Title of article:

Selecting Meal Plan Options:
A Collegiate Dining Services Analysis

Authors:

Steven M. Connor
Bucknell University
Lewisburg, PA 17837

Keith A. Willoughby[1]
Department of Finance and Management Science
Edwards School of Business
University of Saskatchewan
Saskatoon, SK Canada S7N 5A7
Phone: (306) 966-2128
Fax: (306) 966-2515
E-mail: willoughby@edwards.usask.ca

---

[1] Corresponding author

Abstract:

Our university offers its students (from sophomores to seniors) four particular meal plan options, with service available at two specific outlets. First-year students are given no choice in the meal plan they must buy. We conducted a cost analysis of the various alternatives and showed that the choice of the best meal plan option depends on the eating habits of the specific student. Some first-year students appear to be penalized by the specific meal plan they are required to purchase.

1.0   Introduction

Food and drink sales comprise a substantial market in the United States (U.S.). In

2002, restaurants earned $407.8 billion in total sales, with more than 54 billion meals

consumed. Colleges and universities offer a significant outlet for the sales of these

products. In 2002, food and drink sales at such institutions totaled $6.76 billion. Sales

for 2003 were projected to growth to $7.23 billion, an increase of roughly 7%[2].

Collegiate students throughout the U.S. have a variety of alternatives to consider

when choosing meal options. For those students who prefer to dine at on-campus

foodservice outlets, we conducted a cost analysis of meal plan options available at our

institution (a private, residential, liberal-arts college in the northeast U.S.). The Dining

Services department of our university has an annual budget of $8.3 million and a staff of

119. It serves approximately 1.8 million meals each year. Dining Services offers four

distinct meal plan options, with service available at two particular outlets. We feel that

our analysis can provide useful assistance to our students in selecting appropriate, cost-

effective meal plans.

The format of our paper is as follows. The next section presents a review of

pertinent literature to collegiate foodservice operations. It also describes the use of

quantitative models in meal and nutritional analysis. The third section provides a

---

[2] Information obtained from the website of the National Restaurant Association, www.restaurant.org

description of the meal plan options available at our university, while the following section illustrates the cost analysis. Conclusions are offered in the fifth section.

2.0   Literature review

College and university foodservice operations represent a topic of scholarly research and examination. A variety of rather interesting areas within this environment has been analyzed. Matsumoto (2002) illustrated the manner in which Villanova University's dining service operation innovatively managed the confluence of layout and design issues. Moreover, Illinois State University introduced dramatic changes in its décor by adopting a "Rainforest Café" scheme and utilizing aquariums as room dividers (Matsumoto, 1998).

In an attempt to study managerial roles, Sultemeier, Gregoire, Spears and Downey (1989) surveyed almost 1,000 foodservice managers from 80 U.S. colleges and universities. The respondents rated "maintaining standards of quality" as their most important and time-consuming activity. Further, King (2002) reported that a reduction in the endowments of many private colleges and universities is forcing foodservice managers to contend with sharp budget cuts and wage freezes.

Buscher, Martin and Crocker (2001) conducted an innovative study of college students' snack purchase habits. Foodservice officials promoted, on a weekly basis, vegetable baskets, fruit baskets, pretzels and yogurt in point-of-purchase (POP) interventions. Sales of these items were compared before, during and after the interventions. With the exception of the vegetable baskets, each of the promotions resulted in augmented sales.

Anonymous contributors to *Nation's Restaurant News* (1998) and *Foodservice Equipment & Supplies* (2002) highlighted, respectively, the health and convenience features available in Harvard University's food-court additions and the broad selection and widespread popularity of a new university-sponsored restaurant at the University of San Diego. Watkins (1998) reported on the growth of culinary clubs on college campuses; namely, at Ball State University and Middlebury College. These clubs have permitted students to explore healthy alternatives to fast-food choices.

