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BEHAVIORAL ASSESSMENT OF FEEDING PROBLEMS OF INDIVIDUALS WITH SEVERE DISABILITIES

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As many as 80% of the individuals with severe or profound mental retardation exhibit feeding problems. Although behavioral interventions have been used to treat these problems, no assessment procedure for determining a functional relationship between a person's acceptance of food and the type and texture of that food has been reported. The purpose of this study was to test a behavioral assessment procedure for a feeding problem of limited intake. Five individuals with severe or profound mental retardation were fed 10 to 12 types of foods with one or more textures. Behavioral categories of acceptance, rejection, expulsion, and other negative behavior were recorded. Results indicated that each subject fit into one of four categories of feeding problems: (a) total refusal, (b) type selectivity, (c) texture selectivity, or (d) type and texture selectivity. Thus, although all 5 subjects exhibited limited intake, the food characteristics correlated with the problem were different for each individual. Results suggest that treatments for limited intake may be based on assessments that show the association of food type or texture to a person's rejection or expulsion of food.

DESCRIPTORS: feeding problems, behavioral assessment, developmental disabilities, functional assessment

Feeding problems are quite common among individuals with developmental disabilities. Approximately one third of children with disabilities (Gouge & Ekvall, 1975; Palmer, Thompson, & Linscheid, 1975) and as many as 80% of individuals with severe or profound mental retardation exhibit these problems (Perske, Clifton, McClean, & Stein, 1977). Sisson and Van Hasselt (1989) suggested that feeding problems can be divided into four categories: (a) lack of independent self-feeding skills, (b) disruptive behavior (e.g., tantrums or theft of food) during mealtime, (c) eating too much or too little, and (d) limited intake due to selectivity by type or texture of food, resulting in dietary inadequacies.

A variety of behavioral interventions has been used to treat feeding problems. Most have made access to preferred foods contingent upon eating nonpreferred foods (Luiselli, Evans, & Boyce, 1985; Palmer et al., 1975; Riordan, Iwata, Finney, Wohl, & Stanley, 1984; Riordan, Iwata, Wohl, & Finney, 1980). Werle, Murphy, and Budd (1993) reported an intervention that consisted of direct prompts, positive reinforcement in the form of contingent games or preferred foods, and ignoring inappropriate responses. Other procedures include forced feeding (Ives, Harris, & Wolchik, 1978) and overcorrection (Duker, 1981).

All of these studies manipulated the consequences rather than the antecedents relevant to the problem behavior. For some individuals, food refusal and other problematic mealtime behaviors may be caused by inappropriate consequences that have been provided by those feeding the individual. For others, problem behaviors may be related to antecedents such as the food itself; the problem behavior may serve to avoid or escape consumption of the food. In the former scenario, the problem is often associated with the positive reinforcement of problem behavior. In the latter scenario, it is associated with negative reinforcement of escape behaviors. Because problem behaviors may be either associated with or independent of the food being served, and because treatment will often be different depending on this factor, a method of assessing feeding problems may be helpful.

Identification of the reinforcement contingencies

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that maintain the behavior as a basis for treatment has received considerable attention in the study of severe problem behaviors such as self-injurious behavior (SIB). In a seminal study, Iwata, Dorsey, Slifer, Bauman, and Richman (1982) conducted a functional analysis to identify environmental conditions in an analogue setting that would maintain the severe SIB of 9 individuals with mental retardation. The procedure involved exposing each subject to four experimental conditions (social disapproval, academic demand, unstructured play, and alone) and recording rates of SIB under each condition. Differential rates across conditions were considered evidence of a particular function of SIB. For example, 2 subjects exhibited more self-injury during academic demands, suggesting that SIB functioned to terminate demands by the experimenter, and was thus maintained by negative reinforcement. Differences in rate of responding across conditions for other subjects led to hypotheses that SIB was maintained by attention from the experimenter (positive reinforcement) or by automatic (sensory) reinforcement.

