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DEPARTMENT OF NUTRITIONAL SCIENCES

**DINING AT UNIVERSITIES IN NORTH CHINA:
LOOKING AT THE IMPACT OF FOODSERVICE OPERATIONS
ON STUDENT NUTRITION**

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ABSTRACT

The nutrition situation in China is complex. An increasing obesity and over-nourishment trend is reported among older adults, while young college students demonstrated undernourishment. This gigantic population group spends their academic years living on campus and they eat almost exclusively from the university food service (UFS). Therefore, this study aims to find out if the current way of operating and managing UFS in North China affects college students' nutritional health. This three-part study collected and evaluated both qualitative and quantitative data. The analysis was based on: 1) an online satisfaction survey, 2) eighteen extensive interviews with four UFS managers, two UFS staff members, eleven student participants, and one faculty member recruited from six top-ranked North Chinese universities, and 3) observation and nutrition analysis of menus. All data were evaluated and integrated to arrive at the final conclusion. Overall, a possible negative impact of UFS on students' nutritional health was found among the participating universities. Energy, protein, vitamin D, and calcium adequacy, as well as sodium excess are major areas of concern. The situation may be further complicated by the privatization movement in North China, as well as by insufficient nutrition education among both the population group and the UFS staff. The findings and recommendations suggest meal quality improvements in Chinese UFS. The findings could also be used to initiate nutrition promotion programs and to inspire future in-depth studies on the nutritional status of this population.

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Chapter 1

Introduction

College is a unique stage of life, in which teenagers are moving on to their young adulthood and are starting an independent life away from home. In China, there are approximately 27 million young adults currently enrolled in more than 2300 universities or community colleges (Ministry of Education of the People's Republic of China, 2010), and this gigantic group of young adults spend most of their time studying and living on campus. The Centers for Disease Control and Prevention (CDC) recognized eating as an automatic behavior, which is affected by the food environment (Cohen DA, & Farley TA, 2008). Therefore, the college food facility and service may have a considerable impact on the students' overall dietary quality and health. Even though the Ministry of Education provides public universities and colleges with financial assistance to maintain affordable food prices for students (The Central People's Government of the People's Republic of China, 2012), creating a food environment that promotes nutrition and health among this population group is still perceived as beyond the mission for both college food services and students.

This study was conducted to learn how food services operate in top-ranked universities in North China, as well as to evaluate the food quality in these food service facilities, and begin to address hidden nutrition issues. This study employed qualitative methods associated with quantitative methods to collect and analyze data, and to examine food service facilities in North China from both student and management perspectives.

Chapter 2

Background & Literature Review

Nutrition in Emerging Adulthood

The nutritional health of young adults during their college years is just as important as during other life stages. The nutritional status not only impacts the wellness of later adult life, but also plays a role in promoting the health of a wider community.

The concept of “emerging adulthood” was proposed and defined by Dr. Jeffrey Arnett as the transitional stage from adolescence to early adulthood (Arnett, 2004). Dr. Arnett recognized the dissimilarity between young emerging adults and the conventionally defined adults. This difference is partially attributed to the modern lifestyle, including continuing education and postponing marriage. Although these young adults start to take up an increased amount of adult responsibilities, an advanced education allows many of the emerging adults to start independent lives without getting married.

College students, typically between ages 18-26, are the essence of this group. In an article published by the University of Washington, the authors stated that this transitional stage is a time in which developmental continuity will be encouraged and reinforced. It is also a time that provides opportunities for change (Hawkins et al., 2004). The continuity and change in health behaviors established during this stage will influence and predict the population’s future health and wellness. Examples include the risks for obesity and diabetes (Brown, 2010; WHO Technical Report Series, 2003).

Moreover, researchers have found that children's healthy eating behavior is positively associated with their mothers' education, nutritional knowledge, and food-related health attitudes (Al-Shookri et al., 2011). This finding thus implies that college students' nutrition knowledge and attitude relate to both their own health status and that of the future generation. As the highly-educated population group, we can expect that their health beliefs will influence a wider community and future generations (Barzegar et al., 2011). This is especially relevant in developing countries such as mainland China.

Nutrition Issues in Mainland China

Obesity is a leading risk factor for many chronic diseases, and it is now a worldwide problem. The National Health and Nutrition Examination Survey found that in Year 2009 and 2010, 35.7% of the adults in the United States were obese (Ogden et al., 2012). In 2012, the World Health Organization reported a rising obesity trend in both middle- and low-income countries (WHO, 2012). The information proves that obesity is no longer a developed country's issue, but is a challenge faced, or to be faced, by the entire world.

The situation is more complex in mainland China. The problem of overweight and obesity was recognized by the government, and has been set as a priority of the Chinese Centre for Disease Control and Prevention (Chen, & Zhao, 2012). Yet among college students, nutrition inadequacy seems to be a more dominant concern than obesity. Researchers believed that the undernourishment among Chinese college students was associated with their food choice and nutrition behavior.

The literature I had access to showed mixed results in regards to the nutritional status of college students. During the review process, the major challenge I encountered was that the original primary research papers were not accessible to the public on government websites or in

online databases. The most common form of literature I used was review articles in various university journals that summarized multiple primary research papers. Among these review articles, the studies were mostly university-based; furthermore, those studies had a vague common measurement standard. For example, different researchers categorized the “underweight” and “overweight” groups based on different standards (e.g. BMI, population percentile, or other standards that may be common in China but not universal), but the review article authors did not specify the exact standards and cut-offs. Therefore, for the purpose of this paper, I will only use the words “under-nourished” and “over-nourished” to discuss the nutritional status mentioned in the articles.

An article in *Journal of Luoyang Normal University* (Shan & Liu, 2012) reviewed the data from past studies done in six (or maybe more) areas of China from Year 2003 to 2009. In this article, the reported percentages of over-nourished students varied greatly from one participating university to another: it was as little as 1.78% in one university, 21.47% in another; there did not seem to be a recognizable trend. Based on their data, the author did not conclude that obesity was a problem in this review article. Possible explanations for the variance were the geological location and university academic ranking. For example, low-ranked universities located in the less developed area tend to have minimal over-nourished students, which may correlate to the socioeconomic status of the students in that area.

In spite of the unclear over-nourishment trend, undernourishment among the students was implied. In the same article, the percentage of under-nourished students varied from 26.9% to 46.9% in participating universities, which was considered significant. This finding was presented not only in this article, but multiple other ones, such as the review articles published by the *Journal of Jinggangshan Medical College* (Huang & Huang, 2001), and by the *Henan Journal of Preventative Medicine* (Wang et al., 2012). Along with the issue of undernourishment, the

authors of these articles also revealed that protein, calcium, vitamin A, vitamin B2, and iron intake were inadequate in the participating students. Unfortunately, the suspected nutrient inadequacies were not backed up with specific evidence or data.

The finding of undernourishment is an ongoing problem in China. I found that although Huang & Huang (2001) collected data in the late 1990s, while Shan & Liu (2012) collected data in the 2000s, several nutrient inadequacies were consistent over time. The studies in both review articles found that Vitamin A, Vitamin B₂, Vitamin C, calcium, and protein were inadequately consumed among college students. The intake of iron was found to be adequate, but studies still showed that the prevalence of iron deficiency anemia in female students was as high as 26.08%.

Even though the two reviews were ten years apart, nutritional status in college students did not show significant improvement. Based on these studies, I conclude that in spite of the unclear measurement standards, undernourishment in college students is still a problem in Mainland China, and it deserves our attention.

In addition to the two major review articles mentioned above, some other studies proposed factors that contribute to the undernourishment problem. The major factors from all these studies are summarized below:

1. Poor nutrition knowledge

Shan & Liu (2012) found that college students had surprisingly low nutrition knowledge. Through questionnaires and surveys, the researchers found that 80% of participants could not correctly answer the most basic nutrition questions, and more than 80% of participants did not know any information given in the Dietary Guidelines for Chinese Residents.

2. Negative body image perception

Compared to male students, female students had a stronger desire to be thinner and were more likely to adopt a weight-loss diet. It was found that 65% of female Chinese students who were normal weight or even underweight (BMI <20) indicated dissatisfaction with their current body weight (Sakamaki et al., 2005). The problems associated with negative body image perception are found in many other countries around the world, and appears to be a leading contributing factor to undernourishment in female Chinese students, as well. In fact, many researchers believed that it was the most important factor that contributed to the undernourishment trend.

3. Poor food choices and eating habits

According to surveys, 43.1% of students consumed deep-fried food and instant noodles on a regular basis (Li et al., 2012), and only 65% of students had regular breakfasts (Yang, 2012). This factor is relevant in other countries outside Mainland China, and it may also contribute to this circumstance in China.

Factors that Influence Chinese Students' Lifestyle

Most researchers assumed that negative body image perception and poor food choices were attributed to personal decisions and lifestyles. However, for this particular population group, both personal decision and lifestyle could be influenced by other elements. For instance, the quality of the food served by university food services (UFS) may highly influence the food choices of students living on campus.

Based on the available data, we could not determine the percentage of students who live on campus; therefore, my inference was shaped by the following two evidences.

1. Living on campus as social necessity

Although only some universities clearly announced a mandatory housing policy, living on campus has always been perceived as a social necessity among Chinese students. For this reason, the students voluntarily choose to stay in dorms throughout their four-year undergraduate programs. This as well applies to single students in Master's or PhD programs, who also choose to live on campus throughout their program.

2. Heavy academic load

Despite the housing policies of the university, many students choose to stay on campus for academic reasons in addition to social reasons. During the first three years of a four-year undergraduate program, a typical student has to attend as many as 18 class periods per week, including evening classes that end around 9:30pm. In addition to the class schedule, mandatory study hours in the late afternoons and evenings are also common in many universities (Mavrides, 2006).

Due to these two reasons, living on campus would be viewed as a preferred choice for most students. As a result, UFS would become the primary food source for these on-campus students, and its operation could have a direct effect on students' nutritional status. The background information on UFS is presented in the following sections.

University Food Service (UFS) Satisfaction

As mentioned in the previous section, the majority of college students in China are assumed to live on campus. University Food Service (UFS), being their primary food resource, could directly influence the students' diet pattern, and impact their nutritional status. Several

extensive surveys were carried out to assess student satisfaction as well as to evaluate food service quality in UFS.

College students were widely recognized as the captive audience of UFS. According to a survey done in Henan Province, 94.7% of participating students claimed to eat regularly at the UFS (Wang et al., 2012). In a well-designed satisfaction study done in Jiangxi Province, 63.3% participants went to UFS 15-21 times per week, and 28.6% of participants went to UFS 8-14 times per week (Gao, 2011). We could infer from these data that the majority of students visit UFS more than once per day for any given week during the academic term.

In both studies most participating students reported average satisfaction (2.8 on a scale of 5), with concerns about food quality and safety. In fact, 72.3% of students reported to have some experiences of stomach discomfort, diarrhea, or vomiting after dining in UFS. In the last quarter of year 2010, 12 out of the total 54 cases of severe food poisoning happened in school canteens (Wang et al., 2012).

Based on the information presented above, it is reasonable to believe that student health is associated with UFS due to the frequency of visits. On the other hand, it remains unclear whether the satisfaction correlates with their nutritional health.

Higher Education Institution and UFS Reform

The way Chinese universities and UFS operate has changed substantially in recent years due to a reform policy that was established in 1999 by the Ministry of Education. Public universities used to recruit students almost entirely based on government plans, and all supporting facilities were owned and managed by the institution prior to the reform. In contrast, the reform policy of 1999 encouraged the universities to run like a private business firm, which may include transferring the ownership of the UFS.

In fact, the public universities attempted to adopt this business-like operating system in 1980s. According to a dissertation from The State University of New York at Buffalo (Yuan, 2008), this system had three main characters: 1, the institutions operated based more on customer (student) needs than government demands; 2, institutions were accountable for their own decisions and finances; and 3, the institutions depended more on supporting services (e.g. UFS) to make revenues for the university.

Under the influence of this business-like system, many institutions introduced a large-scale expansion in enrollment based on students' needs. As a result, the university-owned UFS facility could not maintain profitability, and thus experienced difficulties in keeping up the service for the rapidly-growing number of customers. In consideration of this scenario, the Ministry of Education published a policy on "Logistic Privatization Reform" in 1999. This policy allows public universities to contract their UFS to private providers in order to accommodate the increased demand from the students while making profits.

This relatively new reform in privatizing UFS brought a contradiction to the nature and priorities of UFS in public institutions. In the article from *The Financial Sector* (Jiang, 2010), the author discussed the conflict between the two priorities in UFS. The two priorities – generating revenue for the institution and providing student welfare – are explained in the following section.

The Origin of UFS Managerial Problems

It has only been twelve years since the official start of UFS reform, and many institutions are still at the exploratory stage in privately operating their own UFS. Therefore, managerial problems seem unavoidable at this stage. For instance, improper supervision may give rise to low food quality, food safety issues, and dissatisfied customers. The origin of these problems can be viewed as a conflict of priorities between the Chinese Government and private UFS operators.

UFS in China was originally non-profit, as it aimed to provide all students with affordable food. In public institutions before the reform, UFS was completely supported by government funding. This funding for UFS was kept after the reform policy of 1999 in the form of government subsidization. However, food and labor costs kept going up with the economic advancement in China. After a sharp rise in food cost in 2006, many UFS had to operate with financial losses even after the subsidization (Zhang, 2010).

