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Effects of Time of Day and Appropriateness on Food Intake and Hedonic Ratings at Morning and Midday

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In societies such as the U.S.A. many foods are considered appropriate or inappropriate for particular meals. Although some previous work has indicated that hedonic ratings reflect these cultural patterns, little is known about the impact of time of day and "appropriateness" in particular on food acceptance and intake. The purpose of the present study was to explore the role of appropriateness on consumption and hedonic ratings of breakfast and non-breakfast foods. Experiment 1 examined these factors in the context of four meals in which the type of menu (breakfast or lunch) was factorially combined with time of day (breakfast time or lunchtime). Experiment 2 examined hedonic ratings obtained in the morning and afternoon using samples of the same foods and rating methods used in Experiment 1. Experiment 3 replicated Experiment 2 but employed the rating methods used in Birch *et al.* (1984). Results from the three experiments indicated that the appropriateness or inappropriateness of when foods were served had no effect upon hedonic ratings and no clear impact on food intake. Postmeal hunger ratings in Experiment 1, however, provided some support for the salience of appropriateness. These results suggest that appropriateness may be more relevant to food selection than to consumption or palatability *per se*.

Introduction

Sociocultural factors play a major role in food selection and patterns of intake (Krondl & Coleman, 1986; Rozin & Vollmecke, 1986). In western societies such as the U.S.A. many foods are identified as appropriate for specific mealtimes (Rodin, 1980). Thus, particular foods are considered as suitable for breakfast (e.g. cereal) and others for lunch or dinner (e.g. chicken, pasta). Although overlap clearly exists (e.g. bread), as a general rule breakfast meals have a "menu" of foods distinct from meals eaten later in the day. Menus in institutional settings and restaurants typically reflect the distinction between breakfast and other meals.

However, little is known about the extent to which the time-appropriateness of food items affects either food selection or consumption. Birch *et al.* (1984) examined the effect of time of day (0800–1000 hrs vs. 1530–1730 hrs) on children's and adults' hedonic ratings of breakfast and non-breakfast foods after tasting samples of each food. As hypothesized, subjects showed a high level of agreement in categorizing the

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foods as breakfast or dinner items and rated the foods as more acceptable when tasted at the appropriate time of day. Similarly, results of a large scale survey using standard nine point hedonic scales (Quigley, Note 1) found large differences in how much people would like to eat particular foods for breakfast as compared to lunch and dinner. These culturally based rules do seem to affect hedonic ratings when measured by questionnaire or when tasting foods. It is not clear whether the primary impact of the appropriateness of foods is on food selection alone or if it also has an impact on consumption. As suggested by Birch *et al.* (1984) and Booth (1990), early exposure to these cultural practices may associatively condition momentary preferences for specific food types at different meal times.

The present study was designed to examine intake and hedonic ratings of breakfast and non-breakfast foods when served at appropriate and inappropriate times. The first experiment examined food intake within the context of a series of meals, and the second and third experiments evaluated hedonic responses to tasting samples of foods at different times of day.

Experiment 1: Food Intake and Acceptability During Breakfast and Lunch Meals

Method

Subjects

The 19 male participants were employees of Natick Research, Development and Engineering Center with a mean (standard deviation) age of 38·8 (9·1) years, mean weight of 90·2 (15·1) kg, and mean height of 1·81 (0·08) m. Subjects were screened to include only those who typically ate breakfast. The subjects were informed that the purpose of the study was to obtain their opinions about the acceptability of ordinary foods that are or may be used in military institutions.

Materials

Prior to the start of the study, subjects completed a questionnaire asking them to rate the acceptability of 36 foods if served for breakfast or lunch. The questionnaire was completed at 0900 hrs by eight subjects and at 1400 hrs by 11 subjects. The ratings were on 100-mm visual analogues anchored at either end with "dislike extremely" and "like extremely". These ratings were used to select items for the meals. Foods were chosen according to several criteria: 1) select breakfast foods rated as highly acceptable for breakfast as compared to lunch and lunch foods highly acceptable for lunch as compared to breakfast, 2) provide representative breakfast and lunch menus, 3) balance weight, calorie, and macronutrient contents of the two types of meals, 4) avoid foods unacceptable to particular subjects. Table 1 shows the prestudy questionnaire hedonic ratings of the foods for breakfast and lunch and Table 2 shows the amounts served and the macronutrient composition of the foods and beverages served at each meal. For some foods the information in Table 2 reflects additions included with the item (e.g., brown sugar in oatmeal, toast