Iwata et al. (1982) also determined relative rates of SIB for each individual by averaging the overall mean rate of SIB for all conditions and comparing the mean occurrence for each condition with the overall mean. Thus, although SIB may have occurred during all conditions, a rate at least one standard deviation higher than the overall mean suggested a functional relationship between SIB and that condition. Using this method to examine relative rates of food intake for individuals with feeding problems may be a good strategy, because individuals may accept significantly more or less of specific foods than is indicated by the overall mean acceptance rate.

In the present study, we applied selected procedures from the investigation by Iwata et al. (1982) to identify relationships between food characteristics (type or texture) and problem behaviors during mealtimes. In this assessment, we manipulated antecedent conditions (food characteristics) and recorded each person's responses under each condition. In contrast to procedures used by Iwata et al., we manipulated only antecedent conditions while maintaining a consistent consequence; thus, the term *behavioral assessment,* rather than *functional analysis,* best describes this procedure.

The purpose of our study was to evaluate an assessment procedure developed for feeding problems to differentiate among individuals who (a) refuse all foods (total refusal), (b) accept certain foods at all textures, but refuse other types of foods at all textures (type selectivity), or (c) accept all foods at one texture, but refuse the same foods at a different texture (texture selectivity). The purpose was met by analyzing the mealtime behaviors of 5 students with developmental disabilities who were referred to us as persons with severe feeding problems.

METHOD

Subjects and Setting

Five individuals with severe disabilities and a history of limited food intake served as subjects. Dan, Carrie, Billy Joe, Konnie, and Nancy were 13, 5, 16, 21, and 8 years old, respectively. With the exception of Konnie (who had severe mental retardation), all subjects had profound mental retardation and multiple physical disabilities. Feeding skills and reported problems varied across subjects. Dan demonstrated rudimentary self-feeding skills (i.e., he required physical guidance for use of utensils) and reportedly refused most foods. Carrie could grasp a utensil but required physical guidance to place food into her mouth. She reportedly refused most foods when prompted or when a staff member presented the bite of food. Billy Joe did not exhibit any self-feeding skills, and he reportedly refused most foods presented by staff members. Konnie could grasp a utensil and place food into her mouth, but she reportedly refused to eat independently and refused food presented by staff members. Nancy did not exhibit self-feeding skills, and she reportedly refused some foods presented by staff members. Dan, Carrie, and Billy Joe lived in a residential program for youths with severe multiple disabilities. Their assessments took place in their dining room, where they were regularly fed. Konnie and

Nancy attended a public school and received services in a classroom for students with severe multiple disabilities. They were assessed in their classrooms, where they were regularly fed.

All subjects were referred for assessment due to feeding problems that were sufficient to affect their overall nutrition. Prior to participation in the study, all subjects were evaluated by a multidisciplinary team including, at minimum, an occupational therapist, speech pathologist, and physical therapist. The purposes of these evaluations were (a) to rule out physical conditions that might affect oral intake of any solid food, and (b) to establish whether each subject exhibited necessary oral-motor functions (e.g., lateralization of tongue, normal swallowing) to consume food at a texture coarser than junior. Because of the high prevalence of oral-motor dysfunction among individuals with severe disabilities, identifying the presence of basic oral-motor functions is necessary if assessment or intervention results are to be generalized to other individuals with similar problems.

Prior to the assessments, all subjects received most of their nutrients from liquid supplements delivered orally. In the past, Dan, Konnie, and Billy Joe had received supplements via a nasogastric tube, but all had received supplements orally for the past 12 months. Staff members attempted to feed all subjects orally on a daily basis, but reported high rejection rates accompanied by physical struggling and other problem behaviors. Billy Joe had been mechanically restrained during attempts to feed him orally. The schedules for oral feedings and delivery of liquid supplements were not altered for this study.