Currently, the UFS contractors still struggle to make ends meet, but the university prevents the contractors from raising the meal price for more revenue to ensure that low-income students are accommodated (Peng, 2011). On the other hand, the financial loss in UFS limited the input of ingredients, equipment, and labor, which could eventually result in low food quality and low service quality.

In addition to this conflict of priority hypothesis, some studies have proposed an additional reason why larger canteens have low food quality. Since many public institutions are gigantic in size and student population, multiple cafeterias with various sizes are common. Contractors take advantage of the size difference and bring in smaller on-campus private restaurants. They purposely make these smaller restaurants serve food with a higher food quality, but at a much higher price. At the same time, they keep the canteen price low, but with a lower food quality. By lowering the food quality in canteens, contractors are able to put more resources and effort into those profitable restaurants. This strategy will directly bring more profit to the contractor. However, while wealthy students are drawn to choose the restaurants over canteens for the better food despite the price, the majority of middle-class or low-income students do not have this privilege. In the end, from the outside, larger canteens still have affordable food to accommodate most students, but the food quality is in fact much lower than it should be (Luo, 2009).

This strategy of using profitable, expensive private restaurants on campus would work particularly well in oversized public universities. In these universities, students are limited to dine on campus due to the time constraint. Meanwhile, few off-campus restaurants can handle such a large volume of customers in a short time frame. Therefore, students from such universities will have to live with the low quality of food in canteens.

Proposed UFS Operation Models

The reform policy aimed to encourage privatization of UFS in large public universities. The idea of privatization was supposedly beneficial to both the food service facility and the institution: if managed properly, the facility could be highly efficient in serving the large number of customers while maintaining customer satisfaction and profit. In reality, this policy was interpreted in many different operation models. Previous studies proposed many different sets of UFS operation models for public schools. Those models were mostly categorized based on 1) their profit nature; and 2) degree of privatization. Some basic ways of categorizing these operation models are illustrated below.

Self-Operating and Contracting

Categorizing UFS operation as either “self-operating” or “contracting” is considered the most basic, and it is recognized world-wide. Take the UFS in the United States for instance. Many UFS in large universities chose to be primarily self-operating, such as Pennsylvania State University, Michigan State University, and Harvard University (Barrows & Powers, 2008). These institutions often have sufficient capital to start, maintain, and improve the UFS operation. In

contrast, smaller schools lacking the initial capital tend to accept investment from an outside source, i.e. a contractor (Porter, 2006).

In China's context, whether the UFS chooses to be self-operating or contracting is seen to be determined by the desire of the UFS facility to be non-profit or for-profit. As mentioned in the previous section, UFS in public schools had been running as non-profit facilities before the reform policy. Self-operating in China is often viewed by the public as non-profit operating, while contracting UFS is regarded as making the facility profit-driven (Jiang, 2010), whereas in reality it is not the case.

Even though categorizing UFS as either "self-operating" or "contracting" is universally accepted, it is inadequate to fully present the complicated operating systems adopted by different universities in China.

Ownership and Revenue Source

Categorizing the operation models by ownership and revenue source was proposed by Dr. Yuan (2008) in his dissertation. Using examples of public universities in Zhejiang Province, he defined three operation models: 1. Private ownership with private revenue; 2. public ownership with private revenue; and 3. public ownership with increasing private revenue but not a corporation. This categorization still seems plausible for today's context.

Ownership, Capital Source, and Supervising Unit

Based upon ownership, capital source, and supervising unit, four UFS operation models were defined by Han (2010) using Inner Mongolian universities as examples. The models are:

1. Independent self-operating

Under this model, the UFS was completely operated and controlled by the university.

The university owns the facility and makes all decisions with an enterprise management system.

2. Management by objectives

This model is similar to the independent self-operating model, but instead of an enterprise management system, UFS is managed with an institutional management system (aka strategic financial management). Under this system, the university determines the goals, and the UFS will work on achieving them. Most decisions are made by UFS directors or managers instead of university committees.

3. Trustee contract

In contrast to the previous two models, trustee contract is a model in which UFS is operated and managed by individuals not related to the university. Under this operation system, the contractor, such as a private logistic company, will make all the decisions.

4. Co-operation of school and enterprise

This model is very similar to the trustee contract, as the decision maker can be either a private company or an individual. The difference from the previous model is that the university committee can choose to be the supervising unit of UFS and make suggestions or some decisions about the operation and management.

In fact, the method of categorization is still being explored due to the relatively recent reform policy. The benefits and drawbacks for each operation model were also debated in financial terms. Likewise, little is known about how these different management systems will be associated with the current undernourishment trend in students.

Evaluation of Literature and Conclusion

As many researchers noted, the privatization reform of UFS in China is still in its exploratory stage. This is characterized by the lack of proper supervision in the facility, and thus results in many managerial problems. The managerial problems include low student satisfaction, low food quality, and the presence of food safety issues.

Current accessible information on the UFS operation system is mostly collected by the university faculty. Although a number of different operational models were proposed by different studies, the information is only relevant for the university being studied. Therefore, the available information is not sufficiently comprehensive to understand how UFS operates under this reform, nor it is enough to draw connections to the management problem.

Furthermore, it is apparent that nutritional considerations have not been incorporated into the task of UFS management. Previous studies and surveys presented common nutritional issues among college students, including the under-nourishment trend, vitamin and mineral inadequacy, and a number of suboptimal diet habits. Even though the data from many surveys lacked a common standard, they still showed a significant and consistent trend of poor nutritional status in the population.

Most students spend nearly their entire academic year on campus, and they are usually considered as captive customers by the UFS facilities. The present nutritional health of this population group can prevent future chronic diseases and promote healthy eating in a wider community. However, little is known about the UFS operation in China, and thus it is important to study the association of UFS services and student health, in particular nutritional health.

Chapter 3

Methodology

The existing literature revealed suboptimal nutritional health among students in Chinese universities. Many researchers in China proposed different reasons for students' under-nourishment, but only a limited number of studies examined the connection between UFS and students' nutritional health. The reform policy published in 1999 has had a major influence on the UFS operation, yet little is known by the general public or health professionals about how the new UFS operation systems work, and how these systems affect students' nutritional health. This study aims to organize the current UFS operation models, and evaluate them from a nutritional perspective.

Both quantitative and qualitative methods were used to gather data, and the technique of triangulation (Denzin, 2006) was employed to enhance confidence in the findings. According to Maxwell (2008), triangulation reduces the systematic biases associated with using a single specific method, and thus ensures validity. This study was therefore divided into three parts. The first part examined the students' satisfaction towards three components of UFS through an online survey. Part 1 served as a preliminary study that set the priority for the interviews and observations in the following parts. The next two parts attempted to explain the results found in part 1, and began to address the under-nourishment trend suggested by existing literature. Part 2 was qualitative in nature. By interviewing UFS managers, staff, and customers (both students and faculty members), information on UFS operation was collected from multiple perspectives. Part 3 included observations and food quality evaluation. This part aimed to explain the trend of nutritional status among students, and served as a basis for proposing recommendations when

combined with Part 1. It also validated the results of Part 1. Figure 3-1 shows the relationship among the three parts and their function towards the goal of this paper.

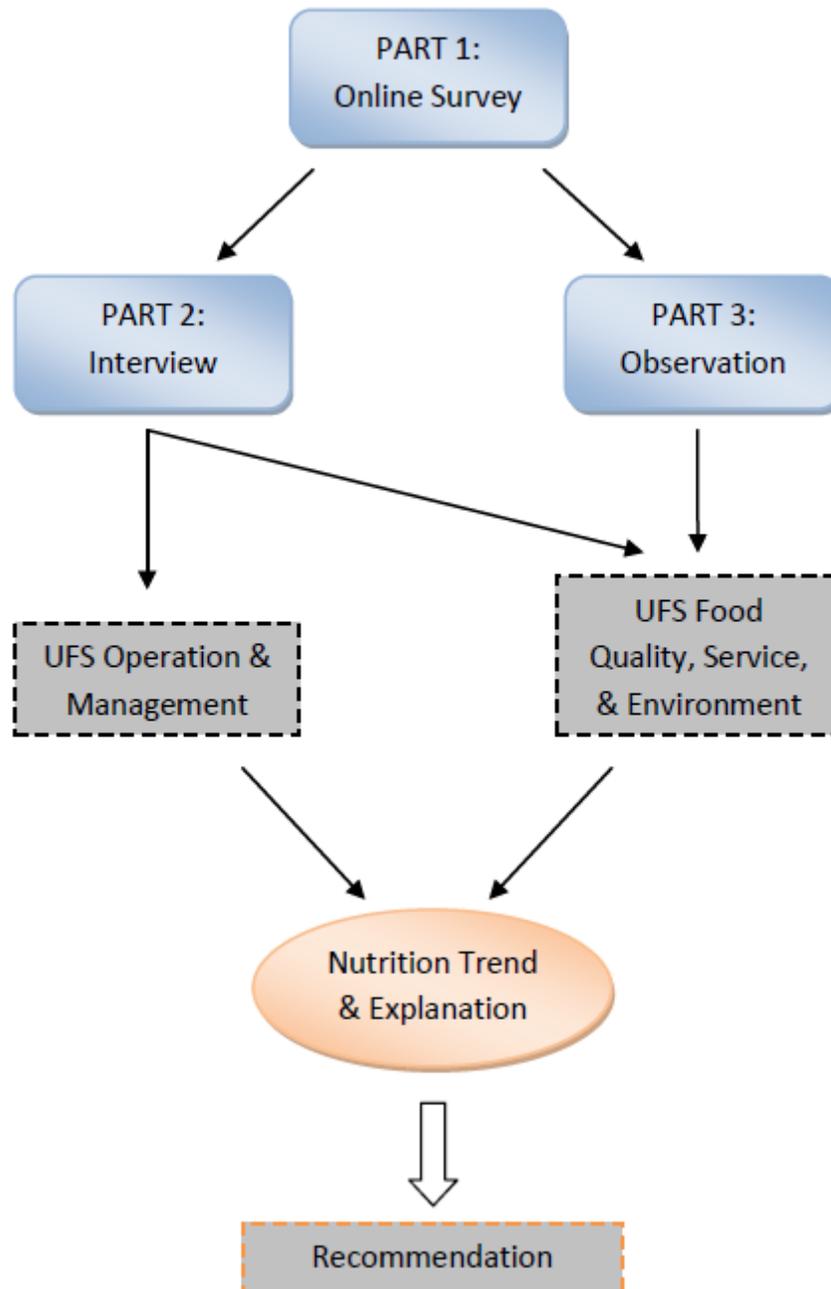


Figure 3-1. Relationship among the three parts of research

The methodology of the study was approved by the Penn State Institution Review Board (IRB) for the use of human subjects. See Appendix A and B for a sample copy of the informed consent form and its translation in Chinese.

Part 1 – Satisfaction Survey

Instrument and Data collection

The survey questionnaire was developed to include the customers' satisfaction based on the three basic components of UFS:

1. *Food Quality*
2. *Service Quality*
3. *Dining Environment*

The participants were given nine Likert-scaled questions, and they were asked to rank their experience with the UFS on a scale of 1 to 10. An additional question, asking if the participant is currently enrolled in a university or college in North China, was placed on top of the questionnaire to sort the responses.

The survey was drafted in English and was edited the thesis supervisor to improve clarity. It was then translated into Chinese. An informed consent was also incorporated into the survey questionnaire.

The survey was written digitally and put out on a website *sojump.com*, which is a professional public survey platform, and is frequently used in China for research and business purposes. The electronic questionnaire presented the informed consent to the participants, and allowed them to skip any question without penalty. See Appendix C and D for a text-only copy of

the questionnaire with its translation in Chinese. Appendix E shows a screenshot of the actual electronic survey in Chinese.

The link to the electronic survey was then distributed via *renren.com*, which has a user base that fits closely with my intended participant groups. *Renren.com* is a social network similar to *Facebook*, and it is currently the most popular social networking service in China. In 2011, it had 31 million active monthly users, and the majority of them were college students. *Renren* users could access the electronic form directly.

Data Analysis

The survey responses were first sorted by the participants' answers to the question, "Are you currently enrolled in a university in North China". The responding form would be marked as useful only if their response to this question was positive. This process was facilitated by a filtering feature provided by *sojump.com*.

The useful responses were then downloaded and analyzed by Microsoft Excel. Statistical mean and distribution were calculated to investigate the trend of students' satisfaction with the UFS facility in North China.

A follow-up study was conducted to get culturally competent perspectives on the results via informal conversations with faculty members from Chinese universities and various university-wide online discussion forums. The following categorization of this scale is shown below in Table 3-1.

Table 3-1. Interpretation of Likert Satisfaction Score for a Chinese Sample

Satisfaction Description	Score
Extremely Unsatisfied	1
	2
Somewhat Unsatisfied	3
Neutral	4
	5
	6
	7
Somewhat Satisfied	8
Extremely Satisfied	9
	10

For each question, the satisfactory percentages and unsatisfactory percentages were also calculated and tabulated.

Part 2 – Interview

University Selection

A non-random sample of six public universities in North China was selected based on their academic ranking, student demographics, and geographic location. Because of the sensitivity of this subject matter in China, as well as the participants' request, the universities in this research will be referred to by code (U1 – U6).

