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Meal Quality and Employee Satisfaction at Inflight Catering using the Cook-Chill System

Norhayati Mat Yusoff[1*], Mohd Salehuddin Mohd Zahari[2], Fatimah Abd Ghani[3], Agus Sudono[4]
** Corresponding Author*

[1] Department of Foodservice Management, [2] Department of Culinary Arts & Gastronomy, Faculty of Hotel and Tourism Management, Universiti Teknologi MARA, Puncak Alam Campus, 43200 Selangor, Malaysia. [3] Department of Foodservice Management, Faculty of Hotel and Tourism Management, Universiti Teknologi MARA, Dungun Campus, 23000 Terengganu, Malaysia. [4] Catering Industry Management Program and Tourism Department, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudhi No 229, Bandung, Indonesia.

norhayati@uitm.edu.my, salehuddinm@uitm.edu.my , fatim131@uitm.edu.my, sudono@upi.edu
Tel: +6012-3442042

Abstract
More than one billion meals are served in flights annually, making airline catering a lucrative industry. This study is to assess the meal quality of in-flight catering company that uses the cook-chill system and its relation to the employee's job satisfaction. Using a quantitative approach, 117 questionnaires were given to the workers to describe their experience. The findings revealed that cook-chilled meals had consistent quality, palatability, flavor and appearance, and were strongly related to the workers' job satisfaction (r=0.758 and 0.709, respectively). Therefore, the cook-chill system is appropriate for mass production, but the safety and quality still depend on employee motivation.

Keywords: Cook Chill System; In-Flight Catering; Meal Quality; Employees' Satisfaction

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1.0 Introduction

The food service industry is the final front of the food supply chain and plays a vital role in ensuring that a nation has enough to eat. It is a competitive industry with many establishments, such as restaurants, caterers, cafeterias, vending companies, hotels, and rehab and retirement centers. According to the United States National Restaurant Association (2020), commercial food service has a progressive outlook due to the increasing number of urban consumers, particularly in the supply of takeaways and ready-made meals.

In the aviation sector, in-flight food services have been used as a marketing strategy by many airlines. Some have even invested a great deal in in-flight catering to create a memorable flying experience (O'Hara and Strugnell, 1997). Jones and Jew (2007) stated that in-flight catering is one of the largest industries in the world, serving more than one billion passengers annually. For example, the Emirates Flight Catering Facility in Dubai, the United Arab Emirates, prepares around 180,000 meals for an average of 481 flights daily. And it takes 10,000 employees to operate the facility. Due to the massive quantity of food involved, in-flight catering may be the most complicated operational systems in the world, with demand and supply being dictated by distance and time. Many airline caterers are putting tremendous effort into ensuring the quality of their in-flight meals, thus creating a more "intelligent concept of catering" (Thorpe, 1998).

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Some airlines have reportedly hired high-profile, experienced chefs to design menus, manage meal production and maintain quality (King, 2001).

The cook-chill system has emerged as the most crucial method of meal preparation that in-flight catering companies have widely adopted. Nettles et al. (1997) stated that the system is one of the most effective and viable means of producing meals on a large-scale operation. The system involves preparing and cooking food using conventional methods. The cooked food is quickly cooled down by blast chilling and subsequently stored at temperatures above freezing point (>0°C) before packing or serving (Payne-Palacio and Theis, 2011). In-flight catering operations usually use a modified system to produce ready-to-eat meals.

Although the system works best in large-scale food production, conventional cooking operations still subject catering employees to many challenges in preparing quality, hygienic meals that must be delivered on time. The workers must comply with extra precautions and instructions on good practices in the cook-chill system. Nekoeui et al. (2014) contended that capable and satisfied employees must resolve operational problems, and technology application can enhance their satisfaction. Despite this, the assessment of meal quality, quality control, and workers' satisfaction in using the cook-chill system have not been holistically investigated, especially in the Malaysian context. Therefore, this study aims to answer three research questions:

i. What is the in-flight catering employees' perception on the quality of cook-chilled meals?
ii. What do in-flight catering employees think about the quality control of cook-chilled meals?
iii. Are employees satisfied with the quality of the meals they produce?