Dependent and Independent Variables

Dependent variables were the subjects' responses during feeding, and included acceptance (opening the mouth and allowing placement of food in the mouth with no resistance), refusal (failure to open the mouth or accept the spoon into the mouth), expulsion (pushing food out of the mouth or opening the mouth and tipping head down so that food falls out), and (for Billy Joe only) negative behaviors (stereotyic head weaving and self-injurious face slapping). Responses were categorized as occurring at the moment food was presented (at-bite) or during the period between presentations (interbite). At-bite behaviors included acceptance or refusal, and interbite behavior was expulsion of accepted food. For Billy Joe, negative behavior was recorded during both the at-bite and interbite periods. (The other subjects had not exhibited negative behaviors during preassessment observations.)

Mean percentage of bites accepted was calculated by summing bites accepted and then dividing by the number of bites offered. Mean percentage of bites expelled was calculated by summing bites expelled and dividing by the number of bites offered. Mean expulsion and acceptance measures were calculated across all food types (10 to 12 per subject) presented at one texture. Percentage of bites with negative behavior was calculated by dividing the number of bites with negative behavior by the number of bites offered. Overall means were calculated for all three of these measures by summing the means for all food types across two or more textures and dividing by the number of means summed.

Independent variables were the type and texture of the foods presented. There were 10 to 12 food types, representative of the menus served in the subjects' school or residential programs. Thus, there was some variation across subjects. Each of the food types presented during the assessment was available as part of a regular menu. Because staff members had been regularly attempting to feed the subjects the foods presented during the assessment, acceptance or rejection of any foods during assessment cannot be attributed solely to novelty. Food textures were those normally consumed across developmental stages. The four textures were junior (blended into a puree), ground (blended to a semisolid consistency such as that of ground beef), chopped fine (cut to approximately 0.25 in. in size), and regular (cut to 0.5 in. or larger). These textures were determined to be appropriate through evaluations completed by a speech pathologist, occupational therapist, and a physical therapist.

Data were recorded by an observer seated beside and at least 1 m away from the subject. Reliability

was assessed by having a second observer record data on 53% of the sessions, distributed relatively equally across the 5 subjects. The second observer sat approximately 1 m from the subject and 2 m from the primary observer. No interaction occurred between the two observers. Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements across all sessions and multiplying by 100%. Mean percentages of agreement were 99% for acceptance of food, 99% for refusal, 100% for expulsion, and 100% for negative behavior.

Assessment of Type and/or Texture Selectivity

In order to determine whether a subject was type selective, texture selective, or type and texture selective, several foods were presented at different textures. Foods were initially presented at the introductory texture, which was the texture appropriate for the subject's oral-motor skills. When assessment data suggested that a subject could eat some foods at a refined (e.g., junior) texture or possibly a coarser (e.g., ground) texture, the more refined texture served as the introductory texture. If a subject accepted some foods while rejecting or expelling others at the introductory texture, type selectivity would be indicated. Because the texture was the same for all foods, texture selectivity was ruled out and variability in acceptance or expulsion across foods could be attributed to preference of food types. If a subject accepted (without expulsion) all foods at an introductory texture and then rejected some or all of those foods re-presented at a coarser texture, texture selectivity would be indicated. If, however, a subject accepted some foods while rejecting or expelling others at the introductory texture and then rejected or expelled re-presented foods at a coarser texture, type and texture selectivity would be indicated. Some subjects were type selective at one texture and then became texture selective as texture became coarser.

Initial textures were selected according to the recommendations of the multidisciplinary team and the textures recently or currently eaten by the child. Based on these criteria, Dan initially received regular textures, and the other 4 subjects received junior textures. Subsequent meals consisted of progression to coarser textures of selected foods when the following conditions were met: (a) A minimum of 80% of bites of that food were accepted, and (b) the subject had the requisite oral-motor skills (e.g., lateralization and chewing skills) to eat the coarser food. For Dan, foods were presented at a finer texture if they were refused at the regular texture.