China has an exceptionally complicated system of university ranking. The six sample universities were chosen from the *Yi Ben* University list, which can be interpreted as the list of top national or provincial public universities by academic ability. Generally speaking, national universities accept applications from the entire country, and thus have a student population made

up of different geographic backgrounds. In contrast, provincial universities have more in-province students.

U1, U2, and U3 are national universities located in Beijing, the capital of China. Among the three universities, U2 was reputed to have more male students than female students. In contrast, U3 was regarded as having more female students. These three universities were ranked from 12th to 60th in Year 2011.

U4 is a national university located in Jinan, the capital city of the province Shandong. U5 and U6 are provincial universities also located in Jinan. U6 is the branch campus of U5, and it is located in Changqin University Park, a newly-constructed area in the suburb of Jinan made up of ten institutions. It includes branch campuses of provincial universities and universities that are not on the *Yi Ben* List.

Participants and Data Collection

Interviews were conducted with a convenience sample of eighteen participants. Table 3-2 shows the sex of the participants. The participants include ten students, four directors or managers, two UFS staff members, and two faculty members. Table 3-3 shows the occupation of the participants by universities. The purpose of interviews with students and faculty members was to describe their experiences with UFS and identify concerns about the UFS. The interviews with managers and UFS staff mainly discussed the operation of the UFS. See Appendix F and G for the recruitment letters of the interviews.

Male	10	56%
Female	8	44%

Table 3-3. Occupation of participants at each university (n=18)

	Student	Faculty	UFS Director/ Manager	UFS Staff
U1	2	0	1	0
U2	3	0	0*	0
U3	4	0	1	0
U4	1	0	1	1
U5	1	0	1	1
U6	0 [†]	1	0 [‡]	0
Total	11	1	4	2

* U2 faculty, UFS staff and manager did not cooperate due to university policy
[†] U5 student participant spent academic years in both U5 and U6, and commented on both facilities
[‡] UFS vice director interviewed in U5 also oversees the UFS in U6

During the research, the UFS director at U2 declined to be interviewed due to the company and university policy and the sensitivity of the subject. This in turn influenced the recruitment of staff and faculty members in the same university.

All interviews were conducted on campus. Faculty, UFS staff, or UFS managers were interviewed individually. Students were interviewed either individually or in small groups (up to three students). They were asked mostly open-ended questions. Additionally, they were encouraged to freely express their opinions about UFS. See Appendix H for the sample interview prompts. All interviews but one were audio recorded, and the remaining one was recorded in text. Then the interview transcripts were translated into English for further analysis.

Some participants were re-contacted for clarification. Any follow-up conversations were recorded by text.

Interview Analysis

Both interview transcripts and audio records were revisited for analysis. The transcripts were first labeled with school (U1 – U6), then with the participants' occupation (S – student; M – manager; T – faculty; S – UFS staff).

Based on the pre-set interview prompts, the interview transcripts were organized according to themes. For the UFS managers, the themes included:

1. *UFS operation system and priority*
2. *Forecasting, menu setting, and efficiency measures in the facility*
3. *Improving student satisfaction in general*
4. *Food-related policies and nutrition education*

The themes of customer interviews (refers to both students and faculty) included:

1. *Positive experiences with UFS*
2. *Negative experiences with UFS*
3. *Their opinion regarding improving UFS*
4. *Alternative food sources*

Due to the qualitative nature of this section, repeated key words were noted and highlighted for each participant. Then these key words and themes were compared to those of other participants. Important quotes were noted and collected as supporting evidence. In some occasions, outside sources were also used for explanation and elaboration. The outside sources included university-based student discussion forums, newspaper articles, or social network websites (including *weibo.com* and *blog.sina.cn*).

Part 3 – Observation and Nutritional Analysis

Instrument and Data Collection

An Observation Checklist (Appendix I) was designed to record findings in UFS. The exercises were carried out during the lunch or dinner peak, and relevant observations were recorded in text. The areas that were especially noted included the dining environment, food safety measures, and staff-customer interaction.

Menus from each UFS were also collected for nutritional analysis. The average number of dishes in one meal period ranged from 30 to 50; thus, a typical meal was assembled from observation and therefore an entire meal was analyzed instead of assessing a single menu item.

Menu and Observational Analysis

The menu analysis started with the estimation of a typical plate. This typical plate was first estimated based on my observation in the facility. Meal items and patterns were noted. Then, adaptations were made according to interviews with students and university-wide discussion forums. Finally, the pattern was further adjusted with the financial information provided by the UFS managers. The financial information included how much, on average, a student spent per meal and how much various dishes cost.

The ingredient amounts are estimated by the standard recipes collected from these UFS facilities. USDA SR25 food composition software was used to analyze the nutrition content for the typical meal. Total energy, macronutrients, and several micronutrients of this typical meal were recorded.

The key nutrients were compared against primarily Chinese Dietary Guidelines. Key micronutrients analyzed included iron, calcium, sodium, vitamin A, vitamin D, and vitamin B2. As the Chinese Dietary Guidelines recommended that 30-40% of the total energy should be from the lunch or dinner plate, I assumed that this typical lunch or dinner plate would provide approximately one third of total energy and key nutrients.

Finally, students' nutritional health was discussed based on the results from meal analysis, as well as the consideration of other factors, such as breakfast and snacks.

Chapter 4

Results

Part 1 – Satisfaction Survey

The survey received 91 responses in total. Among them, 36 were omitted for not being the target population. Target population was determined by the first survey question, which was designed to sort the responses. See Table 4-1 for the responses on student status.

	Positive	Negative	Omit
I am currently a student enrolled in a university in North China	55	33	3

For each question, the means, satisfactory percentages, and unsatisfactory percentages were calculated and tabulated in Table 4-2.

Table 4-2. Survey responses and analysis (n=55)

		Mean	Satisfactory		Unsatisfactory	
			Rated at 8 or above, n	Rated at 8 or above, %	Rated at 3 or below, n	Rated at 3 or below, %
Food quality	The menu has a good variety of items to choose from	5.65	11	20%	8	15%
	The food is served at the proper temperatures	5.75	16	29%	11	20%
	The overall quality of the food is good	4.40	5	9%	19	35%
Service	The employees are very friendly and courteous	5.51	10	18%	7	13%
	The overall service in the cafeteria is good	5.35	8	15%	9	16%
Environment	Both the dining area and serving area are clean	5.40	8	15%	10	18%
	The seating is adequate, and the waiting time is acceptable	5.35	8	15%	12	22%
General	Overall, the food is a good value for the price	4.91	8	15%	14	25%
	I am satisfied with my experience with the university foodservice	4.38	6	11%	19	35%
Total		5.19	80	16%	109	22%

The general satisfaction score was 4.38 on a Likert scale of 1 to 10. Based on the categorization in Table 3-1, the average score of 4.38 indicated that the students rank their canteen experience neutral.

However, 35% of participants ranked overall food quality and overall experience as unsatisfactory as indicated by their response (rated 3 or below on a Likert Scale) to the statements “The overall quality of the food is good”, and “I am satisfied with my experience with the university foodservice”. In contrast, only 9% and 11% participants ranked food quality and experience as satisfactory based upon their response (rated 8 or above) to the same two statements.

Moreover, 25% of the participants disagreed with the statement “the food is a good value for the price”, which could be seen as the participants’ dissatisfaction towards the current food price in conjunction with quality.

On the other hand, 29% participants agreed with the statement “The food is served at the proper temperatures” and 20% participants agreed that “The menu has a good variety of items to choose from”. These results indicated that the participants’ dissatisfaction towards food quality was not due to the lack of food variety or the temperature at service.

Overall, these results suggest that compared to service quality, dining environment, and other aspects of canteens, food quality was a top concern for participants, and strongly influenced their overall UFS experience.

Part 2 – Interview

In the interview transcript, a few key terms were reworded after translation for consistency and better clarity.

1. *Stall* – the basic food selling unit in a canteen (see below for the definition). It is often present as a “window” or a “counter”, and it is commonly run by less than three staff members. Stalls usually are divided according to the food type. For example, the “main dish stall” sells rice, steamed bread, flat bread, and dumplings, and “side dish stalls” sell various vegetable dishes or meat dishes. Each university has its own way of dividing, sometimes the same dishes may appear in different stalls to facilitate efficiency during the peak lunch or dinner period.
2. *Canteen* – large dining area, usually takes up an entire building or floor. It consists of at least ten stalls on each floor, and has a centralized seating area.
3. *Café* – smaller dining area as opposed to the large canteen. In this paper, a café refers to the restaurant-styled facility.
4. *Stand* – supplemental food selling unit that is either in the canteen or somewhere else on campus. It is often constructed on a mobile carrier, selling desserts, beverages, retail snacks, barbeque snack food, soup, or noodles.
5. *Restaurant* – off-campus profitable dining facility independent from the university. The use of this word is to differentiate off campus private restaurants from restaurant-styled on-campus eateries.
6. *Boxed lunch* – a kind of Chinese fast food, often consisting of one main carbohydrate entrée (usually rice) with one or two side dishes of the customers’ choice. It is usually sold on the street, in fast food restaurants, and in convenience stores.
7. *A la carte* – a restaurant model where the customers can order individually priced menu items.

Interview with Manager and Staff

UFS reform invited many different operational models in the Chinese UFS. Although the participating universities for part 2 were recruited using a convenience sampling method, five different models were found among the six universities.

U4 chose to keep the original UFS operation used before the reform, which was entirely self-operated and claimed to be non-profit. On the reverse side, U2 and U6 chose to hand over the management almost entirely to a single contractor (usually a large-scaled logistic company as opposed to small-scaled private vendors). Interestingly, customers from U4 spoke more highly of the UFS in regards to the food quality than those from U2 or U6. However, U2 and U6 respondents reported higher efficiency in the facility, indicated by the waiting time and seating adequacy.

U1, U3, and U5 had different levels of privatization with multiple vendors or contractors. For instance, U3 only privatized a number of smaller stands or stalls; U5 allowed each contractor to take over several stalls; the three contractors in U1 ran their own cafés or restaurants independently. When interviewed, participants from U2, U4, and U6 believed that inviting competition to the current UFS would be a solution to improve food quality and overall satisfaction. Yet, U1, U3, and U5's way of operation seemed to disprove this solution's effectiveness, as in these three universities, participants' satisfaction was not noticeably improved by the competition between UFS contractors or vendors. On the other hand, the UFS contractors still out-competed off-campus restaurants as a result of the "gigantic captive customer group".

The detailed conversations are summarized below according to the universities.

U1

The UFS manager, Miss M, who participated in this study, was the manager-on-duty in charge of a restaurant-style café with *a la carte* service. This café was a supplemental dining facility in addition to the 5-floor canteen. Different from the canteen, this café had a much higher meal price, and hired students as staff. Based on what I had observed and heard from the manager, the guest usually spent ¥20.00 (equivalent to \$3.20) or more per meal. This was close to an off-campus low-end restaurant in that area, and was nearly three times more than what a guest usually spent in U1 canteen. Therefore, this particular café attracted mainly faculty members. According to the manager, many students would come for the better food quality, generally not on a daily basis, but rather for an on-campus dinner date or a weekend gathering.

Miss M works for a logistic company instead of the university. According to her, the U1 main canteen was run by the university, but the three smaller cafés, like the one she was in charge of, were run by three different private companies. Unfortunately, she knew very little about the situation in other canteens or cafés in U1.

The top priorities for this facility included maintaining food safety and food quality, as well as sufficient cash flow. The health inspection for this facility is done by Beijing Health and Epidemic Prevention Station, and all staff members are required to carry out sanitation procedures. When asked, Miss M said that the ingredients for this café were from reliable and large food suppliers and distributors. She claimed all the ingredients were fresh and were approved (aka “stamped”) by the health department (equivalent to the USDA). She thought this was an important measure to maintain high food quality in this facility. In order to ensure sufficient cash flow to support the café’s operation, she expanded the target customers to a broader range. Other than students and faculty members, she started adding new menu items to attract off-campus customers that were local and in the nearby neighborhood.

When asked about students' nutritional health, Miss M felt it to be the responsibility for all food service facilities. She actively searched for some information related to the dietary guideline on her own, and she felt that the students should receive knowledge in this area. As a food service manager, she believed in the future this field could start to "suggest portion sizes". However, she did not show confidence in moving her café in this direction in the near future.

U2

The UFS director and managers in U2 decided not to participate in this study due to "company and university policy". Based upon the concerns expressed by the director and managers, I elected not to interview faculty members in U2 for this research. Therefore I did not get the information directly from them, but through other information sources, such as by observation and university-wide discussion forums.

Up to now, I could confirm that the daily operation and management were both done by one single logistic company. The ownership of this facility could not be determined, nor could the level of involvement of the university. Based on the discussion forum, students identified some contradictions. For example, although this facility was run by a logistic company and was regarded as a "for-profit" facility, the students revealed that it still had access to the reduced tax rate, university and federal subsidization.

Based on observation of this facility, the food variety, price, and facility layout did not seem to differ from other participating universities. Unfortunately, I could not get any more insight regarding how this facility was managed.

U3

The participating manager in U3, Mr. Y, was the associate director in charge of seven canteens. He had been working in this university for 32 years, starting from an entry-level cook. Therefore, he provided substantial information in regard to the evolution of the canteen during the last three decades.

He told me that the large canteens in U3 were mostly run by the university (self-operated). There were some private vendors in this facility, but the UFS management decided to let them take over stalls or stands only. For example, the largest canteen was constructed to have four floors, and private vendors only took over four stands on the top floor. He said that one of the major dining halls (Canteen Five) used to be run by a private contractor, but the university claimed back the ownership after a few years due to unclear reasons.

