Behavioral Management of Multiple Food Aversions of a Multiply Handicapped Child

Steven A. Stang
Western Michigan University

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Several behavioral treatments utilizing the delivery of preferred food with praise contingent upon consumption of nonpreferred foods were evaluated with a multiply handicapped child who exhibited multiple food aversions. Behavioral assessments of food preferences were used to identify preferred and nonpreferred foods and to monitor changes in the subject's preferences for nonpreferred target foods relative to other foods.

Following the implementation of treatment contingencies, a modest increase in the consumption of one nonpreferred target food, and substantial increases in consumption of a second nonpreferred target food, milk, other foods appearing on the lunch menu, and essential nutrients were observed. In addition, a modest change in the subject's preference for one nonpreferred target food relative to two other foods occurred. These results suggest that contingent preferred food with praise, alone and in combination with other techniques, may be an effective means of increasing the consumption of nonpreferred foods in children exhibiting multiple food aversions.
ACKNOWLEDGMENTS

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Steven A. Stang
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BEHAVIORAL MANAGEMENT OF MULTIPLE FOOD AVERSIONS OF A
MULTIPLY HANDICAPPED CHILD

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INTRODUCTION

It has been estimated that feeding problems are exhibited by more than 25% of all children, primarily among those of preschool age ("Infant and Child Nutrition," 1981). The frequency of occurrence is considerably greater among the handicapped; at least 80% of the severely handicapped have some type of feeding problem (Perske, Clifton, McClean, & Stein, 1977).

Palmer and Horn (1978) have defined feeding problems as the inability or refusal to eat certain foods and have attributed them to neuromotor dysfunction, mechanical obstruction, and/or mismanagement of reinforcement contingencies. Foremost among the disorders due to neuromotor dysfunction are those resulting from abnormal development or retardation of the oral reflexes (e.g., swallowing, biting, gagging, and protrusion). However, there remain a number of other neuromuscular disorders, such as delayed maturation, tonic neck reflex, cerebral palsy, and rumination, that are unrelated to the oral reflexes. Traditionally, problems of this nature have been referred to occupational and speech therapists who seek to improve the client's neuromotor coordination and promote development by means of neuromotor stimulation or oral facilitation. For example, progressive tactile stimulation and jaw control exercises are recommended for the management of oral hypersensitivity and tongue thrust (Morris, 1977). Nevertheless, one recent study has demonstrated the efficacy of operant conditioning techniques in the reduction of
pathological tongue thrust (Thompson, Iwata, & Poynter, 1979). When disorders of movement are involved, special positioning or feeding apparatus may be prescribed (Miller, 1976).

The second major cause of feeding problems, mechanical obstructions, includes such structural abnormalities as cleft palate, submucous cleft, obstructive lesions, and defects of the pharynx, larynx, esophagus, and thorax. Surgical intervention or adaptive feeding apparatus may be recommended (Palmer & Horn, 1978).

The most frequently occurring feeding problems among children are prolonged subsistence on pureed or junior foods (27%); sucking, swallowing, and/or chewing difficulty (24%); bizarre food habits (23%); multiple food dislikes (11%); delay in self-feeding (8%); and tantrums (6%). Mismanagement of reinforcement contingencies may be a single or contributory cause in all but sucking, swallowing, and/or chewing difficulties. In one university child development program, behavioral mismanagement accounted for 21% of all feeding problems.

A stringent definition of an aversion requires that avoidance behavior occur in the presence of a stimulus. However, aversions may be inferred, although not directly measured, by differential responding to stimuli in a free operant situation. Food aversions may involve the avoidance of specific food items, food groups (e.g., vegetables), or textures (e.g., solid foods). In any case, nonconsumption can result in total food intake that is inadequate in terms of both calories and nutrients. The possible medical consequences of such deficiencies are weight loss, retarded development

Regardless of the population surveyed, and despite considerable variation in the reported incidence, food aversions appear to be quite prevalent. Moderate to severe food aversions have been reported in approximately 80% of normal children at 3 and 6 years of age (MacFarlane, Allen, & Honzik, 1954). For normal children of all ages, 44% were reported to exhibit food aversions (Sears, Maccoby, & Levin, 1957). Of the developmentally disabled children displaying some type of feeding problem, the incidence of food aversions may reach 57% (Pipes & Holm, 1980).

Nutritionists have traditionally attempted to manage food aversions by modifying the texture, variety, color, and method of preparation of foods (Palmer, Thompson, & Linscheid, 1975). Additional measures may be attempted when severe cases are encountered; nutritional supplements may be added to foods that are consumed, or forced feeding may be initiated either manually or by nasogastric tube (Palmer et al., 1975; Wright, 1971). However, none of these procedures constitutes effective treatment of the food aversion, since unprompted consumption of the nonpreferred food typically remains unaltered.