It would appear that not all collegiate students are exploring health-conscious choices in their eating practices. In fact, King (1998) bemoaned the fact that collegiate students (and other young adults) are foregoing early-morning nutrition. Moreover, the foodservice outlets at many college campuses no longer operate with well-defined meal times. Sloan (1996) discussed the changing trends of collegiate students' eating habits, initiating an increase in the variety of on-campus eateries (many of these being fast-food chains). Kass (1995) described some developments at the University of Wisconsin-Milwaukee, in which students campaigned for the elimination of several college-run restaurants and the addition of such private, fast-food operations as McDonald's and Taco Bell.

As this paper seeks to develop a quantitative framework for selecting meal plan options, it would be useful to explore how others have investigated the combination of quantitative modeling and foodservices. It appears that most of the prior work in this area has been devoted to the use of mathematical programming in select cost-effective mixtures of nutrients in food products. This is the so-called "diet problem". Balintfy (1975) is an early reference on this subject. Mathematical modeling in this environment

has witnessed numerous applications, from nutrient examination for pediatrics (Briend and Darmon, 2000) to adults (Darmon, Ferguson and Briend, 2002).

Westrich, Altmann and Potthoff (1998) developed a mathematical model to estimate food nutrient values. Their approach was eventually used by the Nutrition Coordinating Center at the University of Minnesota to assist in maintaining a food composition database. Fletcher, Sodon and Zinober (1994) modified the usual mathematical model for menu selection. Since least monetary cost diets may be rather unpalatable, they incorporated an objective function based on the food preferences of respective individuals.

Lancaster (1992a and 1992b) presented an evolution of quantitative modeling in menu planning. Further, the interested reader is referred to Dantzig (1980) for an anecdotal (and somewhat humorous) illustration of the development of this modeling application.

3.0   Meal plan options

Our university offers its students four distinct meal plans. They are briefly described in the following table:

Table 1
Meal plan options

Option	Cost per semester	Cost per meal[3]
19-meal plan	$1,335.00	$4.68
12-meal plan	$1,139.00	$6.33
7-meal plan	$751.50	$7.16
Declining balance	---	---

---

[3] Semesters at our university last 15 weeks; hence, a 19 meal plan option would provide $19 \times 15 = 285$ meals during a semester.

The first option allows students 19 meals per week. This provides three meals on each weekday, plus two meals per day (lunch and dinner) on each of Saturday and Sunday. We note that this option is mandatory for first-year students.

The second and third plans are less expensive but offer students fewer meals per week. In these cases, students are directly responsible for purchasing the meals in excess of their allotted meal plan total (i.e. students could pay cash once their meal plan is exhausted during a particular week).

The declining balance alternative permits students to set up an account much like a "debit card". Each time they purchase an on-campus meal, their declining balance account is depleted by a specific amount. There are two specific outlets at which students can use these accounts. The first is a cafeteria featuring buffet (all-you-can-eat) meals. Various options are available at this eatery, depending on the particular meal of the day. Such selections include pasta, traditional home-style food, pizza, stir fry meals, an all-day breakfast bar, salads and soups. The following picture is a typical cafeteria foodservice station.

Figure 1
Cafeteria foodservice station

The second outlet is a food court offering meals in which students pay for the particular menu item ordered, rather than having a one-price, all-you-can-eat buffet. Choices include pizza, submarine sandwiches, hamburgers and fajitas.   Figure 2 provides a picture of a specific station in the university food court.

Figure 2
Food court station

Students who opt to use their declining balance accounts for on-campus eating are charged a particular price, depending on the specific meal and outlet at which the purchase was made. The following table lists the declining balance costs for meals at both the cafeteria and food court.

Table 2
Declining balance meal costs

Meal	Cafeteria	Food court
Breakfast	$4.60	$2.45
Lunch	$6.15	$3.60
Dinner	$7.25	$4.45

At the food court, the declining balance is deducted from the total (actual) cost of the meal. Suppose, for example, that a student visits the food court for lunch. If his actual meal cost were $4.50, then his declining balance account would be debited $3.60 (the "base cost" of the meal). He could then pay the remainder ($0.90) in cash, or have it also deducted from his declining balance account.