He then explained to me the transformation he observed in the past three decades. In the past, all canteens in North China adopted a massive food production method as a cost-saving and high-efficiency solution. Each batch of cooked food could easily serve 100 people or more. Given that present day students demand higher quality food, the massive food production method could no longer be used. Instead, UFS in U3 and in many other universities in North China started to adopt a new way of cooking. This new cooking method was in between the massive production and a la carte service, and it produced about 21-25 servings per batch.

In this facility, there were about 50 different menu items each day, changing according to the season. Mr. Y said that he trusted the cooks' experience in forecasting amount needed, but he had a unique way of setting menus. There were around 110 menu items collected in the standard recipe book, and the management team decided which 40 of them would be on the seasonal menu. Then, they asked the cooks to create ten new dishes to serve as "season's specials". He explained that the "seasonal specials" was his way of updating the recipe book: new seasonal

vegetables or new equipment were reflected in the new dishes, and if any new dish gained student popularity, it would be added to the recipe book permanently.

There were five priorities for this facility, according to the associate director.

1. *Food quality.* The quality of the 40 pre-set menu items were tightly monitored and controlled by the management team.
2. *Service quality.*
3. *Food safety.* He particularly mentioned some policies established by the management team regarding food safety, in addition to existing government ones. One policy was the exclusion of Hyacinth bean, rehydrated seafood, and organ meat. This policy applied to the larger canteens, and the reason was that these foods had higher chance of causing food poisoning when they were not cooked properly.
4. *Production safety.* He stressed training for all staff operating kitchen equipment in order to avoid injury.
5. *Food waste.* He also put food waste reduction on the staff training agenda.

He did not talk about food prices in particular, but based on his attitude and observation in the canteen, maintaining a low food price seemed to be a primary objective.

Mr. Y had an open mind towards nutrition promotion in the UFS, yet currently he was not able to arrange for nutrition education or to accommodate students with special nutritional needs. He believed that nutrition promotion would be very necessary in the future, and a “nutritionally balanced meal” would be a popular trend in UFS. He said that in the past people did not have the awareness, but in the future they would take nutrition into consideration. He also said that he wanted to add a “healthy set-meal” in his menu to respond to the growing awareness in eating healthily and nutritionally. This set meal would have a good balance of nutrients and

would be a healthy meal. However, he was concerned about the feasibility of this idea: he or other members in the management team had never received training in nutrition. He was afraid that this idea might not turn out to be the way he wanted. In addition, he was also worried about the approval of this idea by multiple groups, like the university management or customers.

U4

The participating manager from U4, Mr. X, was the UFS director who directly operated and managed all UFS facilities in the main campus of U4. He also supervised and participated in decision making for the other five branch campuses of U4 in Jinan. He had been working as the UFS director for over eight years and designed the operational model for the facilities he managed. In addition, he took multiple tours over the past years to UFS in other universities in Beijing, Shandong Province, and southern provinces in order to update the system in U4. Thus, he provided me with substantial information related to his operation system and the differences between U4 and other universities he had been to.

Firstly of all, he was exceptionally proud of the operation system he designed. He described the UFS in U4 as “a non-profit organization”: the financial goal for canteens was to achieve break-even, and the goal for cafés was to make a small profit. He went into detail illustrating the financial situation in U4. Federal subsidization to all national universities was the main form of income for UFS, and the revenue earned almost entirely went to pay for ingredients and labor. He designed a separate logistic department in the UFS making all purchases (both ingredients and equipment) for the UFS. The management from each facility would submit any purchase order ahead of time to the logistic department, and he would make the final decision. This centralized financial system in U4 UFS was effective for cost control in the previous years.

When asked about the overall operational system of UFS in U4, he claimed to be entirely self-operated. From his tours to other UFS facilities, he agreed that there had not been a clear set of models for current operational models. Based on his observation, the universities under the “985 Project” had a distinct UFS system as compared to the ones under the “211 Project”. Also, the southern universities had another set of systems that were different from the northern ones. I researched these two projects after the interview, and I found that these projects referred to the two lists of top-ranked national universities. There was some overlap between the two lists, but generally speaking, universities under “985 Project” were perceived by the public as more academically influential ones. Being one of the “985 Universities” in a northern province, the UFS of U4 was representative of other northern universities on that list.

Student satisfaction was an important priority for this facility. This was primarily shown in two ways: 1, maintaining a relatively stable and affordable price; 2, communicating with students about their opinions towards the facility. Sometimes the management team held meetings with student representatives to discuss student comments about UFS.

According to the Mr. X, it would be a great challenge for the facility to incorporate nutrition consideration in the UFS operation. The managerial task was to ensure food safety first, then control quality. He felt that the management did not lead the student in choosing foods with better nutrition, but rather worked to develop menu items that would be popular or easy to sell. He believed that a lack of technical staff was a major contributing factor to this problem. The management team simply did not have any training in the field of nutrition. He said that this situation might be improved in the future.

He also compared the northern and southern UFS. Based on his observation, northern UFS often serves stir-fry dishes with a mix of vegetable and meat; southern UFS, in contrast, provides vegetarian options. Also, northern UFS serves food in large portions, while southern

UFS serves a much smaller portion. During the interview, he showed clear preference for the method that southern UFS was using. He said that the students got more variety of dishes in one meal in southern UFS due to the smaller portion size.

A staff member from this facility, Mr. N, was interviewed as well. Mr. N described to me the situation in the canteen during meal rush. He said that usually the students would get their meal in less than 15 minutes. There was a slight problem of inadequate seating during meal rush, and the students were encouraged to purchase their meal for take-out. He also operated a monthly survey for student satisfaction, and he received positive feedback most of the time. Occasionally there were customer complaints about meal price. After adjustment, the current average spending was about ¥9.00 (equivalent to \$1.50) in the “faculty café” (smaller-scaled canteen, not a restaurant-styled café, strictly speaking) and about ¥5.00-7.00 (equivalent to \$0.80-1.20) in the student canteen.

U5 & U6

The participating manager, Mr. D, was the vice director in charge of the UFS in both U5 and U6. During the interview, he was distracted with a number of phone calls; therefore, he only briefly answered some questions. When asked, he said that the operation system was “centralized management by the university”. He explained that most individual dining areas were owned and managed by private vendors or companies, and the university oversaw the management as a whole. According to the interviews with the students and faculty, U6 seemed to be managed by a single large private contractor (possibly by a logistic company), and U5, on the other hand, consisted of many different private vendors.

Mr. D talked very briefly about the way the menu was developed and forecasted. In fact, he said that it was mostly determined by the cooks’ experience. The university had a complete set

of rules to control quality and safety in order to meet the requirement of the Jinan Health and Epidemic Prevention Station.

One staff member was interviewed in U5. He mainly described the cost of the food and how they dealt with leftovers. According to him, each menu item cost ¥2.00-5.00; thus, the cost of a meal was totally dependent on how many items the students were getting. Generally, on average, students spent about ¥5.00 on weekdays. He also said that the leftover food was disposed of by the end of the meal period. This was not completely in line with what I had found during interviews or observation.

Table 4-3. Summary of interviews with managers and staff

	Theme 1 <i>Operation and Priorities</i>	Theme 2 <i>Special Measures in menu-forecasting etc.</i>	Theme 3 <i>Improving Student Satisfaction</i>	Theme 4 <i>Nutrition Program</i>
U1	<u>Operation System:</u> Self-operated canteen with three major contractors <u>Priorities:</u> Food safety, food quality and cash flow	Attracted off-campus customers to ensure sufficient cash flow	Develop menu items to reflect different cuisines	No current program. Believed UFS should start to “suggest portion size”
U2*	<u>Operation System:</u> Single contractor <u>Priorities:</u> Contradictory	NA	NA	NA
U3	<u>Operation System:</u> Self-operated canteen with multiple private vendors <u>Priorities:</u> Food quality, service quality, food safety, production safety, food waste	Ensured the quality of 40 pre-set dishes	Abandoned “massive production scale” from previous decades and adopted production between massive and a la carte	No current program. Attempted to incorporate “healthy set meal” but abandoned due to the lack of technical knowledge
U4	<u>Operation System:</u> Complete self-operated (non-profit) <u>Priorities:</u> Food safety, customer satisfaction, food quality	Took tours to southern universities (but not yet implementing any change)	Maintaining stable price Monthly survey	No current program. Management concern for lack of staff training in nutrition; therefore promoted best selling dishes rather than promoting nutrition
U5 & U6	<u>Operation System:</u> “Centralized management” – contractors supervised by university <u>Priorities:</u> NA	Through cooks’ experience, University established control quality and safety rules	NA	NA

*U2 manager did not participate in this study

Interviews with students and faculty

U1

In U1, a small group interview was conducted with three students. All three of them were Master's students, and they had been staying in the same campus since their undergraduate years. They lived on campus, and they used the UFS facilities on campus for nearly all meals during the academic year.

According to these students, the canteens owned by the university were considered safer and cleaner compared to the cafés or off-campus restaurants. There were cleanliness ratings posted on the bulletin board outside the facility, and one student noticed that only the canteens received a grade of A, and all other smaller cafés received a grade of B. The cleanliness ratings were done by the university. In addition, they believed that the university monitored the canteens to prevent food safety issues. Therefore, they trusted the canteens for safe food.

On the other hand, they complained about the low food quality in the canteens, and poor service in the smaller cafés. They said that the largest canteen was particularly poor in food quality. Not only did the food not taste good there, but sometimes contained physical contaminants like metal wires from pot scrubbers. Occasionally they even got reheated leftover food from the canteen which discouraged them from eating in large canteens. One participant said that he believed the competition between different contractors in U1 somewhat improved food quality in those cafés. However, these cafés were still disappointing in service because they already had a "gigantic group of captive consumers" to support their business. In other words, due to the abundance of on-campus students, these facilities (both canteens and cafés) lacked any real competition, and thus they were not motivated to improve their general quality.

According to the participants, U1 had a nutritionist position listed in the staff directory, but nobody knew exactly what he did. They were also unaware of any nutrition-related education or promotion.

I noticed that there was no large chain restaurant on campus. When asked about alternative food sources, the participants mentioned a few off-campus restaurants. However, they said that those were only places for weekends with friends and that they would still choose UFS for normal weekdays.

U2

I interviewed three students from U2 in a small group. They had been staying in U2 about two to three years. In the interview, I noticed that they did not have any strong opinion for or against the facility.

They thought that the UFS was better than off-campus small restaurants in terms of food safety and cost-effectiveness. According to them, even with the recent price raise, a meal at UFS still cost less than anywhere off-campus. One participant said that any UFS in top public universities like U2 received subsidization and therefore the students did not have to pay full price for the meals. Additionally, they were impressed about the efficiency of this facility. Most of students reported that they could get their meals in less than three minutes, even during dinner rush.

U3

The four student participants from U3 had been staying on campus in U3 from three years to seven years. They were interviewed in a small group. Unlike other interviewed student

groups, this group was much quieter, and thus I was only able to get limited amount of information.

During the interview, they said that the service and the food quality were okay. On the university-wide discussion forum, some students complained about the reduced portion size and increased price, but the participants thought the prices were still reasonable. The only apparent change was a decrease in food quality in Canteen Five. Occasionally, they revealed that they had found contaminants in the dishes, such as worms in vegetables. One student stated that such an occurrence was “unavoidable” for all large UFS facilities. Other than that, there was no other mention of negative food quality.

For alternative food sources, there were multiple large-scaled and small-scaled restaurants off-campus, as well as some chain fast-food restaurants. Although the chain restaurants had superior dining environments, restaurants still ate on campus most of the time due to economic considerations. Additionally, they would love to see some improvement in the taste of food at the UFS.

U4

The student participant from U4 was a graduating senior, who had been living on campus for four years. He said that living on campus was required, even though he was from this city and lived about 15 minutes away.

He thought that the food quality was acceptable, and the menu items had great variety. He believed that eating in canteens could also ensure food safety when compared to other off-campus places. However, he thought eating in the canteen was quite pricy. According to him, the prices for each side dish varied from ¥1.50-7.00 Usually eggs were considered to be a meat dish and cost around ¥3.00. In this facility, another problem was the seating inadequacy. He said

there was a high school located on the same street as the university, and the students from that high school were allowed to use the UFS facility during lunch time. This decision had affected U4 students' usage severely, for they had to either wait until after the lunch rush, or to order take-out from off-campus places. There were usually only a few dishes remaining after the lunch rush, which was quite disappointing to him. Additionally, there was a chain grocery store that offered take-out boxed lunches. The boxed lunch cost about the same as the canteen, and came with four side dishes (two meat dishes and two vegetarian dishes).

U5 & U6

Two participants were interviewed individually from U5 and U6. One of them was a Master's student in U6. She spent her entire undergraduate years in U5, and transferred to U6 for her graduate classes in 2010. She still lived on campus and used the UFS facility for nearly all her meals. The other participant was a professor teaching in both U5 and U6. As U6 was in the suburb away from where she lived, she ate lunch or dinner in U6 UFS about once or twice per week, based on her class schedule.