A variety of behavioral techniques have been employed to increase consumption of nonpreferred foods. Access to preferred food
contingent upon consumption of nonpreferred food has been combined with praise, instructions, token reinforcement, access to toys and preferred activities, and negative reinforcement to modify selective food consumption in both normal and developmentally disabled children (Bernal, 1972; Hall & Holmberg, 1974; Ives, Harris, & Wolchik, 1978; Palmer et al., 1975; Thompson & Palmer, 1974). Fading was used to increase the variety and quantity of food consumed by autistic children (Clancy et al., 1969). A mixture of a nonpreferred food and a camouflage food was initially presented to the subjects. When an increase in consumption of the mixture was observed, the quantity of camouflage food and the variety and quantity of the nonpreferred foods were gradually altered until a normal diet was attained. In these studies, the efficacy of the treatments could not be determined because the independent variables were components of a broader treatment package, data were not obtained specifically on nonpreferred foods, or because experimental control was not demonstrated. However, functional relations between contingent preferred food with praise and increased consumption of the variety and quantity of food have been demonstrated elsewhere (Madsen, Madsen, & Thompson, 1974; Riordan, Iwata, Wohl, & Finney, 1980). Although these studies report the modification of selective food consumption in the presence of treatment contingencies, it is unclear whether or not the subjects' food preferences in the absence of the treatment contingencies were altered.

Konarski, Johnson, Crowell, and Whitman (1980) suggest that when the opportunity to engage in one response (the contingent
response) is made contingent upon the occurrence of a second re-
response (instrumental response), a reinforcement effect will occur
only when a condition of response deprivation for the contingent re-
sponse is present. Response deprivation is present when the sched-
ule of reinforcement in the contingency results in the subject
having decreased access to the contingent response as long as the
instrumental response does not exceed its baseline level. Thus, the
ratio of the instrumental response to the contingent response must
be greater in the contingency than in baseline in order for the
schedule requirements to be met. Unless the frequency of the
instrumental response increases in the contingency, the subject is
deprived of the opportunity to engage in the contingent response at
its baseline level.

The present study was an attempt to evaluate contingent pre-
ferred food and praise in the treatment of multiple, specific food
aversions of a multiply handicapped child. Preferred and non-
pref erred foods were identified on the basis of objective behavioral
data, and the treatment contingency involving these foods was deter-
mined so as to insure the necessary condition for a reinforcement
effect as suggested by the response deprivation hypothesis. Finally,
the subject's food preferences were behaviorally assessed in order
to detect their possible change across time.
METHOD

Subject

The subject was a 9-year-old male who was educationally classified as trainable mentally impaired, physically impaired, and speech and language impaired. Medical diagnosis indicated congenital central hypotonia and esotropia. The subject had attended a classroom for the multiply handicapped within a special education facility for approximately 1 year.

The subject was identified by the classroom teacher as exhibiting highly selective and quantitatively limited consumption of school lunches. Informal observation for a period of 12 weeks prior to the experiment revealed that the subject consistently ate only five foods presented in the school lunches. Total lunchtime food intake often consisted only of milk. The subject received no edibles in the classroom prior to lunch.

Given food that was cut into bite-sized pieces, the subject demonstrated appropriate utensil usage and independent feeding skills. Evaluations conducted by physical, occupational, and speech and language therapists indicated that the subject's feeding problems did not result from any physical deficit. The absence of abnormal feeding reflexes, tongue thrust, and oral hypersensitivity was noted. The subject exhibited vertical and lateral tongue movement necessary for chewing all types of food and oral musculature adequate for swallowing. In addition, the subject possessed a
well developed repertoire of instruction following and rule governed behavior.

The subject was selected for participation on the basis of multiple food aversions involving different food groups, the presence of self-feeding skills, absence of other behavior problems, and good attendance. The subject participated with the informed consent of his parents.

Beginning on the 9th session of the experiment, the subject was administered methylphenidate hydrochloride (Ritalin) at the request of his parents for control of behavior in the home. Dosages were varied in the following sequence: Sessions 9-11, 10 mg b.i.d.; Session 12, 20 mg b.i.d.; Sessions 13 and 14, no medication; Sessions 15-27, 20 mg q.d.; Session 28, no medication; Sessions 29-32, 20 mg q.d.; Sessions 33-42, 10 mg q.d.; and Sessions 43-65, no medication.

Assessment

Assessment sessions were conducted periodically throughout the experiment in the early morning and early afternoon and were 15-30 minutes in duration. Sessions were conducted in a small training room designed for individual instructional sessions. The subject sat in his wheelchair opposite the investigator at a semicircular table.