TABLE 1

Mean (standard deviation) prestudy questionnaire hedonic ratings of breakfast and lunch foods

Rated for:	Breakfast	Lunch
Breakfast foods		
Scrambled eggs	77·7 (16·7)	45·1 (25·4)
Oatmeal	76·4 (16·5)	35·8 (22·5)
Blueberry muffin	74·7 (20·2)	54·0 (28·3)
Wheat toast	79·1 (19·8)	58·9 (25·4)
Bacon	71·3 (25·4)	51·8 (30·8)
Average	75·6 (14·9)	49·3 (20·3)
Lunch foods		
Turkey sandwich	41·6 (26·3)	83·1 (10·5)
Macaroni & cheese	27·4 (15·2)	77·1 (13·1)
Baked beans	42.2 (23·5)	73·5 (18·0)
Mixed vegetables	24·7 (15·6)	75·0 (14·5)
Average	33·6 (14·9)	76·9 (11·3)

TABLE 2

Nutrient composition of each meal

	Serving *	Calories	Protein* (% Protein)	Carbohydrate* (% Carbohydrate)	Fat* (% Fat)
Breakfast menu					
Total	1093·0	1142·1	40·0 (14·0)	129·1 (45·2)	51·2 (40·3)
Scrambled eggs	100·0	163·0	12·8	0·8	11·6
Oatmeal †	240·0	172·7	4·5	34·0	2·3
Blueberry muffin	71·5	200·2	5·2	30·0	6·6
Wheat toast	70·7	266·1	6·0	26·0	16·0
Bacon	15·0	91·7	4·6	0·5	7·8
Fruit punch	198·5	116·7	0·0	28·0	0·0
Milk	198·5	129·4	6·9	9·8	6·9
Coffee	198·5	2·3	0·0	0·0	0·0
Lunch menu					
Total	1177·0	1304·5	56·9 (17·4)	143·2 (43·9)	56·5 (39·0)
Turkey sandwich	127·9	370·0	23·5	24·7	19·7
Macaroni & cheese	226·8	433·6	14·7	39·9	25·9
Baked beans	113·4	165·0	8·0	24·5	4·0
Mixed vegetables	113·4	87·5	3·8	16·3	0·0
Fruit punch	198·5	116·7	0·0	28·0	0·0
Milk	198·5	129·4	6·9	9·8	6·9
Coffee	198·5	2·3	0·0	0·0	0·0

* Values in grams

† Oatmeal values reflect added brown sugar and toast values reflect added butter

with butter). Subjects were served the same beverages with all meals (fruit punch, milk, and coffee).

Food acceptance and subjective states were also measured with 100-mm analogues. Subjects rated their hunger, fullness, alertness, nervousness, sleepiness, and energy level on lines anchored at either end with "not at all" and "the most hungry (or whatever) I have ever felt". Subjects rated how much they liked the foods served on an hedonic questionnaire using lines anchored at either end with "dislike extremely" and "like extremely".

Procedure

Twenty-four subjects initially agreed to participate. Each subject ate four meals—two per week for two consecutive weeks. Breakfast foods were served for two of the meals (a.m. breakfast, p.m. breakfast) and lunch foods for the other two (a.m. lunch, p.m. lunch). One meal of each food type was served between 0800 and 0900 hrs and the other was served between 1130 hrs and 1230 hrs. The two meals eaten each week were separated by 1 day (e.g. Tuesday and Thursday). Subjects were randomly assigned to one of four groups to counterbalance the order of the four menu and time of day conditions. Subjects were served their meals in a small dining room. A maximum of four subjects sat at each of two round tables prepared with partitions to minimize contact between subjects. Subjects were asked to eat their typical breakfast on days they were scheduled for a lunch time meal. Five subjects were lost from the study due to scheduling conflicts.

Upon arrival for each meal, subjects completed the ratings of their states. The meal was then served, and subjects tasted and rated each food on the hedonic scales before eating freely. Subjects were permitted to eat as much as they wished and were asked during the course of the meal if they wished additional servings of any food. Once subjects had finished eating they again completed the mood and hedonic questionnaires and were given two sets of each questionnaire to complete on their own at 1 and 3 h after the end of the meal. Food consumption was determined by weighing each food item before and after the meal.

Food intake during the meals was analyzed with repeated measures analysis of variance using meal type and serving time as within subject factors. Hunger, fullness, and hedonic ratings at the meals were analyzed with repeated measures analysis of variance with meal type, serving time, and time as within subject factors. Follow-up paired *t*-tests were conducted for significant effects in the repeated measures analyses. Hedonic ratings of the individual food items and their averages on the prestudy questionnaire were compared with paired *t*-tests.