According to the professor, the food quality in U6 did not meet her standards. She would trust the safety of the food, but she was not fond of the taste or the ingredient quality. She said that there was a tremendous variety of foods, but they were "monotonous". During meal time, she was able to use the faculty dining area, which was less crowded than the student dining areas. She also said that the price for the meal was quite low, and she would not mind having to pay a higher price for a better meal in UFS. In fact, she told me that on many occasions she preferred to bring her own lunch or purchase snack foods from elsewhere. When asked, she believed that there were a few restaurants or even shops outside U6 within walking distance. The "commercial street"

where all the shops and restaurants located was about 4km (equivalent to 2.5 miles) away, and most of these restaurants were quite expensive.

The student participant enjoyed U6 UFS more than U5 UFS. She recalled the facilities in both U5 and U6, and said that U5 had less variety of dishes and lower quality than U6. She believed that U5 had multiple private contractors, but U6 had only one. Her reasoning was that U5 had very inconsistent food quality in each stall, but U6 was quite consistent throughout the facility. However, she would love to have better tasting food offered at UFS. As U5 was located in the downtown area, there were quite a number of alternative places to get foods.

Table 4-4. Summary of interviews with students

	Theme 1 <i>Positive Experiences</i>	Theme 2 <i>Negative Experiences</i>	Theme 3 <i>Improving UFS Suggestion</i>	Theme 4 <i>Alternative Food Source</i>
U1	Believed university monitors food safety	Contaminants in food Undesirable service	Introduce real competition in order to improve food quality	Off-campus restaurants for occasional gathering
U2	Thought UFS was better than off-campus restaurants in terms of food safety and cost-effectiveness Impressed by efficiency	No strong opinion against	NA	Off-campus restaurants for occasional gathering
U3	Service meeting expectation Reasonable price	Occasional contaminants in food (but thought it was unavoidable)	Improve in taste and flavor	Off-campus restaurants, chain restaurants
U4	Acceptable food quality Great variety of dishes	Pricy Inadequate seating during lunch rush	Discourage nearby high school students from competing for UFS during lunch	Boxed lunch and take out foods
U5 & U6	Good variety of dishes in U6	Inconsistent food quality in U5 Monotonous taste in U6	Improve food taste and quality (may at the expense of higher price)	A number off-campus food sources near U5 Few alternative food sources near U6

Part 3 – Observation and Nutritional Analysis

During the interview, UFS staff from U4 and U5, as well as students from U1 – U6 provided a rough estimate of their average spending on meals. Based on the average spending amount, observation, and standard recipes collected from U3 and U4, three sets of typical lunch/dinners include:

PLATE 1: One serving of rice, one serving of one side vegetable and one side meat dish.

This plate usually costs around ¥8.00-9.00 in the participating universities, which is slightly above average spending. By observation, male students, students from graduate programs, and faculty order meals similar to Plate 1 from canteens.

PLATE 2: Half serving of rice, half serving of one vegetable dish and one side mixed protein dish (e.g. containing small amount of meat or eggs). This plate usually costs around ¥5.00-6.00 in the participating universities, and is similar to the average spending. Female undergraduate students and some female students from Master's programs tend to order plates similar to Plate 2 from canteens. In some universities where a half serving was not common, the actual food consumption was similar to Plate 2 by observation.

PLATE 3: One serving of noodles with soup. This plate typically costs from ¥4.00 in a canteen stall to up to ¥20.00 in a café. Based on observation, this plate was a common choice in all customer groups.

Energy, macronutrients, and selected micronutrients were analyzed using USDA SR25 Food Composition Software. The results are tabulated in Table 4-5. Calcium, iron, sodium, vitamin B2, Vitamin A, and Vitamin D were selected, as the target population was marginally deficient in these nutrients according to past studies (Shan & Liu, 2012; Huang & Huang, 2001; Wang et al., 2012).

Table 4-5. Nutrient content of selected plates

	Energy/ Kcal	Carb/ g	Prot/ g	Fat/ g	Ca/ mg	Fe*/ mg	Na [†] / mg	B2 [‡] / mg	Vit A /ug	Vit D /IU	Wt /g
PLATE 1											
Rice	130.00	28.59	2.38	0.21	3.00	0.20	0.00	0.02	0.00	0.00	100.00
Cabbage side dish	143.24	12.50	2.80	10.41	103.28	0.46	1261.84	0.09	23.51	0.00	222.00
Meat side dish (spicy chicken)	319.22	6.52	20.41	23.48	26.12	1.48	1221.41	0.16	25.87	10.00	224.00
Total	592.46	47.61	25.60	34.10	132.40	2.14	2483.25	0.27	49.39	10.00	546.00
PLATE 2 (Half serving)											
Rice	65.00	14.30	1.19	0.11	1.50	0.10	0.00	0.01	0.00	0.00	50.00
Cabbage side dish	71.62	6.25	1.40	5.20	51.64	0.23	630.92	0.05	231.70	0.00	111.00
Protein dish (scrambled eggs with squash)	102.93	8.76	2.88	6.77	37.52	0.89	802.90	0.09	428.64	14.44	90.40
Total	239.55	29.31	5.48	12.08	90.66	1.22	1433.82	0.14	660.34	14.44	251.40
PLATE 3											
Rice noodle in tomato soup	446.90	58.58	11.04	5.92	49.65	2.10	257.50	0.32	841.60	36.10	602.00
Total	446.90	58.58	11.04	5.92	49.65	2.10	257.50	0.32	841.60	36.10	602.00

*Iron from cast iron cookware was not taken into consideration

[†]Sodium from additional condiments were not included in the calculation

[‡]Actual B2 amount may be lower due to the different grain fortification policy in China

The nutrient content of Plate 1-3 from Table 4-5 was compared to standard recommendations which is shown for males and females in Table 4-6 and 4-7, respectively. As Plate 2 was only common among female students, its analysis is only shown in Table 4-7. Chinese Dietary Guidelines were used for the analysis of all nutrients except carbohydrate. The results with respect to nutrient are summarized below.

Energy

A rough estimate of 2,500 kcal was used as the daily energy requirement for a typical male student, and the estimate of 2,000 kcal was used as the daily energy requirement for a typical female student. The Chinese Dietary Guidelines recommend that 30-40% of energy should be allocated to lunch or dinner. As shown in Tables 4-6 and 4-7, this recommendation could not be met if a student were to consume any of these three plates exclusively.

For a typical male student, Plate 1 will provide about 23.70%, and Plate 3 will provide only 17.88% of energy recommendations; for a typical female student, although Plate 1 is close to the recommendation, providing 29.62% of the daily energy requirement, Plates 2 and 3 are significantly below this recommendation, providing 11.98%, and 22.35% energy, respectively. Therefore, these data suggest that a typical plate from the canteen can hardly meet the energy requirements for either male or female students, assuming that they eat all meals from the canteen and do not snack in between.

Table 4-6. Nutrient analysis of selected plates for males

	Energy	Carb	Prot	Fat	Ca	Fe	Na	B2	Vit A	Vit D	Wt
	%DV	%Kcal	%DV	%Kcal	%RDA	%RDA	%AI	%RDA	%RDA	%RDA	
<i>DRI (China) – Male</i>	30-40%	-	75g	20-30%	800mg	15mg	2200mg	1.4mg	800ug	200IU	
<i>DRI (US) – Male</i>	-	45-65%	10-35%	20-35%	1300mg	8mg	1500mg	1.3mg	900ug	600IU	
PLATE 1											
Rice											
Cabbage side dish											
Meat side dish (spicy chicken)											
Total	23.70	32.14	34.13	51.80	16.55	14.27	112.88	19.29	6.17	5.00	
PLATE 3											
Rice noodle in tomato soup											
Total	17.88	52.43	14.72	11.92	6.21	14.00	11.70	22.86	105.20	18.05	

Table 4-7. Nutrient analysis of selected plates for females

	Energy	Carb	Prot	Fat	Ca	Fe	Na	B2	Vit A	Vit D	Wt
	%DV	%Kcal	%DV	%Kcal	%RDA	%RDA	%AI	%RDA	%RDA	%RDA	
<i>DRI (China) – Female</i>	30-40%	-	65g	20-30%	800mg	20mg	2200mg	1.2mg	700ug	200IU	
<i>DRI (US) – Female</i>	-	45-65%	10-35%	20-35%	1300mg	18mg	1500mg	1.1mg	700ug	600IU	
PLATE 1											
Rice											
Cabbage side dish											
Meat side dish (spicy chicken)											
Total	29.62	32.14	39.38	51.80	16.55	10.70	112.88	22.50	7.06	5.00	
PLATE 2 (Half serving)											
Rice											
Cabbage side dish											
Protein dish (scrambled eggs with squash)											
Total	11.98	48.94	8.43	45.39	11.33	6.10	65.17	11.67	94.33	7.22	
PLATE 3											
Rice noodle in tomato soup											
Total	22.35	52.43	16.98	11.92	2.46	10.50	11.70	26.67	120.23	18.05	

Macronutrients

The macronutrient recommendation slightly differs between American Dietary Guidelines and Chinese Dietary Guidelines. Chinese Dietary Guidelines recommend that a typical male student consume 75g protein daily, 20-30% of energy should come from fat, and the remaining energy should be from carbohydrate. The recommendation also applies to a typical female student, but instead of 75g protein, she is recommended to ingest 65g protein. As the typical plate counts for one meal only, we should expect the protein content to be approximately 33% in order to meet the protein recommendation.

Based on these standards Plate 1 met the protein requirement, providing 34.13% and 39.38% of daily protein recommendation to males and females, respectively. However, the energy from fat in plate 1 exceeded 50% for both genders.

Plates 2 and 3, on the other hand, had low protein content. Plate 3 provides about 14.72% of the recommended protein for males, and 16.98% for females; Plate 2 provides only about 8.43% of the recommendation due to the small portion size of the ovo-vegetarian dish. In both cases, the protein recommendation was far from being met. At the same time, Plate 3 has a low-fat macronutrient profile, whereas Plate 2 has high-fat profile.

From these findings, we can reasonably suggest that the imbalance of macronutrients would be a potential problem. See below for a simplified chart (Table 4-8) comparing the macronutrient profiles of Plates 1-3.

	Carbohydrate	Protein	Fat
Plate 1	Low	Acceptable	Very High
Plate 2	Acceptable	Very Low	High
Plate 3	Acceptable	Low	Low

Micronutrients

Chinese Dietary Guidelines were applied when analyzing the micronutrient profile. Assuming each plate counts for approximately 1/3 of the total food intake, each sample plate should provide approximately 1/3, or 33% of the Recommended Dietary Allowance (RDA). Among all six micronutrients, calcium, sodium, and vitamin D are of particular concern.

Calcium and vitamin D were provided in small amounts in all three sample plates. For example, the Chinese Dietary Guidelines recommend that 800mg calcium and 200IU vitamin D be consumed by males as well as females. Plate 1 provides 16.55% of the recommended calcium amount, plate 2 provides 11.33%, and plate 3 only provides 2.46%; similarly, plate 1 provides only 5.00% of the recommended vitamin D, plate 2 provides 7.22%, and plate 3 provides 18.05%. Although the amount of calcium and vitamin D varies from plate to plate, all three plates provide less than 20% of the RDA for both nutrients, which would be of concern if this eating pattern were to persist.

Although vitamin D can also be obtained from sunlight, female students in China, in particular, are still not likely to get sufficient vitamin D. This is related to the preference of fair skin color among females in China. The use of sunscreen, sun umbrellas, and the avoidance of outdoor activities may be contributing factors. On top of this, natural vitamin D-rich foods (like fatty fish) and calcium-rich foods (like milk) were not seen in canteens. Therefore, these two nutrients are of concern.

According to the Chinese Dietary Guidelines, no more than 2200mg sodium per day should be consumed to prevent chronic diseases. However, 112.88% of this amount was present in plate 1, which was almost three times more than recommended. Plate 2 contained about 65.17%, which was still quite high, considering the plates assumed to count for 1/3 of the total food intake. Plate 3 only had 11.70% of the recommended sodium amount. However, plate 3 was

a soup dish, and additional condiments (which were not included in the analysis) were usually used to personal preference. Common condiments such as soy sauce, seasoned vinegar, and Sichuan chili paste are all high in sodium. Other than the condiments, the soup base a particular vendor chooses to use will also influence the overall sodium content. I used regular chicken broth found in the USDA Food Composition Software for the analysis. In reality, soup assembled from concentrated base, or soy-based soup will result in a much higher sodium level.

In comparison to the calcium, vitamin D, and sodium, the other three nutrients need more data to be evaluated.

In all three plates, the actual iron content could be higher than calculated due to the wide use of cast iron cookware in UFS. Therefore, the calculated percentages of the RDA for iron were probably not indicative of the students' iron status.

In contrast, the actual vitamin B2 content could be lower than shown. This is related to the unknown level of vitamin fortification in grain products (e.g. white rice or wheat flour). Official government documents related to grain fortification were not accessible to public, and thus it was unrealistic to estimate the exact amount of B2 in the food sold by UFS. On the other hand, in Chinese food markets, I noticed that the grain products labeled as “enriched products” were selling at a much higher price (about six times higher than usual market price), and therefore it was unlikely that UFS made use of such products.

The content of vitamin A varies greatly depending upon the ingredients that are used. Since UFS menus change according to seasonal availability, the amount of vitamin A shown in the calculation may not be representative. For example, although Plate 1 provided only 7.06% of the recommended vitamin A intake for an individual, Plate 3 provided over 120% of that. Due to vitamin A's fat-soluble nature, an individual may not need to consume it daily to meet the

requirement. This suggests that the students will not likely be vitamin A deficient as long as they make the right food choices in the canteen.