All foods in an individual meal were prepared at the same texture level. Six bites of one food were presented before cycling through all (10 to 12) foods, for a total of 60 to 72 bites. Each bite consisted of one-quarter level teaspoon of food placed on the tip of the spoon. Thus, if a subject accepted all presentations, the total amount of food consumed would be approximately 30 level teaspoons per texture. This amount, which was less than that regularly provided at each meal, was used to minimize satiation. The sequence of presentation was pears, peaches, apples, potatoes, macaroni and cheese, pancakes, beans, peas, carrots, beef, ham, and chicken. Substituted foods (e.g., mixed fruit for Dan) were served in the position of the food being replaced. Konnie and Nancy received only 10 and 11 foods, respectively.

The first presentation allowed the subject to sense the food before we judged acceptance or refusal of that food; the subsequent five presentations were used for data recording. The experimenter asked the subject to smell and taste each bite. For each presentation, he tapped the subject's lip with the spoon and then held the spoon within 0.5 in. of the individual's mouth for approximately 3 s. The 3-s presentation was selected because it provided ample time for the subject to sense (see, taste, and smell) the food but did not induce escape behavior. If the subject did not accept the bite, the experimenter withdrew the bite and made no comment. When expulsion occurred, the experimenter wiped the food from the subject's chin. There were no other consequences for acceptance, rejection, or expulsion. There was a 3-s interval between presentations for each food type. After six presentations, we offered the subject a preferred liquid recom-

Table 1
Percentage of Bites Accepted and Expelled by Nancy

	Pears	Peaches	Apples	Potatoes	Macaroni and cheese	Pancakes	Beans	Carrots	Beef	Ham	Chicken	*M*	*SD*
Junior texture													
Accept	100	100	100	100	100	100	100	100	100	100	100	100	0
Expel	0	0	5	18	4	18	13	15	20	17	50	15	14
Ground texture													
Accept	100	100	100	100	100	100	100	100	100	100	100	100	0
Expel	0	0	18	26	21	22	20	20	40	44	14	21	14
Chopped texture													
Accept	100	100	100	100	100	100	100	100	100	100	100	100	0
Expel	19	6	24	36	50	100	44	67	71	67	89	52	30

mended by the teacher. This liquid served as a wash of the taste of that food.

Assessments were completed at each subject's normal lunchtime. Typically, staff members would attempt to feed all subjects solid foods and would then cease feeding when the subjects rejected most or all bites presented. At this time, liquid supplements (e.g., Ensure®) were delivered in a cup. During the assessments, small amounts of liquid supplements were provided between types of foods, with the remainder delivered after completion of the assessment. Thus, each subject's level of hunger (deprivation) during the assessment approximated the level present each day at lunchtime.

RESULTS

Data on percentage and standard deviations of bites accepted and expelled are provided for each subject. For Billy Joe, percentages of at-bite and interbite negative behavior are also presented. In addition, percentages for each dependent variable are presented for beginning, middle, and end segments for each sequence of presentations. These percentages indicate any effects the sequence of foods may have had on a subject's responses. In particular, we attempted to assess whether rejection or expulsion of foods near the end of an assessment was due to consumption of many bites earlier in the assessment.

Results showed four types of feeding problems: (a) texture selectivity (Nancy), (b) type selectivity (Dan), (c) type and texture selectivity (Billy Joe and Carrie), and (d) total refusal (Konnie). Subjects were categorized based on examination of assessment data (described below) and relative differences in dependent variables across food types and textures.

Texture Selectivity

Table 1 presents results of the assessment for Nancy; it serves as an example of the assessment data for the other subjects. Eleven foods were presented at the junior, ground, and chopped textures. The mean acceptance and expulsion percentages are presented for each food under each texture. Nancy accepted 100% of bites at all three textures; however, her mean expulsion increased as texture became coarser. Expulsion was 15% at the junior texture, 21% at the ground texture, and 52% at the chopped texture. For all three textures combined, overall mean acceptance was 100% and overall expulsion was 29% (SD = 20%).