RESULTS

On the prestudy hedonic questionnaire, all food items received significantly higher ratings when rated for the appropriate meal time (p's all $<0{\cdot}007$) than when rated for an inappropriate time (Table 1). When subjects took time of day into consideration they had clear preferences for eating the items at the times they are typically served. When subjects completed the questionnaire (0900 hrs vs. 1400 hrs) did not affect these ratings.

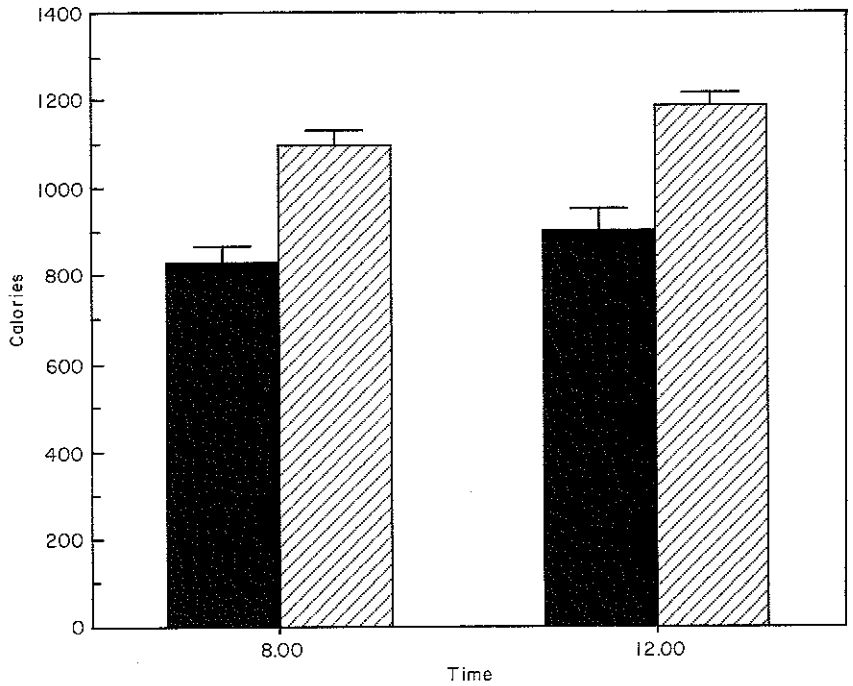

FIGURE 1. Average (*SEM*) total calorie consumption at each of the four meals. ■, breakfast menu; □ lunch menu.

For intake, repeated measures analyses indicated main effects for meal type and serving time for both food and beverage intake combined (grams and calories) as well as for food intake alone (again grams and calories). The hypothesized interaction between meal type and serving time was insignificant in all analyses. Total calorie intakes (food and beverages) were 825·8 kcal (a.m. serving time, breakfast menu), 899·9 kcal (p.m. breakfast), 1093·6 kcal (a.m. lunch), and 1183·9 kcal (p.m. lunch). As shown in Figure 1, subjects consumed more calories when served the lunch menu than when served the breakfast menu regardless of the serving time, $F(1,18)=61{\cdot}4$, $p<0{\cdot}001$. Subjects also ate more at lunchtime than at breakfast time, $F(1,18)=9{\cdot}4$, $p<0{\cdot}01$ although only the intake of the lunch menu was significantly greater at lunchtime than at breakfast time. Calorie intake of beverages alone was 227·9 kcal (a.m. breakfast), 243·4 (p.m. breakfast), 217·2 (a.m. lunch), and 231·0 (p.m. lunch). Repeated measures analyses again indicated significant effects of meal type and serving time with a non-significant interaction. Subjects drank approximately 15 more calories at lunchtime than at breakfast time but, in contrast to food intake, drank approximately 11 more calories when served breakfast foods than when served lunch foods. Macronutrient consumption of the meals as consumed was not affected by time of day and closely matched that of the meals as served (breakfast menu consumption 15·6 per cent protein, 45·7 per cent carbohydrate, 38·6 per cent fat; lunch menu consumption 17·4 per cent protein, 43·2 per cent carbohydrate, 39·7 per cent fat).

Figures 2, 3, 4 show the pattern of hunger, fullness, and hedonic ratings of the foods from before the meal to 3 h after its completion for each of the four meals.