Chapter 5

Discussion

To my knowledge, this study is the first to examine nutritional health represented in university food services (UFS) in North China. The study aimed to explain how the operation and management of UFS in North China can impact college students' nutritional health. It attempted to describe how UFS has been operating in China after the reform policy in 1999, and also to analyze the diet patterns among college students. The study was divided into three parts and examined the issue through various perspectives. Among all population groups, college-aged students are an important target group that should not be overlooked for dietary study. This is due to the fact that they are still in the process of shaping their eating patterns, which can influence future health. In past studies, nutritional issues in this group focused on the trend of under-nourishment. Therefore, this three-part study examined whether this trend is related to UFS operation, and will attempt to provide some solutions.

Student Satisfaction and UFS Management

The results from the online student satisfaction survey in Part 1 are consistent with the available literature on this subject (Wang et al., 2012, & Gao, 2011), but provide more details. It showed that 35% of participants were not satisfied with their experience in the UFS, and food quality appeared to be a major concern among participants. The low student satisfaction would have been the driving force for the UFS to improve. However, UFS is facing two key problems: 1) the financial challenges that limit changes; and 2) the lack of motivation to change.

The reform policy published in 1999 encourages universities to privatize supporting facilities like UFS in order to be less dependent on government funding. Regarding the changes in UFS operation brought by the reform, my findings are consistent with the existing literature (Yuan, 2008 & Jiang, 2010). In fact, my results were more reflective of the general trend in North China after the reform, as the research location was not limited in a single university or a single city. The general trend of UFS operation has changed from total self-operation (owned and operated completely by the university) to partial or complete privatization, as well as from a non-profit facility to a for-profit facility. The massive food production line has been replaced by a smaller-scale production or even restaurant-style *a la carte* service. In short, the UFS operation and management in China is transitioning towards a more business-like system.

The reform in China is thought to improve the UFS and student nutrition, yet I found that the contradictory priorities made this issue complex. Contractors, especially large-scale professional logistic companies, should be able to quickly adjust to the market's needs and improve students' satisfaction. This should be especially true when the UFS has access to federal subsidization and a reduced tax rate. On the contrary, the society continues to believe that UFS should remain a non-profit facility, and this may put financial stress on the contracting companies. As a result, food quality has to be compromised in order to keep the meal affordable to all.

Nutrition has not been a priority in the UFS. It may be related to the lack of technical nutrition education among the staff and general population, and it could also be the lack of motivation to change among both UFS and students. The current priorities among all participating universities include ensuring food safety and maintaining low meal prices. Also, the huge student body has created a gigantic captive customer group, which would not put the UFS out of business despite the current food quality. Additionally, student participants and some managers thought

that nutritional health was a personal responsibility. Therefore, the UFS is under no pressure to change.

Student Nutritional Health

Detailed nutritional analysis was carried out in order to evaluate the nutrient adequacy of the most common dishes from canteens. The findings are consistent with the undernourishment trend among college students presented by existing studies (Huang & Huang, 2001, Shan & Liu, 2012, & Wang et al., 2012). A few major areas include:

1. Possibility of energy inadequacy

Based on the calculation, energy inadequacy may be a concern among students who obtain typical plates exclusively from canteens. Female students who choose the half-portioned plates are particularly subject to this concern given that such plates will only provide 11.98% of the energy recommendation.

2. Imbalance of macronutrient proportion

According to Chinese Dietary Guidelines, none of these three typical plates resembles the recommended macronutrient distribution. Analysis shows that students choosing either Plate 2 or 3 will not meet their protein requirement. Although by consuming Plate 1 students may obtain adequate protein, the high proportion of fat in this plate may invite concerns in the long run. These findings are consistent with the unique nutritional health situation in China, which include both the rising risk for obesity and the trend of undernourishment.

3. Calcium and Vitamin D

The analysis of the three typical plates suggested that the students were consuming inadequate calcium or vitamin D. Even though students may choose to occasionally purchase a calcium-rich food (e.g. a tofu-containing side dish) according to their own preferences, I noticed that other natural calcium rich foods (such as dairy products), and vitamin D rich foods (such as fatty fish) were not sold in the canteens.

Additionally, the avoidance of sun exposure among female students would be likely to further contribute to their low vitamin D status. Since vitamin D is needed to enhance calcium absorption and regulate mineral metabolism, the low vitamin D status, combined with low intake of calcium, will likely place these students at a higher risk for compromised bone health in their later years.

4. Excessive sodium

A concern for excessive sodium intake was not included in any existing Chinese literature. However, after the nutrient analysis, I believe that sodium should receive more attention. Among the three typical lunch/dinner plates, both Plate 1 and 2 were found to have excessive sodium, and Plate 3 could also be high in sodium depending on the vendors and students' preference for condiments. A recent study from National Institutes of Health showed that 19% of young adults have high blood pressure in the United States (NIH Medline Plus, 2011). This study shows that chronic diseases such as high blood pressure will also affect people at a young age. Therefore, sodium should be monitored along with other at-risk nutrients in the UFS facilities, and students should be educated about its association with health issues.

Other than the four major nutritional areas of concern listed, a few others such as iron, vitamin B2, and vitamin A, require further evaluation. Furthermore, nutrients contributed by breakfast were not evaluated. Due to drastically different individual preferences, a typical breakfast plate could not be determined, and thus I could only make inferences from the data gathered for lunch/dinner.

I assumed that the typical lunch/dinner plate counted for approximately one third of a student's total food consumption, and one third of his or her nutrient intake, when in reality this could be inaccurate. Breakfast and snacks vary greatly between individuals, and the nutrients from the foods consumed at these times may exceed one third of the nutrient intake. Under this circumstance, the under-nourishment trend was likely to be overestimated. For example, if a student chose to incorporate soy milk, eggs, and mixed nuts into their breakfast and snack foods, not only the energy requirement would be met, but also the protein and calcium status were likely to be improved.

In addition, the nutrient content of these typical plates may not always be representative. On average, each canteen provides over forty different side dishes, which consist of ingredients that are highly seasonal. An informed student could easily make healthful choices in this facility, and further improve his or her nutritional status with additional foods purchased from off-campus or retail locations. For example, by incorporating soy milk or milk from retail stores in breakfast, a student would easily improve his or her protein intake. Hence, the major challenge is that Chinese institutions or UFS have not started any nutrition promotion or education event for the students, and thus the lack of nutrition education may have contributed greatly to the apparent undernourishment reported here.

Integration of Findings

This three-part study revealed that undernourishment among Chinese college students may be closely associated with the operation and management of UFS in North China: 1) Even though students showed dissatisfaction towards the food quality in the UFS, they still chose to dine in the UFS due to social, academic, or financial reasons. 2) Being at the transitional stage of the reform, UFS management had yet to place nutrition consideration as a primary concern. 3) By observing the students' eating patterns, I further validated the apparent undernourishment among these students.

Both the literature review and the online UFS satisfaction survey (Part 1 of this study) showed consistent dissatisfaction among participants. Through the short ten-question online survey, it was clear that the major complaints were targeted at food quality. If UFS were to operate in an unrestricted "open market", in which all vendors or food service facilities have an equal opportunity of being selected by student customers, UFS facilities might be out-competed by off-campus restaurants or other alternative food sources. However, the unique circumstances faced by students did not lead to the expected scenario. The majority of college students in China are dealing with tremendous academic stress (Mavrides, 2006), and they spend nearly all academic years on campus for various reasons. These two conditions have led the students to choose UFS over other food sources for convenience and cost. In addition, private off-campus restaurants can hardly handle such a gigantic student body in a tight window of time. Therefore, college students have become captive customers of UFS. This fact was shown in past studies (Wang et al., 2012, Gao, 2011, & Luo, 2009) and confirmed by conversations with student participants in the present study.

Given that Part 1 demonstrated that students had a clear dissatisfaction with food quality, Part 2 and Part 3 were completed in an attempt to provide explanations for this, as well as to validate the concern regarding undernourishment.

Since the UFS has become the students' primary food source, the nutritional quality of the meals provided by UFS determines students' nutritional health. However, due to the reform of 1999, management is unable to concentrate on the nutritional quality of food. The reform of 1999 encouraged the privatization of UFS and added complications to management of UFS facilities. According to conversations with UFS managers, most universities in North China were still in the "transitional stage" of this reform movement. The problem of being in the "transitional stage" is indicated by different levels of privatization, and even occasional reversal of ownership transfer (such as U3). Past studies and interviews in Part 2 also revealed the financial hardship faced by UFS. Therefore, it is reasonable to relate the problem of low meal quality to the financial hardship caused by transitioning into privatization.

Moreover, the lack of nutrition education among UFS managers, staff, and students further compromise students' nutritional health. Through Part 3 of this study, the nutritional quality was not shown to be optimal. Energy content, macronutrient proportion, and vitamin and mineral content were not well-balanced for this population group, whereas the UFS managers and student participants in Part 2 believed that eating right should be a personal responsibility. These findings echoed results in existing literature (Shan & Liu, 2012, Yang, 2012 & Li, et al., 2012), and should be addressed in future health studies and intervention research.

The following figure shows a simplified relationship among the above-mentioned factors.

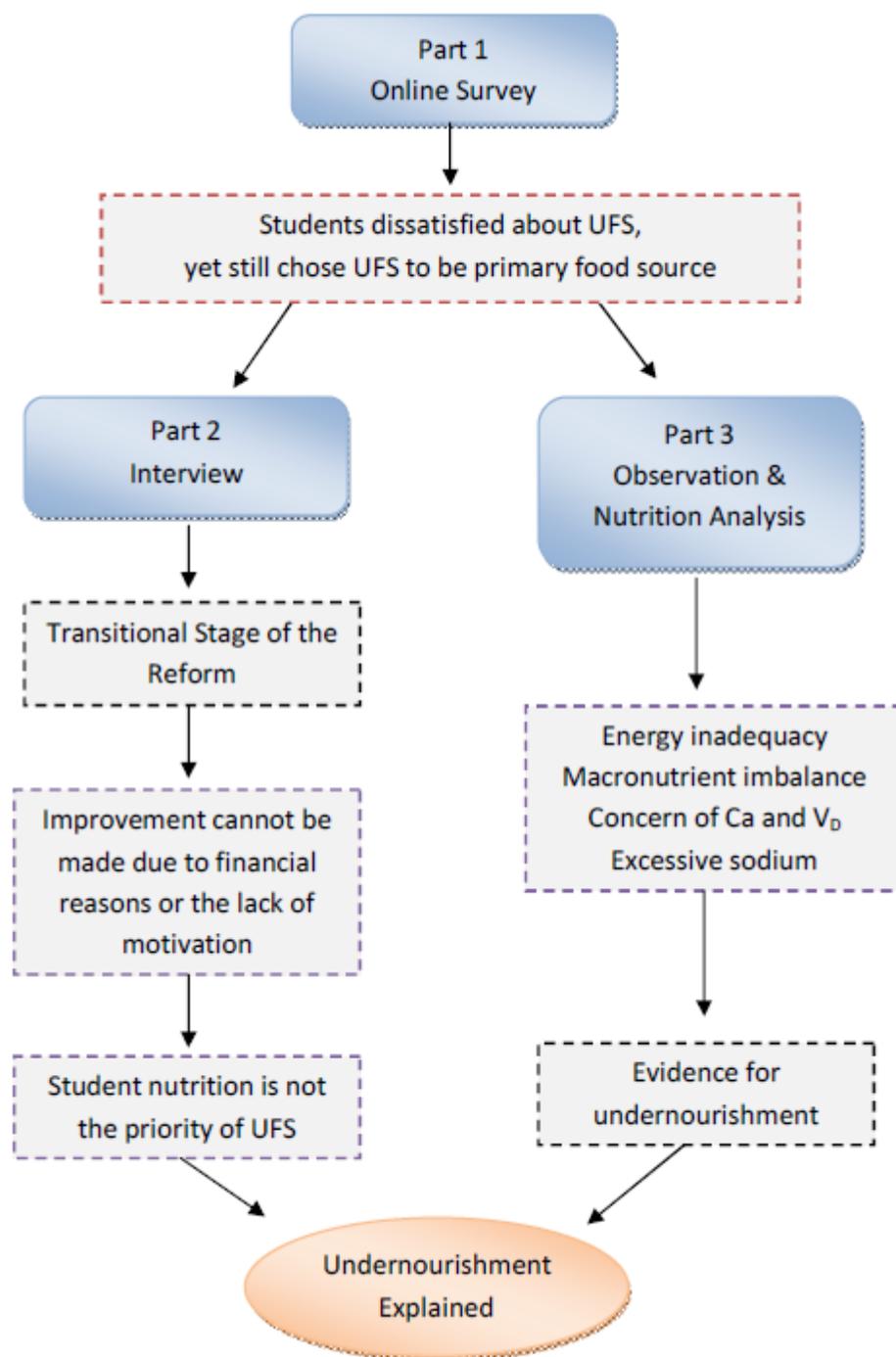


Figure 5-1. Integration of findings

Advantages

The major advantages of this study include the use of an open-ended survey format, multiple perspectives, and multiple methods. In part II of the study, the number of questions was not restricted; instead open-ended questions were to encourage the participants to freely express their opinions regarding the issues. In this way, an in-depth understanding of the participants' attitudes and feelings about the issues could be formed. By incorporating participants from different occupations (manager, staff, student, and faculty), a more well-rounded interpretation of the issues was possible. A helpful feature of this study was the combination of quantitative and qualitative research methods. This feature allowed for the collection and analysis of both subjective and objective data, producing a more reliable result.