2.0 Literature Review

2.1 In-flight catering

Airline meals are usually prepared in advance and are catered to the number of flights and passengers. The use of modern and sophisticated equipment for in-flight catering began in the mid-1950s when incorporated cooking appliances into the aircraft design to enrich the passengers' dining experience. Early aircraft had freezers and ovens installed in the galley, where frozen meals could be defrosted and reheated before being served (O'Hara and Strugnell, 1997). Sometimes, they may also prepare fresh food on long-haul flights. Since then, in-flight catering has grown into a multi-million-dollar business and continues to mushroom as air travel becomes accessible to all segments of society. Most airline companies have, in fact, given serious attention to their in-flight meals. In the 1980s, most airlines had their catering division, with production facilities based at significant airports worldwide (Dana, 1999; Pincus, 2001).

This situation, however, changed in the early 1990s when in-flight catering was contracted out to specialized companies. King (2001) stated that the main reason for doing so is to reduce high operational costs and enable the airlines to concentrate on other requirements. Kansai In-Flight Catering, Gate Gourmet, Alpha Flight Services, and LSG SKY Chefs are examples of multinational in-flight catering companies responsible for preparing thousands of meals for various airlines. These catering companies employ specialist chefs and food connoisseurs to design menus to satisfy an increasingly demanding market (Dana, 1999).

2.2 The cook-chill system and its challenges

The cook-chill system is utilized globally, but little research has been conducted on its application. It is adaptable and expandable to meet rising demand without compromising food safety, consistency, and quality (Kim and Shanklin, 2006). The system prepares food at relatively high temperatures (around 100 °C), followed by rapid cooling and chilled storage. The production process deals with various sequences of processing phases, producing a huge variability of food products (Daelman et al., 2013). The prepared meals are placed in closed carts and transported in refrigerated lorries from the central kitchen to satellite facilities (Mail, 2013).

Catering companies using this system may benefit from cost savings and increased profitability through bulk purchasing, higher productivity, and better equipment utilization and process control (Rodger, 2005). In addition, enhanced cook-chill systems allow food to be prepared on a three-week menu cycle, in which the preparation, cooking and tray assembly are independent of meal time (Lataf et al., 2020). A typical cook-chill process starts with the cleaning and preparation of ingredients. Cooking reduces microorganism contamination, prevents spoilage and inactivates enzymes that cause quality loss in meals (Hasnana and Ramlib, 2020).

According to Yusoff et al. (2022), cooking and blast chilling of food have become methods to increase the shelf-life and retain freshness of food. They added that the cook-chill system may be applied to almost all kinds of cooking, regardless of whether they are Eastern or Western dishes. Implementation of quality control legislation and good manufacturing practices, such as Hazard Analysis Critical Control Point (HACCP) protocols, can help reduce the risk of contamination (Bekhit and Roohinejad, 2016).

Cook-chilled food may be reheated just before consumption using a microwave, hot air, or steam oven. However, hot-air and microwave ovens have limited functions as the former may cause food to become burnt and dry, whereas the latter's heating is uneven, which results in some parts of the food becoming hot while others remain cold (Bekhit and Roohinejad, 2016). In addition, microwave reheating can be carried out only on small quantities of food due to the small size of the oven.

Cook-chilled meals have excellent safety and quality record, making them more appealing than food preserved with other methods. The processing conditions are more or less clear, but there are some challenges, such as optimizing the sensory properties of food and developing a wide range of meals that can match cook-serve options (Bekhit and Roohinejad, 2016). The cook-chill system is tedious, and workers need to adhere to various protocols relating to hygiene, equipment, production, temperature, and many others (Yusof et al., 2018). It is also challenging to train or find workers with the knowledge, familiarity, and commitment to implement HACCP principles (Mudey et al., 2010; Lamuka, 2014; Yusoff et al., 2022).

