restaurants. So far, no data are available to identify significant microbial hazards and relevant, perceived barriers food handlers may have to take appropriate health and safety measures in food preparation. Two hotel restaurants serving foods for a conference were selected from a list of restaurants provided by the People's Liberation Army Institute of Disease Control and Prevention. Data collection took place during a 12-day conference held in 2012. The entire process of cold dish preparation was observed and participants were given a questionnaire to complete. The goal of a <10% risk level was set and a beta distribution was used to describe the probability of occurrence of each observable factor. Our results showed that only one step, product processing, had a significantly high risk level compared with the target limit (<10%). In this step, four factors – indoor temperature, concentration of chlorine bleach solution, hand disinfection, and wearing a mask – had significant, high risk levels compared with the target limit (<10%). Relevant barriers identified most often for the indoor temperature factor were "feels too cold in the room", "no signs/no reminders", and "no incentive/no desire to do it". The barriers to disinfecting their hands were "time constraints", "irritation to exposed skin", and "forgetting/having to remember". "Time constraints", "feels uncomfortable", "lack of masks", and "inconvenient" were the barriers identified most frequently to wearing masks. "Time constraints" and "lack of necessary tools" were the barriers identified against dispensing chlorine bleach solutions. These results provide insight into the high microbial risk level of cold dish processing in hotel restaurants. Effective interventions, therefore, must be developed and implemented to overcome relevant, perceived barriers of food handlers.



## 1. Introduction

Cold dishes are very popular traditional foods in China. Chinese restaurants usually offer a wide variety of cold dishes for consumers. These dishes may be prepared from cooked and/or raw ingredients and receive minimal processing before being consumed or distributed commercially. Preparations often involve direct manual handling, are usually done in advance and stored for a period of time before being served without reheating. These inherent properties and preparation processes appear to strongly affect their microbial safety and shelf lives (Cao et al., 2012; Ma et al., 2010). In addition, during a conference, a large variety of food and dishes are made available to satisfy assorted dining preferences. Usually cold dishes will account for a large proportion of those dishes, often nearly half of the total served, which increases food safety and health risks at these gatherings.

According to the Ministry of Health's statistics, although the number of reported foodborne illness has decreased considerably during the past few years, microbial foodborne illness is still among one of the most pressing problems with food safety in China (Pang, Zhang, & Xu, 2011; Wang & Liu, 2007; Xu & Zhang, 2012; Xue & Zhang, 2013). From 2001 to 2010, there were 5021 outbreaks of foodborne illness, affecting 140,101 people (Xu & Zhang, 2012). Among them, microorganisms were considered the most common causative agents, accounting for 40.93% of the outbreaks and 56.39% of the illnesses (Xu & Zhang, 2012). Many investigations reported that the majority of the incidents were often traced to

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microbial-contaminated cold dishes (Song, Zhuang, Wang, Lu, & Liu, 2012; Zhang et al., 2012; Zhang, Yin, Lu, & Zhai, 2012; Zheng et al., 2011). The implicated food locations were specifically associated with restaurants including hotel restaurants. Approximately 23.4% of the total incidents and 23.3% of the total illnesses occurred in restaurants (Xue & Zhang, 2013). Analysis showed that the quality of the cold dishes was affected by the types of dishes, cooking processes and environments in which they were produced (Jiao, Cao, & Li, 2009). Therefore, there is an urgent need to quantitatively evaluate the risk levels associated with various operational steps in preparing cold dishes.

The Health Supervision Department has taken measures to ensure and promote food safety. During major conferences, cold dish preparation must adhere to five special requirements: restaurants or hotels must provide food handlers, food preparation rooms and tools, as well as disinfection and refrigeration. However, a baseline standard for supervising food hygiene is still lacking, especially where cold dishes are concerned. Moreover, many studies suggest that more knowledge does not always translate into better behaviors (Cohen, Reichel, & Schwartz, 2001). Factors that have been found to negatively influence proper food handling practices included constraints in time, education and training, and negative consequences (Brannon, Pilling, Roberts, Shanklin, & Howells, 2009; Green & Selman, 2005; Pilling, Brannon, Roberts, Shanklin, & Howells, 2009; Pilling, Brannon, Shanklin, Howells, & Roberts, 2008). Thus, research is also needed to identity the barriers that prevent employees from following proper food safety practice. An overall understanding of cold dish preparation, potential microbial risks and possible barriers attributable to food handlers' perceptions will provide key information for enhancing food safety management.