Limitations

The major limitations of this study are related to reliability due to the unrepresentative participant sample and high subjectivity of the data analysis. Since the participating universities and participants were chosen as a convenience sample, they were a small sample, and not statistically representative of the population. Recruiting participants and carrying out individual interviews were highly time-consuming, and thus made it difficult to get a large and representative sample. The analysis of data relies entirely on the researcher's interpretation, which may lead to misunderstandings and inaccuracy. In addition, the quantitative data used in part III relied heavily on estimation of nutrient intake and observation of food behavior and consumption, which might contribute to error.

Recommendations

In spite of its limitations, this study has several implications for both the UFS and the wider community. First and foremost, a formal nutrition education program is needed to increase students' awareness of diet and health. Nutrition education would provide dependable nutrition information and thus allow students to make their own healthful choices in the UFS facility. This education program could either be sponsored by the university or by the community. Considering students' current academic load, the nutrition education should not be an extra university course. Instead, it could be provided by posters, university newspapers, or websites.

Secondly, even with the complicated situation related to privatization reform, there are ways for UFS to improve food quality without added financial burden. For example, nutrient content could be improved by replacing high sodium or high fat flavoring agents with ingredients such as peanuts or house grown herbs. More retail vendors selling soy milk, milk, yogurt, or other packaged nutritious snacks could be moved to the main dining area to provide convenience for students.

Reliable information on the nutritional health of college students in China was rarely found. Although current studies suggested nutritional trends among this population group, more in-depth information, such as students' BMI distribution, eating patterns, exercise patterns, nutritional programs, or chronic disease prevalence, has not been reported. In particular, future studies examining students' nutritional health are needed.

Chapter 6

Conclusion

The aim of this study was to examine the effect of the operation and management of UFS in North China on college students' nutritional health. The analysis and interpretation indicate that the UFS under current circumstances could be negatively affecting students' nutritional health. The previously reported trends of undernourishment among Chinese students could thus be partially explained by this. Also, energy, protein, vitamin D inadequacy, and sodium excess are major areas of concern. The findings and recommendations can be used to suggest meal quality improvements in Chinese UFS, initiate nutrition promotion programs, as well as to inspire future in-depth studies on the nutritional status of this population group.

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Appendix A – Informed Consent (English)

INFORMED CONSENT FORM

Pennsylvania State University

Title of project	“Dining at Universities in North China: Looking Into Foodservice Management and Nutrition for Students”
Person in charge	Jingchen Liu , BS degree student in Nutritional Sciences (Honors)
Contact information	265 Blue Course Dr, 21B, State College, PA 16803 jxl5316@psu.edu (814) 954-2551
Student advisor	Dorothy A. Blair , Ph.D., Assistant Professor
Contact information	Department of Nutritional Sciences, University Park, PA 16802 Ey6@psu.edu (814) 863-2912

1. This section provides an explanation of the study in which you will be participating

- A The study in which you will be participating is a part of research intended to define the specific problems found in university food services and attempt to provide solutions in order to promote the health of university students in North China. By conducting this study, we also hope to call public attention to these problems that the students are facing.
- B An unstructured face-to-face interview will be held in public place on campus. During the interview, the study will be explained, this consent will be signed, and the process of the interview will be explained.
- C Your participation in this research will take approximately one hour, which only includes the interview.
- D This study involves no risk to your physical or mental health.
- E This study may involve the use of audio recording. The digital audio file will not be shared with anyone but the primary investigator, Jingchen Liu, and it will be stored and secured in a password protected folder. The adviser of the primary investigator may have access to the written transcript of the recording. Both the audio file and transcript will be destroyed at the end of this study. In the event of any publication or presentation resulting from this research, no personally identifiable information will be disclosed.
- F The final written report, containing only anonymous quotations, will be available to all at the end of the study.

2. This section describes your rights as a research participant

- A Your participation in this research is confidential. Only the primary investigator,

Jingchen Liu, will have access to your identity and to information that can be associated with your identity. In the event of publication of this research, no personal identifying information will be disclosed/ To make sure your participation is confidential, only a code number will appear on all digital files and subsequent transcripts. Only the primary investigator can match the identity with code numbers.

- B Your participation in this study is voluntary. You may withdraw your participation at any time, or decline to answer any specific questions without penalty.
- C After you have finished participating, you will receive a more detailed explanation of the findings of the study. Any questions you have will be answered.
- D You may also ask any questions about the research procedures at any time, and these questions will be answered.
- E You may contact the adviser of this study, Dr Blair, at (814) 863-2912 with questions, complaints or concerns about this research study.

3. This section indicates that you are giving your informed consent to participate in the research

Participant

- A I agree to participate in a scientific investigation of the management and hidden nutritional issues in university foodservices in North China, which is an authorized part of the education and research program of the Pennsylvania State University.
- B I understand the information given to me, and I have received answers to any question I may have had about the research procedure. I understand and agree to the conditions of this study as described.
- C I have no physical or mental illness or difficulties that would increase the risk to me in participating in this study.
- D I understand that I will receive no compensation for participating
- E I understand that my participation in this study is voluntary, and that I may withdraw from this study at any time by notifying the primary investigator
- F I am 18 years of age or older
- G I understand that I will receive a signed copy of this consent form

Signature

Date

Researcher

I certify that the informed consent procedure has been followed, and that I have answered any questions from the participant above as fully as possible.

Signature

Date

Appendix B – Informed Consent (Chinese Translation)

知情同意书

INFORMED CONSENT FORM

宾州州立大学

Pennsylvania State University

研究课题	中国北方高校餐饮：纵观餐饮管理，食品质量，以及学生满意度
Title of project	Dining at Universities in North China: Looking at foodservice management, food quality, and students' satisfaction
研究者	刘静晨，营养科学系（荣誉学院）学生
Person in charge	Jingchen Liu, BS degree student in Nutritional Sciences (Honors)
联系方式	265 Blue Course Dr, 21B, State College, PA 16803
Contact information	Jxl5316@psu.edu (814) 954-2551
指导教授	Dorothy A. Blair, Ph.D., 助理教授
Student advisor	Dorothy A. Blair, Ph.D., Assistant Professor
联系方式	Department of Nutritional Sciences, University Park, PA 16802
Contact information	Ey6@psu.edu (814) 863-2912

1. 研究说明

- A 您将要参与的这项研究旨在发掘高校餐饮业现存的问题，并尝试提出解决方案，以此促进中国北方高校学生健康。我们也希望能够通过开展这次研究，呼吁公众重视学生营养问题。
- B 此非结构化的面对面采访将会在校园公共场所举行。在采访中，采访者会说明此项研究、并请您签署这份知情同意书，并且会解释采访过程。
- C 您的参与，包括此次采访，将会占时约一个小时。
- D 这项研究不会对您的身体或者精神造成危害。
- E 这项研究会被录音。数码录音文件不会与除了研究者以外的任何人分享，文件将会被存放在密码保护的数码文件夹中。指导教授可以要求浏览书面副本。研究结束后，数码录音与副本会被删除。如果研究论文被发表或者公开，任何关于您身份的信息都不会被泄漏。
- F 在研究结束后，您可以要求只含有匿名引文的最终书面报告。

2. 研究参与者权利

- A 在这项研究中，您的参与将会被保密。研究者刘静晨(Jingchen Liu) 是唯一一个获取有关您身份的信息。如果研究被公开，您的身份信息不会被泄漏。为保证您的隐私，您的信息将会以号码命名，并且只有研究者可以将您的身份与号码匹配。
- B 您的参与是自愿的。你有权力在任何时候退出研究，或者拒绝回答某一问题。您的退出与拒绝不会对您有任何不利后果。
- C 结束参与后，你将会收到一份详细的研究结果说明。你的任何问题将会被得到解答。
- D 在研究中的任何时间，您可以对研究过程提出任何问题，它们会被解答。
- E 如果你仍对研究有疑问、不满或者顾虑，你可以联系这项研究的指导教授 Blair 博士。联系电话：(814) 863-2912

3. 知情并同意参与

参与者

- A 我同意参与这项由宾州州立大学授权的、关于高校餐饮部管理、食品质量，以及学生满意度的科学研究。
- B 我了解上述信息，并且我提出的关于这项研究的问题已经得到解答。我明白并且同意上述关于这项研究的条件。
- C 我没有身体或者精神上的症候与困难，并且不会因为它们增加我参与的风险。
- D 我明白我的参与没有经济上的补偿。
- E 我明白我的参与是自愿的，并且我可以通过告知研究者随时退出研究。
- F 我已年满 18 周岁。
- G 我明白我将会收到这份文件的复印件。

签名

日期

研究者

我保证我遵循了知情同意的程序，并且我已经尽可能完整地回答了参与者提出的问题。

签名

日期

Appendix C – Survey Question Text (English)

Survey questions

Thank you for taking a moment to answer the following questions about the food and service you receive in your university cafeteria. Please indicate your response to the following statements by circling the number on the right. (1 – strongly disagree; 10 – strong agree)

		Strongly Disagree					Strongly Agree					
Student Status												
1	I am currently a student enrolled in a university in North China	1									10	NA
Food quality												
2	The menu has a good variety of items to choose from	1	2	3	4	5	6	7	8	9	10	NA
3	The food is served at the proper temperatures	1	2	3	4	5	6	7	8	9	10	NA
4	The overall quality of the food is good	1	2	3	4	5	6	7	8	9	10	NA
Service												
5	The employees are very friendly and courteous	1	2	3	4	5	6	7	8	9	10	NA
6	The overall service in the cafeteria is good	1	2	3	4	5	6	7	8	9	10	NA
Environment												
7	Both the dining area and serving area are clean	1	2	3	4	5	6	7	8	9	10	NA
8	The seating is adequate, and the waiting time is acceptable	1	2	3	4	5	6	7	8	9	10	NA
General												
9	Overall, the food is a good value for the price	1	2	3	4	5	6	7	8	9	10	NA
10	I am very satisfied with my experience with the university foodservice	1	2	3	4	5	6	7	8	9	10	NA

Attached: Chinese-version survey questions for non-English speaker

Appendix D – Survey Question Text (Chinese Translation)

调查问卷

感谢您的参与。对于以下关于食品质量与服务的陈述，请根据您所在的大学食堂，圈出您的回答。（1，非常不同意该说法；10，非常同意该说法）

学生现状											
1	我现在就读于一所中国北方大学	1								10	
食品质量											
2	每餐所提供可以选择的食品种类很多	1	2	3	4	5	6	7	8	9	10
3	拿到的食品温度合理（热菜还是热的；凉菜是凉的）	1	2	3	4	5	6	7	8	9	10
4	总的来说，食品质量很好										
服务											
5	食堂员工友好并且有礼貌	1	2	3	4	5	6	7	8	9	10
6	总的来说，服务质量很好	1	2	3	4	5	6	7	8	9	10
环境											
7	用餐区和服务区都很干净	1	2	3	4	5	6	7	8	9	10
8	用餐区有充足的座位，并且排队等待服务的时间合理	1	2	3	4	5	6	7	8	9	10
综合											
9	总的来说，食品质量和价格相符合	1	2	3	4	5	6	7	8	9	10
10	我对我们学校的食堂很满意	1	2	3	4	5	6	7	8	9	10

Appendix E – Online Survey Screenshot



大学食堂食品质量与服务调查

发布者: [ichlet](#) 12-04-07 有效答卷: 91份

此问卷处于停止状态, 仅供浏览, 请勿填写! [恢复运行](#) [关闭](#)

感谢您的参与! 这份问卷包括10道选择题, 其中9道为量表题。回答这份问卷最多将会占用您3分钟。这份调查问卷将用于调查者的学术论文, 该论文着重于研究中国北方大学食堂的管理、食品质量、以及学生营养。调查问卷的最终统计结果仅作为分析与参考, 您的姓名、大学的名称或者任何有关您个人隐私的信息不会被调查者公开。在回答问卷的过程中, 您有权跳过任何一题。您对调查问卷的完成并提交代表你阅读并且同意以上陈述。对于以下关于食品质量与服务的陈述, 请根据您所在的大学食堂, 选择您的答案。

- 我现就读或工作于一所中国北方大学 (包括专科、本科、硕士、博士、或者任职) *

请选择
- 食品质量 *

	非常不同意	2	3	4	5	6	7	8	9	非常同意	跳过这题
食堂提供的食品种类很多	<input type="radio"/>										
在食堂拿到的食物温度合适 (热菜是热的, 凉菜是凉的)	<input type="radio"/>										
总的来说, 食品质量很好	<input type="radio"/>										
- 服务 *

	非常不同意	2	3	4	5	6	7	8	9	非常同意	跳过这题
食堂工作人员很友好、有礼貌	<input type="radio"/>										
总的来说, 服务质量很好	<input type="radio"/>										
- 用餐环境 *

	非常不同意	2	3	4	5	6	7	8	9	非常同意	跳过这题
就餐区和服务区都很干净整洁	<input type="radio"/>										
就餐区有充足的座位, 排队等待的时间合理	<input type="radio"/>										
- 综合 *

	非常不同意	2	3	4	5	6	7	8	9	非常同意	跳过这题
食品质量和价格相符合	<input type="radio"/>										
总的来说, 我对我们食堂很满意	<input type="radio"/>										

提交答卷
[预览或打印答卷](#)

Appendix F – Recruitment Letter for Student Participants (With Chinese Translation)

Introductory letter

Dear student,

I am, just like you, a student. I am currently studying Nutritional Sciences at the Pennsylvania State University, and my field of study includes international nutrition, and foodservice management. I have worked for Penn State Foodservice, and I am going to work in Ferris State University as an intern manager. Working with both the management team and students makes me realize how important the university cafeteria is to set a good start for your busy study.