2.3 Meal quality

To prevent food poisoning, meal quality is crucial and must be prioritized. Bobeng and David (1998) defined quality as an overall characteristic encompassing microbiological, nutritional, and sensory attributes. Kim (2002) noted that the period between food preparation and consumption is critical to prevent microbial contamination and nutrient loss, and it should be kept as short as possible. On the other hand, El-Ansari and Bekhit (2014) argued that using fresh and high-quality raw materials is essential to guarantee food quality. Microbial contamination and growth may be eliminated in cooking and subsequent storage at low temperatures. The standard cook-chill system requires a thermal treatment of food at between 65 and 80 °C, followed by chilling to between 10 and 3 °C within one-and-a-half to four hours before storing within 0 to 3 °C (Hill, 1995). Super-cooling conditions have been recently used to extend the shelf-life of meals by maintaining their temperature at -1 or -2 °C and the food is also subjected to vacuum treatment known as “sous-vide” to retain nutrients and freshness (Nyati, 2000).

In terms of food quality, most food establishments are very particular on the level of cleanliness by ensuring that all preparations strictly followed operational standards. In-flight catering is no exception, which needs to ensure that the food served to passengers and the aircrew are safe to consume. The researcher also observed that employees who are happy in their jobs are more likely to participate in their organizations and be committed in providing high-quality services (Lee and Ko, 2016). Many airline caterers have devoted considerable resources in their marketing strategies to guarantee the high standard of food they serve (Cho and Bae, 2017). To achieve this, it is important that the food is prepared in a workplace that has a high level of motivation. Thus, we propose:

H1: There is a relationship between the quality of cook chilled meals and in-flight catering employees’ level of satisfaction.

2.4 Quality control

Quality control ascertains that the meals meet the required safety regulations and requirements. According to Chen and Zhang (2014), quality control is an essential aspect that needs to be implemented and managed across various stages, including sourcing, processing and packaging. HACCP models were initially developed for meal production in hospital food service systems (Herath and Henson, 2010). Time and temperature were critical control points throughout meal production in each model where the parameter was established for critical control points. Campers et al. (2012) posited that equipment and personnel hygiene are vital aspects in establishing standards in food preparation. Determining quality control effectiveness includes continuous monitoring critical points related to time and temperature. Sanitation of equipment and personnel should be monitored using established standards.

Regarding quality control of cook-chilled meals, some parameters should be checked and recorded for every batch of meals produced (Food Safety Advisory Committee, 1991; Lyra et al., 2018). The parameters include the quality of raw materials at the point of entry, the temperature used to store perishable ingredients on delivery and before preparation for cooking; the central temperature of ingredients during cooking; elapsing period of portioning process; elapsing period of the cooling process; the time of chilling process for portioned meals; and central temperature of meals after the chilling process as recorded by automatic instruments. Others are the temperature of the food during storage and the air temperature of the chilling storeroom; the temperature of the food before and after refrigeration; the temperature of the food after its distribution; and the central temperature achieved during reheating each meal. In short, many parameters must be monitored to ensure strict quality control of the production schedule. Despite the importance of preparing in-flight meals under strict quality control, many studies on airlines mainly focused on their overall service quality (Lee and Ko, 2016; Ansari, 2015) and passengers’ perception of the in-flight food (Cho and Bae, 2017; An and Noh, 2009). However, there are few studies that related catering employee satisfaction with the quality control of food served. Thus, we also propose:

H2: There is a relationship between quality control and in-flight catering employees’ level of satisfaction.

2.5 Employee job satisfaction

Employee satisfaction is an essential aspect of any organization because it influences the method and manner in which employees perform. The meaning of employee satisfaction has been defined by various academics (Wan, 2007; Navimipour and Zareie, 2015; Coetzee and Stoltz, 2015). Robbins and Judge (2009) state that the workers’ emotional behavior toward their job allows them to find confidence, comfort, rewards, happiness, personal recognition, and other positive opportunities, such as upward mobility and appraisal, leading to better rewards. Employee satisfaction is assumed as one of the most critical factors influencing company performance. According to Matzler and Renzl (2007), employee satisfaction has received crucial attention among researchers, and many businesses have been investing in improving their workers’ skills in the past two decades. It cannot be denied that employee satisfaction is related to crucial issues in the service industry (Lam, Zhang, and Baum, 2001). Chi and Gursoy (2009) said that giving employees a superior internal working environment may likely boost satisfaction and nurture organizational loyalty, besides providing outstanding service to customers.