The top left panel of Figure 1 presents the relative differences in expulsion by Nancy for three textures of foods. Mean expulsion at the chopped texture (M = 52%) exceeded the overall mean (M = 29%) across the three textures by more than 1 standard deviation (SD = 20%). Possible sequence effects were assessed by computing mean acceptance

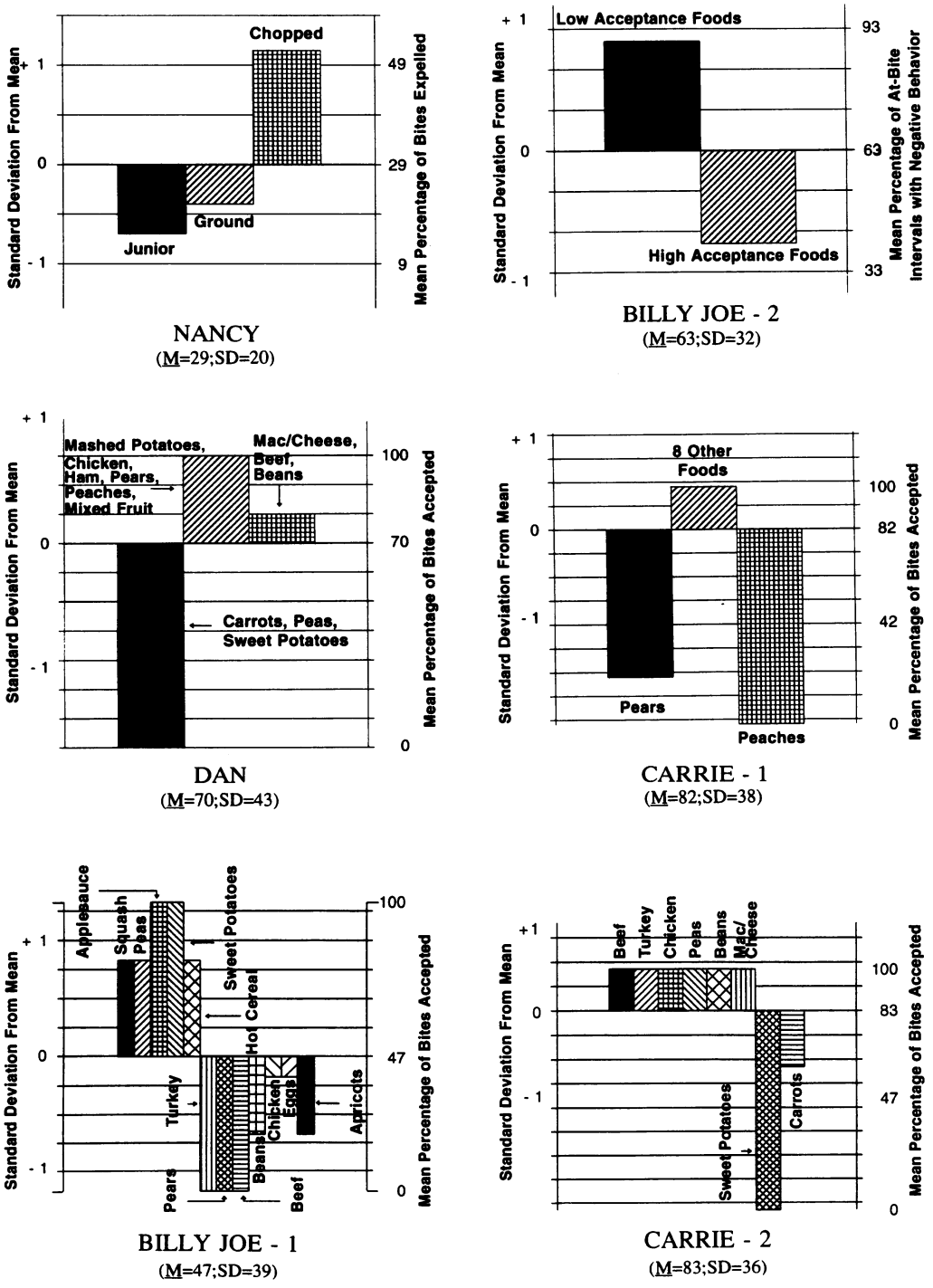

Figure 1. Mean percentages and standard deviations for Nancy (bites expelled across textures), Dan (bites accepted at regular texture across food types), Billy Joe (bites accepted at junior texture across food types; at-bite negative behavior across low- and high-acceptance foods), and Carrie (bites accepted at junior texture across food types, and bites accepted at ground texture across food types).