Premeal hunger and fullness ratings were not different for the four meals. One subject failed to complete the 1- and 3-h hunger and fullness ratings after one of the meals and was excluded from these analyses. The repeated measures analysis for hunger showed a significant time effect, $F(3,15)=83{\cdot}5$, $p<0{\cdot}01$. Hunger decreased significantly from before to after the meals and increased significantly during the first hour after the meals and during the next 2 h. The serving time by meal type interaction was also significant, $F(1,17)=6{\cdot}2$, $p<0{\cdot}03$. This interaction arose from the fact that average postmeal hunger was lower for the appropriate meals (a.m. breakfast and p.m. lunch) compared to the inappropriate meals. Paired t-tests indicated that hunger was significantly higher 1 h after the meal for the p.m. breakfast as compared to the a.m. breakfast, $t(17)=2{\cdot}4$, $p<0{\cdot}03$ and significantly higher 3 h after the meal for the a.m. lunch as compared to the p.m. lunch, $t(17)=2{\cdot}35$, $p<0{\cdot}04$.

For the fullness rating, the only significant effect was for time, $F(3,15)=99{\cdot}8$, $p<0{\cdot}01$. Fullness increased significantly from before to after the meal and declined significantly at each subsequent interval. Hunger and fullness ratings typically have a significant, inverse correlation with each other. To determine the independent effect of each, the repeated measures analyses were also carried out using fullness as a covariate in the hunger analysis and likewise using hunger as a covariate for fullness. In both analyses the effect of time was diminished, but the serving time by meal type interaction for hunger ratings remained significant.

For the hedonic ratings of the food, the only significant effect for the breakfast and lunch menus was a higher average rating for the breakfast foods than for the lunch foods $F(1,18)=5{\cdot}65$, $p<0{\cdot}03$. For the individual foods, the time at which the

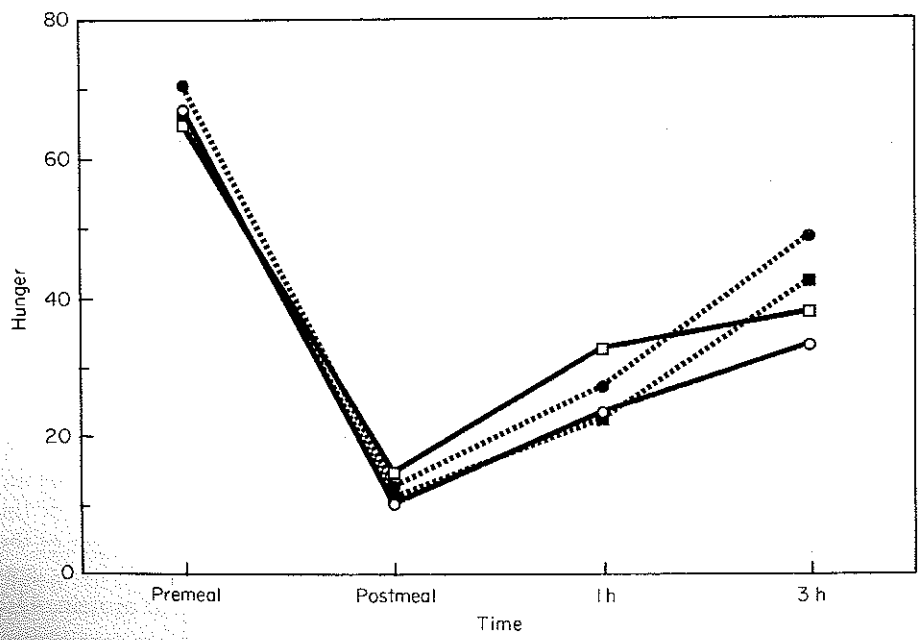

FIGURE 2. Hunger ratings before, after, and at 1 and 3 h after each of the four meals. ■, a.m. breakfast; —□—, p.m. breakfast; ●; a.m. lunch; —○—, p.m. lunch.