4.0   Meal plan analysis

In order to determine the effectiveness of respective meal plan options, let us consider two respective students. One desires to eat solely to eat at the cafeteria, while the other opts to eat at the food court (perhaps the latter student has a smaller appetite). As our performance measure, we shall determine the one-semester cost of respective alternatives, given that the student consumes 19 meals per week. If a 12 or 7 meal plan is chosen, we shall assume that the student uses a declining balance account to cover the remaining meal purchases. Further, we can assume that a rational decision-maker would use meal plans for their most expensive meals (dinner), thus using the declining balance account for breakfast or lunch purchases.

4.1   Cafeteria analysis

The cost of the 19-meal plan is, simply, the one-semester cost of $1,335. Should a student select the 12-meal plan, then (using the data in Table 2) they would require 5 breakfast meals (at $4.60 each) and 2 lunches (at $6.15 each) during every week. With 15 weeks per semester, this gives a total cost of $1,139 (the 12-meal plan cost) plus {15 × ((5 × $4.60) + (2 × $6.15))} = $1,139 + $529.50 = $1,668.50.

If a 7-meal plan is chosen, then the student would purchase 5 breakfasts (at $4.60 each) and 7 lunches (at $6.15 each). Noting that a 7-meal plan cost is $751.50, the one-semester cost of this alternative is $751.50 + $990.75 = $1,742.25.

Using declining balance to purchase 19 meals per week would result in 5 breakfasts ($4.60), 7 lunches ($6.15) and 7 dinners ($7.25). The one-semester cost of this option is $1,752.00. The following table summarizes the cafeteria cost analysis.

Table 3
Cafeteria cost analysis

Plan	One-semester cost	Percentage difference from least-cost option
19-meal	$1,335.00	---
12-meal	$1,668.50	25.0%
7-meal	$1,742.25	30.5%
Declining balance	$1,752.00	31.2%

Clearly, the best alternative for a student wanting to purchase buffet-style meals is the 19-meal plan. Its average cost per meal from Table 1 was $4.68. Although the declining balance charge for a breakfast was marginally better ($4.60), the 19-meal plan offers such incredible savings on lunch and dinner selections.

4.2   Food court analysis

We now consider the case of a student who desires to purchase meals in our university's food court. As stated earlier, these meals are not of the one-price, all-you-can-eat variety. Students are charged for the particular menu items selected.

The cost of the 19-meal plan is, as before, the one-semester cost of $1,335. We note here an implicit assumption; namely, that the use of a meal plan, or a declining balance debit, would completely cover the cost of those particular meals.

If a student chooses the 12-meal plan, then (again using the data in Table 2) they would require 5 breakfast meals (at $2.45 each) and 2 lunches (at $3.60 each) during every week. This gives a total cost of $1,139 (the 12-meal plan cost) plus {15 × ((5 × $2.45) + (2 × $3.60))} = $1,139 + $291.75 = $1,430.75.

In the case of a 7-meal plan, the student would purchase 5 breakfasts (at $2.45 each) and 7 lunches (at $3.60 each). The one-semester cost of this alternative is $751.50 + $561.75 = $1,313.25.

Using declining balance to purchase 19 meals per week would result in 5 breakfasts ($2.45), 7 lunches ($3.60) and 7 dinners ($4.45). The one-semester cost of this alternative is $1,029.00. Table 4 recaps the food court cost analysis.

Table 4
Food court cost analysis

Plan	One-semester cost	Percentage difference from least-cost option
Declining balance	$1,029.00	---
7-meal	$1,313.25	27.6%
19-meal	$1,335.00	29.7%
12-meal	$1,430.75	39.0%

For those who wish to consume meals in the food court, the declining balance offers the best alternative. The relatively lower-priced meals available through a declining balance system (the most expensive was the dinner at $4.45) offer significant cost advantages over the other options.

The most cost-effective meal plan option definitely depends on the eating habits of the particular student. The declining balance option was the worst possible alternative for a "buffet" cafeteria eater, but is the most appropriate choice for one who elects to eat in the food court. The 19-meal plan, a definite value for the cafeteria patron, is one of the worst selections for a food court customer.