Initial Assessment of Preference

The following 10 foods were selected to assess the subject's food preferences: cottage cheese, milk, whole wheat roll, whole
wheat cracker, peas, pineapple, oyster crackers, applesauce, lima beans, and cheese. The subject's food preferences were assessed by presenting each of 45 possible pairings of these foods in random order. Each pair was presented twice such that each food item appeared 18 times. Fifteen trials were presented per session on six consecutive school days. Two token cans were placed side by side on the table directly in front of the subject. Equal volumes of each food comprising a pair were presented on a paper plate or in a styrofoam cup adjacent to the cans such that one food corresponded to each can. The position of the foods was randomly determined. The investigator pointed to each food and asked, "What's that?" If an incorrect tact occurred, the investigator prompted a correct response and repeated the trial. Correct tacts were followed by praise (e.g., "That's right."). After both foods were tacted correctly, the investigator placed one token (a poker chip) on the table in front of the subject, equidistant from the token cans, and instructed, "Show me the one you want." If the subject failed to place the token in the can within 10 seconds, the investigator retrieved the token and repeated the trial. The trial was repeated until a choice response occurred. When the subject placed the token in one of the cans, a portion of the food corresponding to that can was raised on a utensil or in the investigator's hand to within 4 inches (10.16 cm) of the subject's mouth. If the food was not consumed within 5 seconds, it was returned to its container on the table. After a portion of the food was consumed, the subject had access to water for 10 seconds.
Prior to the assessment trials, 10 forced-choice trials were conducted in which the subject's choice response was prompted and food was placed in the subject's mouth, insuring that the subject tasted each of the 10 foods.

Data obtained from the initial assessment of preference were utilized in the selection of reinforcer and target foods. Cottage cheese, the food for which the subject made the greatest percentage of choice responses, was selected as the reinforcer to be used in training. Peas, lima beans, and cheese, for which the subject made relatively few choice responses, were selected as target foods.

Preference Tests

Preference tests were designed to allow the repeated assessment of the relative preference of the target foods in order to measure a change in preference over time. Four of the foods appearing in the initial assessment of preference (whole wheat roll, pineapple, oyster crackers, and applesauce) were selected for comparison with the target foods. (Cottage cheese later replaced pineapple for comparison with one target food.) Each was paired with one target food per session and each pair was presented in random order to the subject six times for a total of 24 trials. Target foods were alternated between sessions so that each was compared with the other foods on three occasions prior to the initiation of training and once upon termination of training. Trials were conducted as in the initial assessment of preference.
Reinforcer Sampling

Animal crackers, Cheetos, M&M's, peanuts, and cottage cheese were compared in order to identify the food for which the subject had the strongest preference. These foods were paired in 10 possible combinations and were presented to the subject in random order. Each pair was presented twice per session such that each food appeared eight times. One session was conducted per day on four school days. Five forced-choice trials were initially conducted to insure the subject's exposure to each food. Thereafter, trials were conducted as in the initial assessment of preference.

Animal crackers, the food for which the subject made the greatest percentage of choice responses, replaced cottage cheese as the reinforcer food.

Lunch Sessions

Lunch sessions of 20 minutes duration were conducted on most school days on which a school lunch was served. Sessions were conducted at lunchtime in the school cafeteria, in which approximately 60 pupils were served daily. The investigator and subject sat at a table adjacent to a wall which partially obscured the subject's view of other pupils.

Five foods were served on a sectional styrofoam plate. Three of the foods (peas, lima beans, and cheese) were designated target foods and were served daily. The criteria for selection of target foods were: (a) the food was identified as a low preference food in
the initial assessment of preference, (b) the foods were part of the standard school lunch menu, (c) observations of meals conducted prior to the experiment indicated that consumption of these foods did not occur, (d) the foods were selected from two different food groups, and (e) two of the foods were from the same food group and shared common stimulus properties. The remaining two foods on the subject's plate were selected from the standard school lunch menu and varied daily. When possible, foods that had few properties in common with the target foods were chosen. In addition, milk was served in a plastic cup with each lunch. When possible, all foods were served in 50 g portions, except cheese and milk, which were served in 25 g and 150 g portions, respectively. All foods eaten with utensils were cut into bite-sized pieces prior to serving. At the onset of each session, the plate of food, milk, and a plastic "spork" were placed on the table within reach of the subject.

Response Definitions

The following behaviors were scored by observers during lunch sessions:

1. **Food expulsion** occurred when any food that contacted the mouth, tongue, or lips within a plane connecting the foremost part of the upper and lower lips was ejected beyond the lips. Expulsion of milk was not scored.