and expulsion rates for the beginning (Foods 1 through 4), middle (Foods 5 through 8), and end (Foods 9 through 11) segments of the presentation. Results showed 100% acceptance for all three segments. Expulsion rates for each segment for each food, however, indicated a pattern of progressively increasing expulsion that was similar across textures from the beginning to the end of a presentation. At junior textures, expelled bites for the three segments were 6%, 10%, and 29%, respectively. Expulsion percentages for the three segments for the ground texture were 11%, 21%, and 33%. At the chopped texture, expulsion levels were 21% for the first segment, 65% for the second, and 76% for the third segment. These data indicate that expulsion increased throughout each texture level, but decreased at the beginning of subsequent presentations of coarser textures. This pattern suggests that the progressive increases in expulsion during each texture level were not due principally to satiation; rather, the effects were due to type selectivity, particularly of the last three foods. Thus, although Nancy was texture selective (as indicated by increasing percentages of expulsion across the three textures), she also exhibited some type selectivity. For example, expulsion of chicken exceeded the 1 *SD* criterion at the junior and at the chopped textures, but not at the ground texture. In addition, expulsion of beef and ham exceeded the 1 *SD* criterion at the ground texture, but not at the junior or chopped textures. Because type selectivity was not consistent across all textures, we were disinclined to label Nancy as type selective.

In summary, although Nancy accepted some food at all three textures, she expelled more than 50% of the foods at the chopped texture; thus, the assessment identified a food characteristic (texture) that was associated with a significant increase in a feeding problem (expulsion).

Type Selectivity

Assessment data for Dan indicated type selectivity. All foods were presented at regular texture, with the following percentages of acceptance: pears, 100%; peaches, 100%; sweet potatoes, 0%; macaroni and cheese, 80%; mashed potatoes, 100%; beans, 80%; carrots, 0%; peas, 0%; beef, 80%; ham, 100%; chicken, 100%; and mixed fruit, 100%. Overall percentage of acceptance was 70% (*SD* = 43%). Percentages of acceptance for peas, carrots, and sweet potatoes were more than 1 *SD* below the overall mean. No occurrences of expulsion were observed.

The middle left panel of Figure 1 presents relative differences in acceptance percentages across food types at the regular texture. Due to the large standard deviation (43%), no mean acceptance could exceed the overall mean (70%) by a full standard deviation. Six foods were accepted at the maximum (100%), and three others were accepted at a percentage (80%) just 10% above the mean. Mean acceptance for the first segment of the presentation (Foods 1 through 4) was 70%, followed by 40% (Foods 5 through 8) and 100% (Foods 9 through 12). This inconsistent pattern suggests that acceptance of foods earlier in the sequence did not affect acceptance of foods in the last segment of the presentation.

Foods rejected at the regular texture (peas, carrots, and sweet potatoes) were re-presented at the chopped level to test texture selectivity unique to these three foods. Carrots were accepted on 20% of the presentations, and peas and sweet potatoes continued to be rejected on all presentations. In summary, data presented in the middle left panel of Figure 1, coupled with rejection of three foods at both textures presented, suggest type selectivity for Dan.