To achieve high organizational standards, employees need an environment that allows them to work freely (Raziq and Maulabakhsh, 2015). The working environment is a crucial component, and workers who work under challenging conditions will end up feeling dissatisfied with their jobs (Bakotic and Babic, 2013). As noted by Ali and Farooqi (2014), employee dissatisfaction may reduce work efficiency. The authors found that female employees burdened by household responsibilities may become dissatisfied with their jobs if their workload is increased. There is abundant literature on consumer satisfaction devoted to domestic products (Ting and Chen, 2002; Brady and Robertson, 2001; Yeh, Chen, and Chen, 2019).

3.0 Materials and Methods

This cross-sectional study applied a quantitative approach using a self-reported questionnaire by Yang (1991). The study respondents were food production workers at an in-flight catering company based in Kuala Lumpur, Malaysia (Pos Aviation Sdn. Bhd). The survey instrument consisted of three sections: Section A solicited the respondents' demographic profile, Section B assessed the quality of meals they produced and quality control measures adopted in their job, and Section C asked about their job satisfaction. Respondents answered the questionnaire by stating their views on a five-point Likert scale ranging from 1 (very poor) to 5 (Excellent). The original questionnaire in the English language was translated to Bahasa Malaysia by a language expert before being distributed to the employees. A pilot study was conducted to verify the reliability and validity of the items used before a final version of the questionnaire was confirmed.

The questionnaires were distributed to respondents through the catering company's human resource department. The manager was briefed on the aim and purpose of the survey. After receiving approval, the questionnaires were presented to respondents who were gathered in batches. A total of 170 food production employees were identified to participate, but only 117 returned a complete questionnaire. The data was analyzed using the IBM SPSS version 22 (IBM Corp, Armonk, NY, USA). The descriptive statistics were compiled, and the Pearson Correlation Coefficient was used to determine the association between variable groups.

4.0 Results

4.1 Respondents' profile

Among the 117 respondents, there were slightly more female workers (n=68, 58.1 %) than males (n=49, 49.1 %). The majority of them were single (n=76, 65 %), followed by those who were married (n=28, 23.9 %) and a small number of divorcees (n=13, 11.1 %). Most respondents were approaching middle age, between 31 and 40 years old (n=50, 42.7 %). Young adults aged between 26 and 30 comprised 38.5 % (n=45) of the respondents, and those between 18 and 25 were 14.5 % (n=17). The 41-50 age group, mainly comprising veterans, made up 4.5 % (n=5) of the group. In terms of educational status, 42.7 % (n=50) had attained a diploma, 34.2 % (n=40) had a degree, 13.7 % (n=16) possessed a certificate, and 9.4 % (n= 11) completed secondary schooling. With regard to working experience, 59.3 % (n=93) had worked in the company for two to three years, 11.1 % (n=37) had worked more than four years, and 9.4 % (n=11) were juniors with less than a year's experience.

4.2 Descriptive statistics

The mean scores of the Likert scale answers for each item in the questionnaire were compiled and presented in Table 1.

Table 1: Average scores (±SD) of questionnaire items by workers in an in-flight catering company in Kuala Lumpur, Malaysia.

Code	Items	Mean	S.D
Section B1: Quality Meal			
QM1	Consistent quality food	4.50	.593
QM2	Increasing the palatability of food	4.67	.491
QM3	Flavor	4.35	.551
QM4	Food product appearance	4.25	.589
Section B2: Quality Control			
QC1	Good quantity control	4.39	.643
QC2	Serving temperature	4.32	.567
QC3	Microbiological condition (amount of bacteria safety of the food)	4.36	.595
QC4	Nutrient retention	4.20	.631
Section C: Worker's level of Satisfaction			
SL1	Overall quality of meal	4.07	.716
SL2	Overall food quality control	4.19	.730
SL3	Productivity	4.16	.589
SL4	Less hazard of food poisoning	4.12	.613

On the quality of meals, the magnitude of mean scores in the five items was between 4.25 and 4.50, indicating most respondents agreed that consistency, palatability, flavor and food product appearance were good. With the mean scores ranging from 4.20 to 4.39, respondents also agreed with all four quality control items, namely temperature, microbiological safety and nutrient retention. Regarding job satisfaction, the majority of respondents were satisfied with the overall quality of the meals they produced, in addition to quality control, productivity and hazard of food poisoning items. Their average scores ranged from 4.07 to 4.19.