2. **Mouthing** occurred when any inedible object contacted the mouth, tongue, or lips within a plane connecting the foremost part of the upper and lower lips without food being delivered into the
subject's mouth. Body parts (e.g., fingers) were excluded from this definition.

Consumption of target foods was not scored during lunch sessions. However, portion sizes constituting a bite were defined in order to specify a criterion for reinforcement. Consumption of target foods occurred when one pea, one lima bean, or one cube of cheese (measuring 5 mm on each side) was placed within the mouth and the subject opened his mouth to show that the entire bite had been swallowed.

Data Collection

During the initial assessment of preference and reinforcer sampling, the investigator recorded the number of times the subject placed the token into the token can corresponding to each food. The percentage of times each food was chosen was obtained by dividing the number of choice responses on each food by the number of times each food was presented.

During preference tests, the investigator recorded the number of choice responses on each food (whole wheat roll, pineapple, oyster crackers, applesauce, and cottage cheese) when it was paired with one of the target foods. This number was divided by the total number of times each food was presented to obtain the percentage of times each was chosen.

Lunch sessions were divided into 30-second intervals signaled by audio tape. The occurrence of food expulsion or mouthing during any portion of each interval was scored on a data sheet at the end
of each interval. The percentage of intervals in which food expulsion and mouthing occurred was obtained by dividing the number of intervals in which each behavior was scored by the total number of observational intervals.

The number of grams consumed during each lunch session was recorded for each food. A Universal Accu-Weigh M-800 spring scale was used to determine the mass of each portion of food to the nearest gram. The mass consumed was calculated by subtracting the mass of each food measured after lunch sessions from the mass of each food measured before lunch sessions. Spilled and expelled food was wiped up with a napkin and was included in the post-lunch session measurement, from which the mass of the napkin was subtracted.

The subject's bodyweight was measured to the nearest 1/2 pound using a Continental Health-O-Meter Model 134 scale. Bodyweight was measured at 1- to 2-week intervals throughout the experiment.

The percentage of the recommended dietary allowances consumed by the subject during lunch sessions was calculated once during baseline and once during the final experimental condition. The average nutritive content of foods consumed (excluding the reinforcer food) in three randomly selected lunch sessions during each condition was determined from tables of food values. The average nutritive content was divided by one-third of the value of the daily recommended dietary allowances to obtain the percentage of recommended dietary allowances consumed per lunch session.
Interobserver Agreement

A second observer was present during 20% of lunch sessions and provided independent recordings of food expulsion, mouthing, and the masses of foods. The second observer sat approximately 5 feet (1.52 m) away from the investigator to observe the subject's behavior. Both observers were prompted by audio tape to observe and simultaneously record the occurrence of food expulsion and mouthing during the 30-second intervals. Interobserver agreement was calculated on the occurrence, nonoccurrence, and occurrence plus non-occurrence of the behaviors. The percentage of agreement was obtained by dividing the number of intervals in which observers agreed by the total number of intervals in which observers agreed and disagreed and multiplying by 100.

The second observer recorded the pre- and post-mass of each food on 20% of the sessions. An agreement between observers was defined as a difference in recordings of no more than ± 1 g. The percentage of agreement was obtained by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100.

Procedure

During all experimental conditions, food expulsion and mouthing were recorded but not consequated in lunch sessions. If the subject dropped or threw his cup or spork on the floor, the investigator left them on the floor within the subject's reach and continued the
session. All other inappropriate behaviors were ignored.

Baseline

A paper plate containing 50 g of cottage cheese was presented in addition to the typical lunch. The subject had free access to all foods served. No contingencies were in effect for food consumption, and the investigator did not verbally interact with the subject. After the cottage cheese was eaten, the paper plate was removed to prevent its destruction so that accurate measurement of consumption could be obtained.

Differential Reinforcement of Other Behavior

This condition was identical to baseline except the plate of cottage cheese remained in front of the investigator, out of the subject's reach. Approximately every 80 seconds on the average, 1 teaspoonful of cottage cheese was delivered to the subject if he had consumed no food within the preceding 15 seconds. This condition assessed the effects of restricted access to cottage cheese in the absence of a contingency for consumption of target foods.

Contingent Cottage Cheese

During this condition, the investigator held 1 teaspoonful of cottage cheese approximately 12 inches (30.4 cm) from the subject's mouth at the onset of each minute and stated the rule, "If you eat one pea, I'll give you some cottage cheese." Praise (e.g., "Nice job." "That's the way!")