I am trying to learn about the operation and management of the on campus foodservice facility. For example: What kind of food is being served to the students? How can the food benefit the students nutritionally? How can the current foodservice be even better? These are the questions I hope to find answer to with this study about university foodservice in North China.

These questions cannot be simply answered in a few minutes. Also the answers could be very subjective based on your personal experience with the facility. Therefore, I would like to spend some time with you for a discussion either on campus, or over the phone. I will be grateful if you are willing to share your thoughts and experiences with me.

The reason I am asking you is that nobody else is experiencing the on-campus foodservice facility more closely than you, and thus what you think and feel is very important. You are the best person whom I can learn from.

What I learn from you will be used for my Honors thesis. No names, nor university names, will be used. You will be completely anonymous in my thesis. You always have the right to quit this study at any point of time.

I am doing this research because I think it is the best way to find out how the foodservice in North China is operated and managed, and how students' nutrition needs are met. I appreciate your consideration of being a part of my study. If you have any questions or would like to enroll in the study, please contact me at jx15316@psu.edu.

Sincerely,
Jingchen Liu

P.S. Chinese Translation

亲爱的同学,

我是一个学生, 就像您一样。我来自美国宾州州立大学健康与人类发展学院, 营养科学系。我的研究方向包括国际营养和餐饮服务管理。我曾经为宾州州立大学的餐饮部工作, 现在是费里思州立大学餐饮部的实习经理。作为和您一样的学生, 并且与管理团队工作经验让我深刻体会到大学食堂对于大学生生活的重要性。

我这次到北京是为了深入了解中国大学餐饮系统的运作和管理。例如: 餐饮部为学生提供的是怎样的食物和服务? 食品的营养价值如何? 目前的餐饮部如何会更好? 我希望能您的学校找到这些问题的答案。

这些问题恐怕不是通过一个选择题就可以得到的答案, 同时每个人的答案一定也是根据您对餐饮部的个人经历而相异的。所以我希望能够占用您宝贵的时间与您见面或者是通过电话和您交流。在这里非常感激您能够愿意考虑和我分享您的想法和经历。没有人比您更深入地了解这所大学的餐饮部, 所以毫无疑问, 您是我这次调查最佳的人选。

这份调查将会被用作我在宾州州立营养系荣誉学院的结业论文。您在我的论文中将会是完全匿名的: 您的名字, 大学的名称, 或者任何私人信息不会被引用。并且您可以随时要求退出调查。

这份调查对我来说非常重要, 因为它是我了解中国北方大学餐饮部运作和管理, 以及学生营养情况的最好方式。十分感谢您能够考虑参与这份调查。如果您有任何关于调查的问题, 请随时联系我, 我会很乐意向您作出更详细的解释。

再次感谢您的时间和考虑。

联系人: 静晨

Email: jxl5316@psu.edu

电话: (+1) 814-954-2551

Appendix G – Recruitment Letter for UFS Managers (With Chinese Translation)

Introductory letter

Dear Mr./Ms.

I am a student from the Pennsylvania State University, and I am currently studying Nutritional Sciences. My field of study includes international nutrition, and foodservice management. I have worked for Penn State Foodservice, and I am going to work in Ferris State University as an intern manager. Working with both the management team and students makes me realize how important the university cafeteria is to provide the students with nutritious food to start their day, and to set a good image of the university.

I am trying to learn about the operation and management of the on-campus foodservice facility. For example: How was the menu created? How operation efficiency is ensured? What methods are used to increase student satisfaction? These are the questions I hope to find answers to with this study about university foodservice in North China.

These questions cannot be simply answered in a few minutes. Also I would like to obtain your opinion based on your personal or professional experience with the facility. Therefore, I would like to spend some time with you for a discussion in person. I will be grateful if you are willing to share your expertise, thoughts and experiences with me.

The reason I am asking you is that nobody else is experiencing the on-campus foodservice facility more closely than you, and thus what you think is very important to me. You are the best person whom I can learn from.

What I learn from you will be used for my Honors thesis. No names, university name, or any other personal identifier will be used. You will be completely anonymous in my thesis. You always have the right to quit this study at any point in time.

I am doing this research because I think it is the best way to find out how the foodservice in North China is operated and managed. I appreciate your consideration of being a part of my study. If you have any questions or would like to enroll in the study, please contact me at jx15316@psu.edu.

Sincerely,

Jingchen Liu

P.S. Chinese Translation

亲爱的先生/女士,

我是一名来自美国宾州州立大学的学生, 目前就读于营养科学系。我的研究方向包括国际营养以及餐饮管理。我曾为宾州州立餐饮部工作, 并且即将成为费里思州立大学餐饮部的实习经理。作为一个学生, 并且与餐饮部的管理团队的合作的工作经验让我深刻体会到高校餐饮部对于大学生生活的重要, 因为餐饮部不仅仅要满足学生的营养与餐饮需求, 对这所大学在社会中的整体形象更是重要。

我目前正在学习中国校园餐饮设施的运营以及管理。例如: 菜单是如何设定的? 怎样保证运作效率? 怎样提高学生满意程度? 这些问题我希望能够通过这次对于中国北方高校餐饮部的研究得到答案。

这些问题恐怕不是能在几分钟内就简单回答的。更何况通过在此部门工作, 您的个人与专业经历一定让您对上述问题有着独特的见解。因此, 我希望能够占用您宝贵的时间与您见面交流。在这里非常感激您可以考虑与我分享您的专门知识、想法与经历。对于校园餐饮设施, 没有人比您了解得更深入, 所以您的想法与见解对我非常重要, 您毫无疑问, 是我这项研究的最佳人选。

调查的结果将会被用作我在宾州州立大学营养科学系荣誉学院的结业论文。您在我的论文中将会是完全匿名的: 您的名字、学校的名称、或者任何其它关于私人或学校的信息都不会被引用。您可以随时要求退出调查。

这份调查对我来说非常重要, 因为他是我了解中国北方大学校园餐饮运作与管理、以及学生营养情况的最好方式。十分感谢您能够考虑参与这项研究。如果您有任何关于调查的问题或顾虑, 请随时联系我, 我会很乐意向您作出更详细的解释。

再次感谢您的考虑以及您宝贵的时间。

联系人: 静晨

Email: jxl5316@psu.edu

电话: +1 (814) 954-2551

Appendix H – Interview Prompts

Interview Questions

Interview with students/university staff (phone or in person)

1. What is your field of study?
 - a. (student only) What year are you in?
 - b. How long have you been in this campus?
2. How often do you eat on campus?
3. Could you describe for me your experience with the cafeteria in your university? (Below are only prompts, as we expect the interviewees to talk about their experiences freely. In the event that they only focus on one aspect, we may use one or more of the prompts below to help them.)
 - a. What is the average time for you to get food?
 - b. How's the quality of the food that you get?
 - c. How's the dining environment and staff?
 - d. Is there any nutritional information that you can get access to in the cafeteria?
 - e. Have you experienced any problems associated with the university cafeteria in the past month?
4. Where do you think can the cafeteria be improved?
5. Where else can you get food from when you are on campus?
6. Do you have any outside food chains come into school to sell food?

Interview with the foodservice manager (in-person)

1. What is your job title?
2. How many years have you held this job (or how long have you been working in this field)?
 - a. Academic backgrounds?
3. How many cafeterias are there in this university?
4. Does the cafeteria self-operating, or does the university have contract with outside foodservice company?
5. Could you describe how the system works? (Possible areas to discuss include forecasting, menu planning, efficiency, and staff training. Due to the qualitative nature of this interview, questions below only serve as prompts.)
 - a. How do you forecast the volume?
 - b. May I ask how the menu was set?
 - i. Based on what criteria?
 - c. How do you ensure efficiency in the cafeteria?
6. Could you tell me your thoughts on food-related policies currently in effect in your school?

7. What do you feel the role of the school should be in regard to dealing with students with special nutritional needs (i.e. allergies, obesity, or other conditions closely related to food, like diabetes)?
8. What are the goals for the upcoming year?

Interview with cafeteria staff (in-person)

1. What is your job title?
2. How long have you been working here?
3. What is the operating hour of this cafeteria?
 - a. Where else can the students get food from?
4. Could you describe the cafeteria environment during mealtimes? (Questions below serve as prompts)
 - a. What is the students' behavior?
 - b. How long does it take for the students to get food?
 - c. Is the seating adequate during meal rush?
 - d. What is the cafeteria policy for students who come in late?
5. What are the students' comments about the food or environment?
6. How much do they usually pay for food here?
7. What happened at the end of the meal period?
 - a. What happened to the leftovers at the end of the day?

ACADEMIC VITA

Name: Jingchen Liu

Address: 265 Blue Course Dr, Apt 21B, State College, PA 16803

Email: jx15316@psu.edu

Education: **The Pennsylvania State University, University Park, PA** **May, 2013**
Schreyer Honors College
B.S. in Nutritional Sciences (Applied Option)
Minor in Biology

Thesis Title: Dining at Universities in North China: Looking at the Impact of Foodservice Operations on Student Nutrition

Supervisors: Dr. Dorothy Blair & Dr. Rebecca Corwin

Work, Volunteer, and International Experiences:

- Internship* **National Association of College & University Foodservices (NACUFS), Ferris State University, Big Rapids, MI** **Summer, 2012**
Foodservice Management Intern (Full-time)
Supervisor: Brenda Walton
- Managed and supervised food preparation in the on-campus dining facility
 - Received training on inventory control and forecasting using Food Pro menu management system
 - Developed a themed meal and sold over 500 servings during lunch period
 - Worked with a registered dietitian in preparing nutritional information for stations and menu items Collaborated with another intern to carry out research on gluten-free food preparation
 - Conducted a staff training session
- Nutrition & Food Service* **Starbucks Coffee Company, University Park, PA** **2012 – 2013**
Barista in Penn State licensed store
- Prepared drinks in one of the busiest Starbucks stores in town
 - Worked under pressure and demonstrated excellence in customer service
- Mount Nittany Medical Center, State College, PA** **2011 – 2012**
Volunteer for Nutrition/Culinary Administration **2011 – 2012**
- Assisted clinical dietitians and dietary clerks in visiting in-patients
 - Telephoned discharged patients for follow-up
 - Prepared nutrition education material for staff training sessions
- Volunteer for Guest Services* **2012**
- Greeted guests and gave directions
 - Facilitated disabled patients in getting to their destinations

Volunteer for Physical Therapy Department 2011

- Assisted physical therapist in their treatment sessions
- Helped care patients and set up equipment

Penn State Food and Housing Service 2011 – 2012

Student Employee for Findlay Dining Commons 2011 – 2012

- Assisted cooks in preparing various dishes in Findlay main dining commons
- Worked independently in preparing retail food items
- Climbed over eight positions in two years, including line server, cashier, dish room worker, and etc.

Student Employee for Asian Grill 2012

- Took customer's orders and prepared personalized dishes on electric flat grill

Penn State Department of Nutritional Sciences Fall, 2011

Teaching Assistant for "Introductory Principles of Nutrition"

- Conducted exam review sessions and helped students in preparing for their exams
- Assisted instructor in grading papers and assignments
- Answered questions and replied emails from students

International **Institut Paul Bocuse, Lyon, France** 2012

- Studied basic French gastronomy
- Received hands-on culinary training in basic French cuisine
- Attended advanced pastry demonstrations, wine tasting, and cheese tasting sessions

Penn State Global Program, University Park, PA 2011 – 2012

- Facilitated social events for newly enrolled international students
- Helped in campus tour and information booths during new international student orientation

Honors and Achievements:

Dean's List Academic Achievement, Penn State Fall 2013
Fall/Spring 2012
Fall/Spring 2011
Fall 2010

Schreyer Honors College grant for study abroad 2012

Schreyer Honors College Research Grant 2012

Ministry of Education Scholarship (SM1), Singapore 2005 – 2009

- Annual cash allowance of S\$2,200 (secondary level)/2,400 (pre-university level)
- Exemption from tuition, accommodation, medical and accident insurance

Certifications:

SERVSAFE Food Safety Certification Nov 2011

Singapore-Cambridge General Certificate of Education (Advanced Level) Mar 2010

- Certified subjects include: H1 General Paper, H1 Project Work, H2 Mathematics, H2 Chemistry, H2 Biology, and H3 Chinese Language & Literature

Involvement and Membership:

Academy of Nutrition and Dietetics	Student Member, 2011 – 2013
Penn State student Nutrition Association	Member, 2011 – 2012
Women’s Chorale at Penn State	Member, 2010 – 2012
PSU Center for the Performing Arts	Stagehand, 2010 – 2011

Language Proficiency:

Chinese Language (native speaker and advanced learner)

- Fluent verbal and oral communication
- Studied ancient literature and calligraphy

English Language (advanced learner)

- Fluent verbal and oral communication