Type and Texture Selectivity

Assessment data for both Billy Joe and Carrie indicated type and texture selectivity. Data for Billy Joe include percentages of acceptance, expulsion, and negative behavior. Foods with 80% to 100% acceptance rates at the junior texture were later fed at the ground texture to assess texture selectivity. Percentages of acceptance for foods at the junior level were as follows: pears, 0%; sweet potatoes, 100%; beans, 20%; beef, 0%; turkey, 0%; chicken, 40%; eggs, 40%; apricots, 20%; applesauce, 100%; squash, 80%; peas, 80%; and hot cereal, 80%. The mean acceptance at the junior texture was 47%

(*SD* = 39%). Three foods—turkey (0%), pears (0%), and beef (0%)—were accepted at percentages more than 1 *SD* below the overall mean. For two foods (applesauce and sweet potatoes) 100% of the presentations were accepted, exceeding the overall mean by more than 1 *SD*. Squash (80%), peas (80%), and hot cereal (80%) were almost 1 *SD* above the mean.

Mean percentages of acceptance for the beginning, middle, and end segments of the presentation were 25%, 45%, and 70%, respectively. This progressive increase suggests that acceptance of foods at the beginning or middle segments of the presentation sequence did not decrease acceptance in the last segment. The bottom left panel of Figure 1 presents the relative differences in percentages of acceptance of foods at junior texture, and indicates type selectivity.

When the five foods with acceptance exceeding 80% were re-presented at the ground texture, percentages of acceptance were as follows: squash, 100%; peas, 80%; applesauce, 40%; sweet potatoes, 60%; and hot cereal, 0%. Hence, percentages of acceptance decreased by 80% (hot cereal), 60% (applesauce), and 40% (sweet potatoes) when texture became coarser. This pattern of decreased acceptance of previously accepted foods when texture was made coarser indicates texture selectivity.

Billy Joe's negative behaviors during at-bite and interbite intervals were also recorded. Percentages of presentations with at-bite or interbite negative behavior were calculated for high-acceptance foods (i.e., foods accepted on 80% to 100% of bites) and for low-acceptance foods (i.e., foods accepted on 0% to 20% of presentations). The mean percentage of interbite negative behavior was 50% (*SD* = 32%); percentages were 25% for high-acceptance foods and 75% for low-acceptance foods. The top right panel of Figure 1 presents relative differences in percentages of at-bite negative behavior across high- and low-acceptance foods. As with interbite negative behavior, at-bite negative behavior decreased with foods accepted at relatively high rates. In summary, assessment data for Billy Joe indicate type selectivity for foods at the junior texture and texture selectivity for preferred foods served at a coarser texture.

Assessment data for Carrie also indicated type selectivity at the junior texture and texture selectivity at the ground texture. As with Billy Joe, all foods were initially fed at the junior texture, with high-acceptance (*M* = 100%) foods re-presented at a coarser texture. At the junior texture, Carrie accepted 100% of all foods except pears (20%) and peaches (0%). Expulsion remained at 0% across all foods. An analysis of sequence effects indicated 100% acceptance in the beginning and middle segments and 40% acceptance in the last segment containing pears and peaches. Because she accepted 100% of the two foods (sweet potatoes and macaroni and cheese) just prior to the pears and peaches, the reduced acceptance in the last segment suggests type selectivity rather than satiation. The middle right panel of Figure 1 presents relative differences in acceptance across foods presented at the junior texture. The eight foods (beef, turkey, chicken, peas, beans, carrots, sweet potatoes, macaroni and cheese) accepted on 100% of the presentations at the junior texture were re-presented at a ground texture. Acceptance remained at 100% for all foods except carrots (60%) and sweet potatoes (0%).

The bottom right panel of Figure 1 presents relative differences in acceptance rates of high-acceptance foods (*M* = 100%) when fed at a ground texture. Mean overall acceptance for foods re-presented at the ground texture was 83% (*SD* = 36%); thus, acceptance of a food could not exceed the overall mean by 1 *SD*. Six foods were accepted on 100% of the presentations. Two foods—carrots and sweet potatoes—were accepted at percentages below the overall mean. With an acceptance of 0%, sweet potatoes fell more than 1 *SD* below the overall mean, indicating a significant relative difference in acceptance.

In summary, the middle and bottom right panels of Figure 1 reveal a profile of type and texture selectivity. Relative differences in acceptance at the junior texture indicate type selectivity, and changes in acceptance of preferred foods when texture was increased indicate texture selectivity.