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delivered contingent upon the subject's scooping, placing in the mouth, and chewing of peas. Cottage cheese and additional praise were delivered when the subject opened his mouth to indicate that the pea had been swallowed. Social reinforcement and cottage cheese were delivered after the consumption of each pea. If a pea was expelled from the subject's mouth, social reinforcement was terminated and the pea was removed. No other verbal interaction occurred, and the subject continued to have access to all remaining foods. Based on data obtained in baseline, the schedule of reinforcement in this condition was determined so that the ratio of the instrumental response to the contingent response was greater than baseline, thus insuring a condition of response deprivation.

Contingent Animal Crackers

Animal crackers replaced cottage cheese as the reinforcer food after the subject indicated a stronger preference for animal crackers during reinforcer sampling sessions. This condition was identical to the contingent cottage cheese condition except approximately 1/2 of an animal cracker was delivered contingent upon consumption of each pea.

Contingent Animal Crackers Plus Prompts

In previous conditions, the subject consumed peas only within the first 5 minutes of the session. This condition was identical to the contingent animal crackers condition except a prompt sequence was added in an attempt to occasion consumption throughout the
session. If the subject did not initiate the delivery of a pea to his mouth within 10 seconds of the rule statement, the investigator instructed him to pick up his spork. Praise was delivered if he complied within 5 seconds. If the subject did not comply, the response was physically prompted and no praise was delivered. Identical procedures were then followed with the instructions, "Scoop a pea." and "Put it in your mouth." to complete the prompt sequence. If the subject physically resisted or attempted to escape from the delivery of the pea into his mouth, the pea was returned to the plate. The prompt sequence was not initiated if the subject was in the process of delivering food to his mouth or chewing.

Taste Masking

In this condition, the taste of the target food was masked by presenting it in combination with a preferred food, cottage cheese. At the onset of each 30-second interval, the investigator presented the mixture of target food and cottage cheese and a piece of animal cracker approximately 3 inches (7.62 cm) from the subject's mouth. The investigator stated the rule, "If you eat this, I'll give you an animal cracker." If the subject placed the mixture in his mouth, social reinforcement was delivered. When it was observed that the mixture had been swallowed, the animal cracker and additional praise were delivered. If the subject did not initiate a consummatory response within 5 seconds of the rule statement, he was instructed to open his mouth. If consumption did not occur then after an additional 5 seconds, the mixture was removed. The mixture was not
presented if the subject was delivering food to his mouth or chewing. The subject continued to have access to all remaining foods. Portions of target foods used in the mixture were taken from the 50 g portions presented on the subject's plate.

At the onset of the taste masking condition, approximately 1/4 of one pea was initially combined with approximately 1 teaspoonful of cottage cheese to form the mixture. The portion of pea remained visible at all times. Gradually the volume of pea was increased until a whole pea was combined with 1 teaspoonful of cottage cheese. During Sessions 50-53 (the final 4 days of training with peas), pineapple replaced lima beans on the subject's plate.

Following unsuccessful attempts to further increase pea consumption, training began with pineapple. Pineapple was selected for training because its consumption in small amounts had been infrequently observed. At the onset of the taste masking condition with pineapple (Session 54), a portion of pineapple measuring approximately 3 mm x 3 mm x 3 mm was combined with cottage cheese. The pineapple was visible in the mixture at all times. During Sessions 54 and 55, the volume of pineapple was increased gradually and the volume of cottage cheese decreased gradually until 1/2 teaspoonful of pineapple was presented without cottage cheese.

In Session 56, a piece of animal cracker was delivered contingent upon consumption of a 1-teaspoonful portion of pineapple presented by the investigator. This criterion for reinforcement remained in effect for the duration of the taste masking condition.
During Session 57, the investigator physically prompted the subject to scoop and place 1 teaspoonful of pineapple in his mouth. The physical prompts were faded until the subject fed himself. The investigator restated the contingency at the onset of each 30-second interval.

**Contingent Animal Crackers**

The subject continued to feed himself throughout this condition. In Sessions 61-64, the statement of the contingency was gradually faded until it was eliminated in Session 65. Social reinforcement was delivered each time the subject placed 1 teaspoonful of pineapple in his mouth. In Session 62, a piece of animal cracker was delivered after two out of every three consummatory responses. The schedule of animal cracker reinforcement in Sessions 63, 64, and 65 was FR2, FR3, and FR4, respectively,

**Experimental Design**

Experimental conditions were planned for implementation in a multiple baseline across target foods. However, because early experimental conditions were ineffective, each experimental condition first was implemented successively on the peas baseline, with the other foods remaining in baseline. Beginning with Session 54, the taste masking condition was implemented with pineapple, and peas returned to the baseline condition. Baseline conditions were re-instated for pineapple in Sessions 59 and 60. In Sessions 61-65,
the final contingent animal crackers condition was implemented on pineapple.
RESULTS

The mean percentage of interobserver agreement for the pre- and post-mass of each food was 93%. The mean percentages of interobserver agreement for occurrences, nonoccurrences, and occurrences plus nonoccurrences were 54%, 90%, and 93% for food expulsion and 64%, 95%, and 96% for mouthing, respectively. In all cases, the agreement scores obtained for food expulsion and mouthing equaled or exceeded the chance agreement scores that would result from random responding (Hopkins & Hermann, 1977).