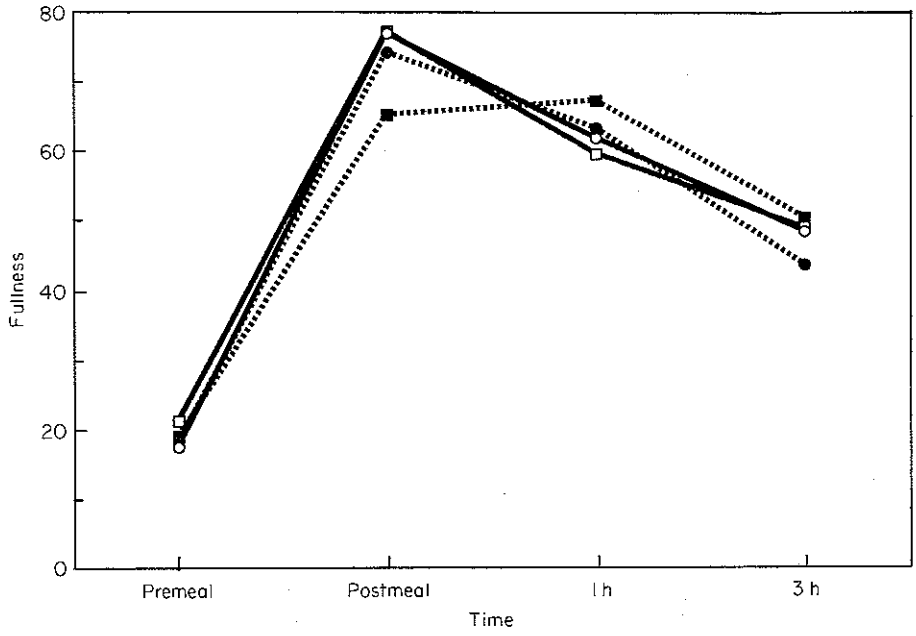

FIGURE 3. Fullness ratings before, after, and at 1 and 3 h after each of the four meals. ■, a.m. breakfast; —□—, p.m. breakfast; ●, a.m. lunch; —○—, p.m. lunch.

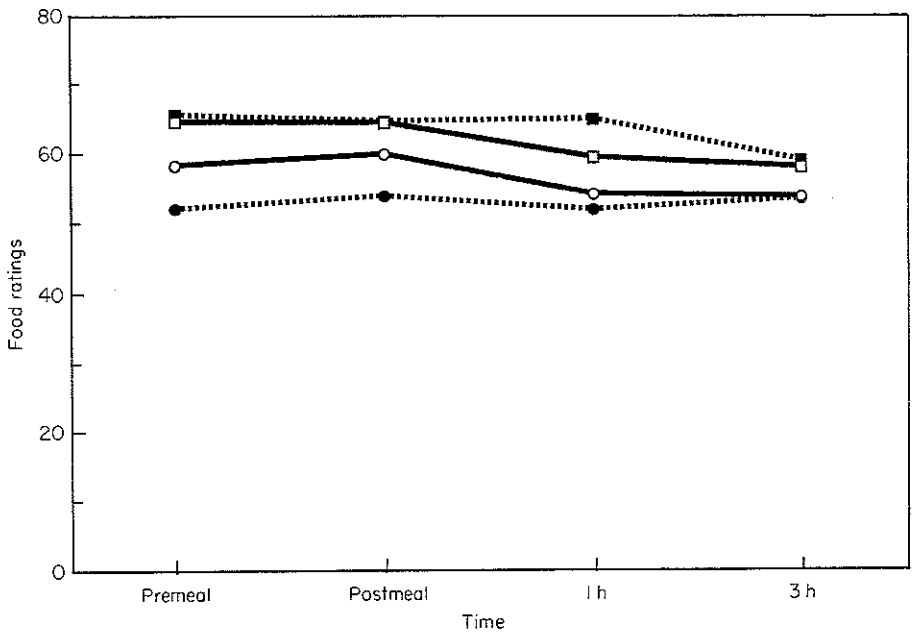

FIGURE 4. Hedonic ratings before, and at 1 and 3 h after each of the four meals. ■, a.m. breakfast; —□—, p.m. breakfast; ●, a.m. lunch; —○—, p.m. lunch

food was served had no significant effect except for scrambled eggs which received higher ratings immediately after the meal and 1 h later when served in the morning than when served at lunchtime. Hedonic ratings during the meals were essentially identical to those given for the appropriate time of day on the prestudy questionnaire. For example, breakfast foods rated for breakfast on the prestudy questionnaire received an average rating of 75·6 and breakfast foods rated during the meals received a rating in the low 70s regardless of serving time. The order in which the four meals were eaten had no effect upon the results.