4.3 Hypothesis testing

In response to the two proposed hypotheses, the Pearson product-moment correlation analysis was undertaken to describe the strength and direction of the linear relationship between the variables of interest. Dancey and Reidy (2004) stated that in a correlation indicator, a correlation coefficient (r) value of 1 indicated a perfect relationship between two variables, whereas 0 showed no relationship. Table 2 below shows the regression analysis output of the hypotheses in relation to employee satisfaction.

Table 2: Summary of Pearson correlation analysis on association with employee satisfaction

		Level of Satisfaction
Quality meal	Correlation Coefficient	.758**
	Sig. (2-tailed)	.000
	N	117
Quality Control	Correlation Coefficient	.709**
	Sig. (2-tailed)	.000
	N	117

**. Correlation is significant at the 0.01 level (2-tailed).

There was strong correlation between meal quality (r = .758**) and employee satisfaction. This value explained that 75.8% in employee's job satisfaction has significant relationship toward meal quality of using cook chill system at this inflight catering. This clearly indicated that the company's product consistency, palatability, flavor and appearance were strongly influenced by the employees' happiness in their jobs. This result clearly supported Nanu (2020) that an employee's meal in term of food quality has significant impact on employee satisfaction and satisfaction were essential to achieve company performance. It is also strengthened the consensus among researchers that high employee satisfaction could lead to more engagement in a company, which in turn, would yield excellent performance (Markos and Sridevi, 2010; Sunday, 2011).

Similar to meal quality, there was also a positive correlation between quality control (r = .709**) and employee satisfaction. This value clarified that 70.9% in employee's job satisfaction has significant relationship with quality control implement at Pos Aviation Sdn. Bhd. This finding verified well with Busra et.al (2017), which reported that food prepared under high quality control measures could greatly enhance patient satisfaction in hospital stays. In fact, the evaluation of quality control could be more important than food appearance.

5.0 Discussion

The implications of this study could be looked at from two perspectives. On the academic side, the findings offered theoretical and methodological knowledge, such as the understanding of how catering employees' job satisfaction could affect the quality of the cook-chilled meals they produced. This study found that both variables were strongly correlated. In other words, the quality of the cook-chilled meals in terms of consistency, palatability, flavor and meal appearance, and quality control indicated in temperature, microbiological safety and nutrient retention were strongly associated with the catering employees' level of job satisfaction. This finding had, therefore, contributed knowledge that could better utilize the cook-chill system. The results could be used as a reference for other researchers to expand similar studies in a much broader scope.

In the practical perspective, the airline industry is one of the main contributors to the national economy. The positive development of travel and tourism has created greater competition among catering companies in providing good quality in-flight meals**.** As Malaysia is trying to revive its airline industry after the COVID-19 pandemic by attracting more local and international passengers, thus, implementing the cook-chill system could be the most affordable and practical method to produce large amounts of quality in-flight meals. All those mentioned elements were positively dependent on catering employees who prepared the meals. Some businesses, in fact, realized that the cook-chill system could reduce labor cost, resolve the difficulty in finding skilled workers, increase productivity and bring an effective service delivery. The system was not complicated to implement and did not require substantial manpower compared with other methods; hence it could also be implemented in small organizations like restaurants, corporate catering, and even school canteens.

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Limitations and directions for future research

The apparent limitations in this study and recommendations for future research must be highlighted. The quantitative approach in assigning value to the data could undoubtedly symbolize the relationship between relevant variables, but it would not completely answer issues in a wider context. Using the mixed approach could be expensive and time-consuming, but it might offer deeper causality inferences and enhance the understanding of survey complexities. A survey involving more in-flight catering companies and interview with the top management would provide better insight and a detailed picture of the subject being studied. Therefore, comprehensive and accurate results could be obtained.

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