The initial preference assessment sessions were conducted on six consecutive school days prior to the experiment. The percentage of choice responses made by the subject for each food was: cottage cheese, 94%; milk, 67%; whole wheat roll, 67%; whole wheat crackers, 61%; peas, 50%; pineapple, 44%; oyster crackers, 39%; applesauce, 28%; lima beans, 28%; and cheese, 22%.

Four reinforcer sampling sessions independent of lunch sessions were conducted on the days of Sessions 33, 34, 35, and 37. The percentage of choice responses made by the subject for each food was: animal crackers, 72%; Cheetos, 63%; M&M's, 59%; peanuts, 31%; and cottage cheese, 25%.

Figure 1 presents the number of grams of peas and pineapple consumed by the subject across all experimental conditions. Open circles indicate sessions in which the observer detected consumption of any amount of peas or pineapple, and closed circles indicate sessions
Figure 1. Consumption of peas and pineapple
in which consumption was not detected.

Consumption of peas was not observed in either the baseline or the DRO condition. The nonconsumption of peas in baseline resulted in a ratio of the instrumental response (consumption of peas) to the contingent response (consumption of cottage cheese) of zero. Thus, the CRF schedule of reinforcement in the contingent cottage cheese condition produced a condition of response deprivation (Konarski et al., 1980). During the contingent cottage cheese condition, consumption increased slightly over the levels of the previous baseline and DRO conditions ($\bar{x} = 1$ g per session). Similar levels of consumption occurred in subsequent training conditions (contingent animal crackers, $\bar{x} = 1$ g per session; contingent animal crackers plus prompts, $\bar{x} = .17$ g per session; taste masking, $\bar{x} = 1$ g per session). Consumption of peas was observed in one session when baseline conditions were reinstated.

Pineapple was included in the daily lunch menu beginning with Session 49. Prior to that session, pineapple appeared in the lunch menu sporadically as part of the standard lunch menu. Pineapple consumption was observed during the first session of the initial baseline, resulting in mean consumption per session of 1.8 g. Further consumption was not observed until the implementation of the taste masking condition ($\bar{x} = 32$ g per session). A small increase in consumption of pineapple occurred in Sessions 54 and 55 when pineapple was presented in mixture with cottage cheese. An additional increase in consumption of approximately 40 g per session occurred when pineapple was no longer mixed with cottage cheese. Consumption
ceased when the baseline condition was reinstated, and returned to
the previous level when the contingent animal crackers condition was
implemented ($\overline{x} = 48.6$ g per session). Pineapple consumption re-
mained at high levels despite the thinning of the schedule of animal
 cracker reinforcement and the elimination of the statement of the
contingency.

Lima beans appeared in the daily lunch menu in Sessions 1
through 49, while cheese appeared in the lunch menu in all sessions.
Neither food was consumed during any lunch sessions.

Figure 2 presents the number of grams of milk and two other
foods that were consumed. The two other foods were selected from
the standard lunch menu and varied daily. However, these other
foods were available regularly throughout the experiment. Although
treatment contingencies were not implemented with these foods, their
consumption was monitored to detect changes in the consumption of
untreated foods. The number of grams consumed of each food was
summed for display in Figure 2. The open circles indicate sessions
in which the consumption of food was observed, and closed circles
indicate sessions in which consumption was not observed.

Consumption of milk was highly variable in baseline, ranging
from 0 to 160 g ($\overline{x} = 119.9$ g per session). Variability decreased
somewhat in the DRO condition, in which the preferred food (cottage
cheese) was delivered contingent upon any behavior other than food
consumption ($\overline{x} = 136.9$ g per session). Consistently high consump-
tion of milk occurred in the final baseline condition, when the mean
consumption per session reached 147.1 g.
Figure 2. Consumption of milk and two other foods
Consumption of the two other foods occurred in one session in the first baseline condition ($\bar{x} = .42$ g per session) and in the DRO condition ($\bar{x} = .89$ g per session). Consumption of other foods increased significantly during the final baseline condition ($\bar{x} = 6.8$ g per session).