Discussion

Neither calorie intake or hedonic ratings provided clear support for an effect of appropriateness. Intake of calories was higher for the lunch menu when served at noon compared to when served in the morning but intake of the breakfast menu also showed a rise (albeit insignificant) from the morning to noon. Hedonic ratings obtained during and after the meals were unaffected by time of day (Figure 4) which was in sharp contrast to the large differences obtained when subjects responded to a questionnaire rating how much they would like to eat the items at breakfast time and at lunchtime (Table 1). The differences between ratings based on a questionnaire and ratings based on actually tasting the foods are consistent with findings reported by Friedman *et al.* (1989) and Zellner *et al.* (1988). Although the questionnaire vs. taste test differences were smaller in these two reports, both found that the relationship of hedonic ratings to beverage temperature (Zellner *et al.*, 1988) and the change in hedonic ratings from before to after consumption (Friedman *et al.*, 1989) was more pronounced for questionnaire ratings than when the foods were actually tasted.

However, the impact of appropriateness on hunger is interesting and may be a meaningful effect. Hill *et al.* (1984) reported increased hunger (with no effect on fullness) 2 h after subjects consumed a preferred food relative to hunger following consumption of a similar, equicaloric, and equal size but less preferred food. The differences in hunger found following the meals in the present study may indicate that subjects did respond to the appropriateness of the meals even though no impact was found for acceptability or consumption. The potential importance of the hunger ratings is supported by the fact that when hunger was analyzed with fullness as a covariate, hunger following the inappropriate meals was still higher than hunger after the appropriate meals. It may be that the differences in hunger reflect past learning as suggested by Booth (1990) and that subjects were less satisfied with the inappropriate meals.

The greater consumption of lunch foods relative to breakfast foods is consistent with data showing that breakfast is typically the smallest meal of the day (Fricker *et al.*, 1990; Chao & Vanderkooy, 1989) and may also reflect conditioning effects. If lunch types of foods are associated with larger meals, then presentation of a lunch menu could be expected to result in greater consumption compared to a breakfast menu regardless of when that meal is served. Similar conditioning could also occur related to time of day. The fact that subjects ate the most when served lunch foods at lunchtime and least when served breakfast foods at breakfast time is consistent with conditioning effects for both meal type and meal time. Given that appropriateness can be conceptualized as the combined effects of time of day (e.g. a.m. vs. p.m.) and

food type (breakfast vs. non-breakfast), additional study of these two components appears worthwhile. The failure to find an interaction between meal type and serving time for consumption may, in part, be due to competing effects of time of day and menu type under "inappropriate" conditions. For example, serving a lunch menu at breakfast time may well reflect both a facilitating effect (lunch-type meal) and an inhibitory effect (morning meal time). However, this possibility does not explain the lack of differences in hedonic ratings as a function of time of day and meal type.

Experiment 2: Effects of Time of Day on Hedonic Ratings

A second study was conducted to evaluate more fully the impact of time of day on food acceptance independent of intake. This study was also a closer replication of Birch *et al.* (1984) which found an effect for time of day.

Method

Subjects

Subjects were 52 males employed at the Natick Research, Development, and Engineering Center who had not participated in the first study. Both people who had frequently participated in past taste test studies ($N=29$) and people who had no such experience ($N=23$) were recruited. Subjects with and without prior experience were recruited to determine if past exposure to the taste test situation would influence the impact of appropriateness. Subjects averaged 47·2 (11·4) years of age, 89·9 (12·3) kg, and 1·78 (0·09) m tall. The two groups did not differ in age, height, or weight. As in the first study, subjects were screened to include only those people who ate breakfast. Subjects were telephoned and asked to attend a taste test session (in a manner similar to those frequently done throughout the year) on two occasions 5 to 6 days apart. Subjects were given no information about the study other than that they would rate a number of foods. Results for the present study are based on the 52 subjects who completed both sessions. The morning session took place between 0830 and 0930 hrs and the afternoon session between 1300 and 1400 hrs. Order of sessions was counterbalanced so that approximately half of the participants had their first session in the morning and half in the afternoon.

Procedure

At each session subjects were seated at individual booths for the task. Prior to rating the foods, subjects rated their hunger and fullness using 100-mm lines identical to those used in the previous study. Subjects were given a small tray with nine food samples in 2-oz paper cups. The foods were identical to those used in the first study. Subjects tasted and rated each food in a self-selected order and rated how much they liked or disliked the items on the same 100-mm line used previously. Subjects were not given any instructions or guidelines for rating items (e.g. for breakfast) other than to rate their liking or disliking of the food at that moment. Multivariate analyses (Hotelling's T^2) and paired *t*-tests were used to test the impact of time of day on hedonic ratings.