To further promote the safety of cold dishes during major conferences, we conducted a study to identify potential microbial risks and possible perception barriers associated with various preparatory steps. Our goal was to help guide food safety supervision to mitigate or eliminate the potential microbial hazards in cold dish preparation.

## 2. Methods

### 2.1. Subjects

Two hotels that serve foods for a conference were selected randomly from a list of restaurants provided by the People's Liberation Army Institute of Disease Control and Prevention. The two hotels had a total of four cold rooms. The restaurant managers were informed of the scope of the study and the benefits of participation, and were asked to permit researchers to recruit their food handlers to participate. Thirty-two participants included all the cold dish handlers, who had both obtained a health certificate and completed health education training. Random identification codes were used to maintain participant confidentiality. Ethical approval was obtained from the Local Human Ethics Committee. A goal was set to decrease the operational food safety risk level. A risk level of $\geq$10% indicated a needed improvement for food safety management.

### 2.2. Observation

A wide variety of cold dishes are usually served for consumers in a conference: some may involve cooking, some are just prepared from raw ingredients, and some are mixed with both cooked and raw ingredients. Cold dishes may be prepared in advance and stored at room temperature for a period of time before serving and they are not usually reheated before consumption. During the conference, four cold rooms were visited once every day. The observation form included five processing steps encompassing 13 observable factors. Five processing steps were receiving, rough processing, cold storge, product processing, and transmission (the step from kitchen to the buffet table). 13 observation factors were "buy food materials from licensed suppliers with reliable food sources", "use separate utensils to handle raw food", "heat food thoroughly with core temperature at 75 °C or above for at least 30 s", "kept in the refrigerator at below 10 °C", "kept indoor temperature at below 20 °C", "make chlorine bleach solution's concentration exceed 250 ppm", "disinfect hands after soap and water hand washing", "wear mask during food handling", "take raw food separately from cooked food to avoid cross-contamination", "do not take too much food at a time to avoid leaving food for too long", "foods should be well covered before transferring them from the kitchen to the buffet tables to avoid food contamination during transport", "do not display foods earlier than necessary and display them in small portions to avoid leaving food at room temperature for longer than 2 h", and "leftovers should not be (served again) put out and do not mix them with freshly prepared food".

### 2.3. Survey instruments

Baseline assessments consisted of two components: an on-site visit to observe food handling practices and obtain objective data related to those practices and a written questionnaire directed at food handlers, to identify the most obvious barriers to implementing food safety practices. The on-site assessment form was developed based on a food hygiene supervision quantitative assessment form provided by the People's Liberation Army Institute of Disease Control and Prevention. Two researchers were trained to use the assessment form. Before conducting assessments, the two researchers visited a cold dish room to test the assessment form and the process. They all conducted assessments of the cold dish operation and food handling practices. A multi-part written questionnaire was developed to identify the most obvious barriers. These questions were related to observable factors such as indoor temperature, concentration of chlorine bleach solution, hand disinfection, and wearing a mask. The questionnaire was pre-tested by 10 food handlers to identify concerns and suggestions. All suggestions were considered and used to revise the questionnaire before data collection.

### 2.4. Data collection

Data collection occurred between November 4, 2012 and November 15, 2012. Data were collected by on-site visits to observe food handling practices and to obtain relevant objective data. Each day, trained researchers observed the entire process of preparing cold dishes, including receiving, rough processing, cold storage, product processing, and transmission. Researchers recorded daily observations during food processing tasks. Objective measurements such as temperatures (of food, refrigerators and freezers) were taken with calibrated, tip-sensitive digital thermometers (Zhongwei, Beijing, China), and available chlorine in sanitizing solution was checked for correct concentrations using test strips (Zhongwei, Beijing, China). Participants were also given a questionnaire to complete and asked to answer questions based on factors that were involved in food production. To improve the quality of data obtained, they all gave the opportunity to think about their answers. Subsequently they were asked to fill out the questionnaire. At the same time, the two researchers documented the data by taking notes on a blank questionnaire on which the questions were listed. A response was documented if a person stated the barrier.