Table 1 presents the percentage of recommended dietary allowances consumed per lunch session in baseline and the final contingent animal crackers condition. The percentage consumed of the recommended allowance of each nutrient was markedly greater in the final experimental condition.

Figure 3 presents the percentage of choice responses made for oyster crackers, whole wheat roll, applesauce, and pineapple when these foods were paired in preference tests with peas. Three preference tests for peas were conducted prior to the implementation of contingencies for consumption of peas (on the days of lunch Sessions 2, 14, and 26). Variability in the percentage of choice responses made for peas relative to other foods was evident across sessions. One preference test was conducted on the last day of reinforcement contingencies for pea consumption (on the day of lunch Session 53). Compared to the percentages of choice responses obtained prior to the implementation of reinforcement contingencies for peas, no significant change in preferences occurred.

Three preference tests each (data not shown) were conducted during the initial baseline and DRO conditions for lima beans and cheese relative to oyster crackers, whole wheat roll, pineapple, and applesauce. Reinforcement contingencies were never implemented
Table 1

Percentage of Recommended Dietary Allowances Consumed Per Lunch Session

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Baseline</th>
<th>Contingent animal crackers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>2.3</td>
<td>14.2</td>
</tr>
<tr>
<td>Protein</td>
<td>15.0</td>
<td>56.0</td>
</tr>
<tr>
<td>Calcium</td>
<td>23.5</td>
<td>74.6</td>
</tr>
<tr>
<td>Magnesium</td>
<td>6.7</td>
<td>20.8</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>19.5</td>
<td>65.9</td>
</tr>
<tr>
<td>Iron</td>
<td>0</td>
<td>12.1</td>
</tr>
<tr>
<td>Thiamine</td>
<td>0</td>
<td>25.0</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>20.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Niacin</td>
<td>0</td>
<td>13.8</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>2.7</td>
<td>41.2</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>13.4</td>
<td>43.9</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>16.1</td>
<td>47.4</td>
</tr>
</tbody>
</table>

for consumption of either of these two target foods. Wide variability between sessions was evident in the subject's choice responding in the preference tests for lima beans relative to all other foods. In preference tests for cheese, variability in responding also occurred between sessions, but to a lesser degree than in preference tests for lima beans.

Figure 4 presents the percentage of choice responses made for oyster crackers, cottage cheese, applesauce, and whole wheat roll
Figure 3. Choice responses vs. peas in preference tests.

Figure 4. Choice responses vs. pineapple in preference tests.
when these foods were paired in preference tests with pineapple. One preference test occurred prior to the implementation of the taste masking condition for pineapple (on the day of lunch Session 54). Additional preference tests were conducted on the final day of the contingent animal crackers condition for pineapple (on the day of lunch Session 65) and 3 days after the final lunch session (follow-up). No significant change occurred in the subject's preference for pineapple relative to whole wheat roll after the implementation of reinforcement contingencies. However, the subject's preference for pineapple relative to both cottage cheese and applesauce increased somewhat, while a substantial decrease in preference for pineapple relative to oyster crackers occurred.

The occurrence of food expulsion and mouthing during 30-second intervals was recorded throughout the experiment. Food expulsion ranged from 0 to 30% of the intervals. The highest levels of expulsion occurred in the DRO condition (\(\bar{x} = 21.7\%\)), the contingent animal crackers plus prompts condition (\(\bar{x} = 20.7\%\)), and the contingent animal crackers for pineapple condition (\(\bar{x} = 19.2\%\)). In general, increased food expulsion varied directly with increased consumption of any food appearing in lunch sessions. Mouthing occurred at its highest levels during the taste masking conditions for peas and pineapple (\(\bar{x} = 23.2\%\)) and the contingent animal crackers plus prompts condition (\(\bar{x} = 22.8\%\)). Mouthing was not systematically related to food consumption or experimental conditions.

The subject's bodyweight gradually decreased by 4.5 lbs. (2.0 kg) from Session 10 (baseline) to Session 46 (the contingent
animal crackers plus prompts condition). As of Session 62 (the contingent animal crackers condition for pineapple), the subject had regained 2 lbs. (.9 kg).

Although Ritalin was administered in the morning prior to 31 lunch sessions, no relationship was observed between Ritalin and food consumption, food expulsion, mouthing, or bodyweight.
DISCUSSION

The results of the present study demonstrate the efficacy of contingent preferred food with praise alone and in combination with other behavioral techniques for the treatment of multiple food aversions of a multiply handicapped child. Prior to the onset of treatment, the subject exhibited selective and quantitatively insufficient food intake, as indicated by the nonconsumption of peas, lima beans, and cheese, and low or inconsistent consumption of pineapple, milk, and other foods. In addition, comparison of the subject's nutritive intake with recommended dietary allowances indicated inadequate consumption of 12 nutrients. When treatment conditions were implemented, a modest increase in the consumption of peas, and substantial increases in consumption of pineapple, milk, and other foods were observed, as well as improvement in the subject's nutritive intake when compared with recommended dietary allowances. Finally, slight increases in preference for pineapple relative to two other foods were noted.