Results

Table 3 shows the average rating for each food as well as the overall rating of breakfast and lunch-type foods at the morning and afternoon sessions. Multivariate analysis and follow-up *t*-tests indicated no effect of time of day on the hedonic ratings for the breakfast or lunch foods or for any individual food. On average, lunch food items were rated more favorably than breakfast items both at the morning [$t(51)=3{\cdot}46$, $p<0{\cdot}01$] and afternoon sessions [$t(51)=4{\cdot}52$, $p<0{\cdot}001$]. Hunger and fullness ratings were not different at the morning and afternoon sessions. Neither prior experience in taste test studies nor session order had an impact on the results.

Discussion

Experiment 2 was consistent with Experiment 1 in demonstrating no effect of time of day on relative preference for either breakfast or lunch types of food items when the foods were actually tasted. As in Experiment 1, the results when subjects tasted the foods contrasts with the large hedonic differences seen in the prestudy questionnaire from Experiment 1. As discussed previously, hedonic responses to time of day are markedly different when subjects taste the foods as compared to filling out a questionnaire but do not sampling the items. In contrast to Experiment 1 where breakfast foods were rated more favorably than lunch foods, Experiment 2 found a small preference for lunch foods. Interestingly, subjects with extensive prior experience in taste testing situations and subjects for whom the situation was novel responded in a nearly identical fashion.

Table 3

Mean (standardard deviation) hedonic ratings by experienced and inexperienced subjects

	Experienced ($N=29$)		Inexperienced ($N=23$)	
Rated for:	Breakfast	Lunch	Breakfast	Lunch
Breakfast foods				
Scrambled eggs	61·1 (19·6)	56·0 (18·6)	45·6 (21·4)	47·7 (18·3)
Oatmeal	49·2 (20·9)	50·3 (18·5)	50·5 (27·4)	50·6 (25·9)
Blueberry muffin	63·4 (17·4)	60·7 (18·2)	57·5 (17·6)	58·0 (19·6)
Wheat toast	49·7 (14·8)	52·2 (16·1)	52·2 (19·0)	49·7 (20·1)
Bacon	61·1 (25·3)	68·4 (20·9)	59·1 (20·3)	60·0 (23·1)
Average	56·9 (11·6)	57·5 (10·1)	53·0 (14·0)	53·2 (14·6)
Lunch foods				
Turkey sandwich	71·7 (18·3)	73·9 (15·2)	62·1 (20·4)	66·6 (19·1)
Macaroni & cheese	67·7 (14·5)	63·2 (18·2)	67·0 (15·7)	67·8 (16·6)
Baked beans	53·6 (25·0)	55·3 (17·7)	54·7 (21·9)	56·2 (21·1)
Mixed vegetables	59·1 (18·1)	64·3 (16·2)	51·2 (20·0)	48·0 (22·6)
Average	63·0 (14·6)	64·2 (10·2)	58·8 (15·6)	59·6 (14·6)

EXPERIMENT 3: REPLICATION OF BIRCH *ET AL.* (1984)

Birch *et al.* (1984) employed a different methodology in measuring hedonic responses to breakfast and non-breakfast foods at a different time of day. In order to determine if these procedural differences might be accounting for the differing results a third experiment was conducted using the same rating methods as in Birch *et al.*

METHOD

Subjects

Subjects were 35 male employees of the Natick Research, Development and Engineering Center similar those in Experiment 2 who had previous experience with taste testing. Subjects averaged 41·8 (10·6) years of age, 81·2 (11·2) kg, and 1·8 (0·09) m tall. Subjects were obtained in the same manner as in Experiment 2 with approximately half attending a morning session on the first day and the afternoon session on the second day with the other half attending in the reverse order. The two sessions were held 1 week apart and were scheduled for the same time each day as in Experiment 2 (0830 to 0930 hrs and 1300 to 1400 hrs).

Procedure

The procedure followed that of Experiment 2 with the exception that the hedonic ratings were obtained using the methods of Birch *et al.* (1984) and hunger and fullness ratings were not obtained. After subjects tasted each food they assigned it to one of three columns labeled "like", "neutral", and "dislike". Once all foods had been assigned to columns, subjects ranked the foods in each column by assigning a "1" to the one they liked most, a "2" to the second most liked and so on. On the second day of testing, subjects were also asked to categorize each food as a breakfast or lunch food after they had completed the other ratings.