As noted earlier, our university makes the 19-meal plan mandatory for first-year students. As demonstrated by our cost analysis, such an approach clearly benefits one group of students (cafeteria consumers), but is tremendously disadvantageous for those students who want to purchase meals in the food court. In a way, those students who are satisfied with $2.45 breakfasts, $3.60 lunches and $4.45 dinners (perhaps those with smaller appetites) are somewhat penalized under the current system for first-year students. It would be in the best interests of these students to completely forego the 19-meal plan, and opt instead for a declining balance account. They could save almost 30% in their food costs ($306, or roughly $1.07 per meal) each semester.

5.0 Conclusions

Our paper has provided a cost analysis of meal plan options available for students at our university. We showed that the choice of the best meal plan option clearly depends on a person's food consumption habits. Students who prefer all-you-can-eat meals are best served by a 19-meal plan. Those who like to purchase individual items ought to use

declining balance accounts. Our university's decision to compel first-year students to

purchase 19-meal plans may penalize some of these students.

References:

Anonymous (1998). "Harvard food-court additions focus on health, convenience". *Nation's Restaurant News*, vol. 32, no. 48, p. 18.

Anonymous (2002). "La Paloma at top of dining service's class". *Foodservice Equipment & Supplies*, vol. 55, no. 7, pp. 13-14.

Balintfy, J.L. (1975). "A mathematical programming system for food management applications". *Interfaces*, vol. 6, no.1, pp. 13-31.

Briend, A. and Darmon, N. (2000). "Determining limiting nutrients by linear programming: A new approach to predict insufficient intakes from complementary foods". *Pediatrics*, vol. 106, no. 5, pp. 1288-1298.

Buscher, L.A., Martin, K.A., and Crocker, S. (2001). "Point-of-purchase messages framed in terms of cost, convenience, taste, and energy improve healthful snack selection in a college foodservice setting". *Journal of the American Dietetic Association*, vol. 101, no. 8, pp. 909-913.

Dantzig, G.B. (1990). "The diet problem". *Interfaces*, vol. 20, no. 4, pp. 43-47.

Darmon, N.; Ferguson, E.L.; and Briend, A. (2002). "A cost constraint alone has adverse effects on food selection and nutrient density: An analysis of human diets by linear programming". *The Journal of Nutrition*, vol. 132, no. 12, pp. 3764-3771.

Fletcher, L.R.; Soden, P.M.; and Zinober, A.S.I. (1994). "Linear programming techniques for the construction of palatable human diets". *The Journal of the Operational Research Society*, vol. 45, no. 5, pp. 489-496.

Kass, M. (1995). "Can I get you some fries with that final exam?" *The Business Journal*, vol. 12, no. 22, p. 8.

King, P. (1998). "Challenging 'the most important meal of the day'". *Nation's Restaurant News*, vol. 32, no. 50, p. 50.

King, P. (2002). "Drop in endowments starves college foodservice projects". *Nation's Restaurant News*, vol. 36, no. 47, pp. 4,55.

Lancaster, L.M. (1992a). "The history of the application of mathematical programming to menu planning." *The European Journal of Operational Research*, vol. 57, no. 3, pp. 339-347.

Lancaster, L.M. (1992b). "The evolution of the diet model in managing food systems". *Interfaces*, vol. 22, no. 5, pp. 59-68.

Matsumoto, J. (1998). "Dorm food revisited". *Restaurants & Institutions*, vol, 108, no. 25, p. 16.

Matsumoto, J. (2002). "Double duty". *Restaurants & Institutions*, vol. 112, no. 12, p.122.

Sloan, A.E. (1996). "It's not like when I went to school". *Food Technology*, vol. 50, no.5, p. 38.

Sultemeier, P.M., Gregoire, M.B.; Spears, M.C.; and Downey, R. (1989). "Managerial functions of college and university foodservice managers". *Journal of the American Dietetic Association*, vol. 89, no, 7, pp. 924-928.

Watkins, C. (1998). "Culinary clubs sprout up on campuses". *Food Management*, vol. 33, no. 12, p. 23.

Westrich, B.J., Altmann, M.A.; and Potthoff, S.J. (1998). "Minnesota's Nutrition Coordinating Center uses mathematical optimization to estimate food nutrient values". *Interfaces*, vol. 28, no. 5, pp. 86-99.