Although the experimental design of the present experiment does not allow the unequivocal determination of a functional relation between contingent preferred food with praise and consumption of non-preferred foods, evidence of such a relation exists. The baseline and DRO conditions demonstrated that neither free access to preferred food nor delivery of preferred food contingent upon other behavior resulted in increased consumption of target foods.
Consumption of peas increased only when preferred food with praise was made contingent upon consumption. Although the contingent animal crackers plus prompts and taste masking conditions incorporated other independent variables in addition to contingent preferred with praise (e.g., physical prompts, fading), the level of pea consumption remained at the same level as in the previous conditions in which contingent preferred food with praise was not combined with other variables. Moreover, when the preferred food contingency was removed in Session 54, pea consumption decreased to pretreatment levels.

While reinforcement contingencies were in effect for pea consumption, no consumption of pineapple occurred. However, pineapple consumption immediately increased with the implementation of taste masking in Session 54. As a result of the fading of the use of the cottage cheese mixture during Sessions 56, 57, and 58, these final sessions of the taste masking condition essentially represented the use of only contingent preferred food with praise. Although sequence effects may be present as a result of taste masking in Sessions 54 and 55, the decrease in pineapple consumption in the subsequent baseline and the recovery of pineapple consumption in the contingent animal crackers condition support the hypothesis that contingent preferred food with praise were the efficacious variables.

The variables responsible for the discrepant effects of the contingent animal crackers and taste masking conditions on pea and pineapple consumption remain unclear. However, a possible explanation may be suggested by relating these procedures to the basic
principles underlying them. Nonconsumption of food was conceived as a motivational deficit rather than a skill deficit, in that aversive consequences follow the consumption of nonpreferred foods. The use of contingent preferred food with praise was an attempt to remediate this situation by providing a greater magnitude of reinforcement for consumption than was previously available. Taste masking was an attempt to alter the discriminative stimuli that may be controlling the aversion, to eliminate the possible aversive consequences of consumption by masking the taste, and to increase the magnitude of reinforcement by delivering preferred food with praise contingent upon its consumption. Thus, if the intensity of the aversive properties of two target foods differ, identical treatment procedures may have differential effects.

The lack of correspondence between observed food consumption and the pre- and post-mass of foods warrants explanation. Despite data to the contrary obtained from recordings of the pre- and post-mass of foods, consumption was considered to occur only when observed by the investigator. This practice was adopted in recognition of numerous factors that contributed to erroneous measurement of the mass of food consumed. Errors in measurement of food consumption may result from the evaporation of moisture, the mixing of food items, the addition of saliva, observer error in reading the display, or inaccuracy of the measurement instrument. Furthermore, lack of correspondence may occur when consumption occurs in quantities too small to be detected by the measurement instrument. The magnitude of error resulting from these sources appears to have been
limited to no more than approximately 5 g. Thus, reported changes in food consumption that exceeded this value may be accepted with greater confidence. Future research might present behavioral data on subjects' consummatory responses in addition to measurements of the mass of food consumed.

Interpretation of the results of preference tests was also somewhat problematic. Variability in preference test data between sessions and the small number of preference tests conducted precluded the unequivocal interpretation of results. Additional preference tests might be conducted to provide more continuous pretreatment and posttreatment data to aid in interpretation. Further research might be undertaken to identify and control possible sources of variability in preference tests, such as position-controlled responding, random responding, and deprivation states.

Despite increases of varying magnitude that occurred in consumption of nonpreferred target foods, significant changes in the subject's preferences for these foods were not obtained. It remains unclear as to how food preferences may be favorably altered. Additional research is needed to identify the relevant variables.

Further substantiation of the noneffects of Ritalin on the subject's behavior is provided by Silver (1979). Although Ritalin may produce appetite suppression and increase food selectivity, these effects often disappear after 2 to 3 weeks. Furthermore, Ritalin works in the body for approximately 4 hours with minimal or no residual effects. The subject in the present study was administered Ritalin at least 4 hours prior to lunch sessions.
Future research should be conducted to develop the appropriate methodology to assess the specific stimuli that control food aversions so that treatment strategies can be devised to manage the relevant variables. For example, a fading procedure may be indicated in cases in which nonconsumption of food is controlled by texture, whereas an alternative strategy may be more suitable for aversions controlled by taste.
BIBLIOGRAPHY