For the analysis, each food was given a ranking from 1 to 9 based on the column assignment and rankings. Thus if two foods were placed in the dislike column the most liked of the two was given a ranking of "8" and the other a "9". The relative rankings of the breakfast and lunch items at the two times of days were used to evaluate any time of day effects. Following Birch *et al.* (1984), the sum of the ranks (lower sums reflecting relative preference) for each food type at the two times of day were compared for all nine foods as well as for only those categorized as breakfast or lunch foods by 100 per cent of the subjects. Differences in the sum of ratings as a function of time of day were tested with the Wilcoxen signed ranks test.

RESULTS

For all nine of the foods, the Wilcoxen results were insignificant for both breakfast and lunch items (p's $> 0{\cdot}9$) indicating that time of day did not influence the ratings of either food type. Similar findings were obtained using only the six foods categorized as for breakfast (scrambled eggs, oatmeal, and bacon) or for lunch

(turkey sandwich, macaroni & cheese, and mixed vegetables) by 100 per cent of the subjects (p's $> 0{\cdot}5$). The average sum of the ratings for the three breakfast foods was 11·34 at the morning session and 11·23 at the afternoon session. The parallel averages for the three lunch foods were 9·66 and 9·77. As in Experiment 2, session order had no impact upon the results, and lunch items received more favourable ratings regardless of time of day.

Discussion

The results of Experiment 3 paralleled those found in Experiment 2. Forcing subjects to rank foods as opposed to rating each item individually did not lead to a discrimination of breakfast and lunch foods based on time of day. As with Experiments 1 and 2, appropriateness had no discernible impact upon hedonic ratings.

General Discussion

The present results show that appropriateness does not necessarily affect either food intake or hedonic ratings. Serving foods at times typically considered inappropriate had little impact on food intake or hedonic ratings. During meals subjects ate more of lunch-type foods regardless of serving time despite the fact that they gave breakfast foods somewhat higher hedonic ratings. Hunger ratings did recover somewhat more rapidly after inappropriate meals, but this effect was not reflected in intake, and fullness ratings were unaffected by the appropriateness of the meal. Perhaps hunger ratings are a more sensitive measure of the satiating power of a meal and in the present study reflect that time appropriate meals are more satisfying or satiating over time due to their association with satiation in the past. A follow-up study in which appropriate and inappropriate meals served as preloads for subsequent meals might, for example, show that intake following the preload meal differs as a function of appropriateness.

Our failure to find an effect of appropriateness on hedonic ratings is particularly interesting given that subjects, as seen in the prestudy questionnaire, showed a clear preference for eating foods at their typical serving times. In contrast to previous assessments employing taste tests (Birch *et al.*, 1984) or questionnaires (including the prestudy questionnaire used in Experiment 1; Quigley, Note 1), the present study found no evidence for an effect of appropriateness on acceptability when food samples were tasted and rated.

None of the three experiments reported here found an effect of appropriateness on hedonic ratings as reported by Birch *et al.* (1984). One potentially important difference between the present studies and Birch *et al.* (1984) is the fact that most of her subjects were female. Although only men were recruited for the present studies, eight women attended and were allowed to participate in Experiment 2. As was the case for males, appropriateness had no impact on the hedonic ratings. Interestingly, while men gave slightly higher ratings in the afternoon session then in the morning session for both breakfast and lunch foods, women gave higher ratings during the morning session: breakfast foods' average ratings in the morning and afternoon were 55·1 and 52·5 and lunch foods' 59·9 and 57. Given the small number of women and

the small size of the effect, these differences lack reliability but suggest that sex differences may exist in response to time of day if not appropriateness *per se*.

Birch *et al.* also differed from the present study in that the afternoon session was conducted between 1530 and 1730 hrs in the afternoon as compared to at noon (Experiment 1) or between 1300 and 1400 hrs (Experiments 2 and 3). The later time in Birch *et al.* may have resulted in a more clearcut time of day effect if that later time shifted the comparison from breakfast vs. lunch toward breakfast vs. dinner. The actual relevance of the differences in timing remains to be determined.

These results suggest that culturally learned patterns of eating certain foods at particular times of the day may not directly influence food intake or acceptability. If subjects had been given a choice among types of food, or had been aware of or instructed to attend to the issue of time of day (as was the case for the prestudy questonnaire in Experiment 1), food choices and possible food intake and hedonic ratings might have reflected an influence of appropriateness. Nonetheless, when subjects were not given a choice of which foods to eat or taste, appropriateness of the foods for that time of day did not influence food acceptability or intake. The interactive effects of time of day and meal type appear to be complex and merit further investigation.

Reference Note

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