Total Refusal

Assessment data for Konnie indicated total refusal of all food types at the junior texture, the

finest texture possible. Assessment data ruled out type selectivity and, theoretically, texture selectivity.

DISCUSSION

The purpose of the present study was to determine whether a variation of the functional assessment procedure developed by Iwata et al. (1982) could be used to identify types of feeding problems. For each of 5 subjects, 10 to 12 foods with several of four possible textures were fed to determine whether food rejection would be specific enough to show individual types of problems. These types were hypothesized to be (a) total refusal, (b) type selectivity, (c) texture selectivity, and (d) type and texture selectivity. Results showed that each of the 5 subjects fit into one of the categories.

As a follow-up to the assessments, we implemented an intervention to increase intake by Billy Joe. Assessment results had indicated type and texture selectivity. The multidisciplinary team hypothesized that increasing intake at the junior texture would produce the fastest weight gain; thus, an intervention for type selectivity only was implemented to increase acceptance of all foods that appeared in the regular menu. The multicomponent intervention consisted of (a) adding preferred foods to meals; (b) clearly instructing Billy Joe to open his mouth when food was presented, and holding the spoon near his mouth until the bite was accepted, typically within 5 s; (c) alternating two bites of nonpreferred and two bites of preferred food throughout the meal to intersperse stimuli (foods) associated with acceptance and to reinforce acceptance of nonpreferred foods with bites of preferred foods; and (d) providing a preferred liquid after acceptance of two consecutive bites. In addition, manual guidance and restraint were omitted from the mealtime procedure.

Implementation of the intervention with two feeders produced immediate increases in the percentage of bites accepted of foods served at the junior texture. Billy Joe accepted 100% of bites presented after several treatment sessions, an increase that was maintained at follow-up. In addition, negative behavior decreased, perhaps as a combined result of altering the antecedent conditions that produced it and escape extinction. Following several sessions in which Billy Joe accepted all or nearly all bites presented, staff members began to address the problem of texture selectivity by presenting small amounts of each food (e.g., 10% of food) at the ground texture. The amount of each food presented at the ground texture was gradually increased as long as Billy Joe continued to accept a high percentage of bites.

We believe that the assessment procedure reported here can be used by practitioners to identify conditions associated with selective acceptance, expulsion, or total refusal of food, and to select the least intrusive interventions for increasing intake. In some cases, refusal of a food whose texture makes it difficult to swallow seems to be appropriate and highly adaptive. However, foods at textures that are initially difficult to consume may become conditioned aversive stimuli and may continue to be refused or expelled even after the individual has demonstrated the oral-motor skills necessary to chew and swallow. A similar paradigm of negative reinforcement exists for rejection or expulsion of food types. Type-selective eaters are communicating food preferences, which could be considered adaptive. Such selectivity becomes a problem when an individual rejects so many foods that his or her nutritional health is threatened; in addition, it may preclude acquisition of preferences through repeated sampling.

For individuals who are type and/or texture selective, procedures such as time-out, overcorrection, and forced feeding may be contraindicated. Time-out would merely strengthen problem behaviors that are maintained by escape or avoidance of either a food or the feeding situation. Overcorrection and forced feeding could add to the aversive properties of the feeding situation and do not alter the antecedent conditions (e.g., food type and texture) for the original escape response. When intervention is warranted, we believe that a behavioral assessment can be used to select a nonaversive intervention that is more closely related to the reason the problem exists.

The success of positive reinforcement procedures (e.g., Luiselli et al., 1985; Riordan et al., 1984) may depend on the ability of staff members to

identify preferred foods to use as reinforcement for acceptance of nonpreferred foods. Results of the assessment could be used to identify the preferred and nonpreferred foods to be manipulated in treatment. Similarly, texture selectivity may be effectively treated by fading in coarser textures of preferred foods. The assessment can be used to identify foods for which texture fading could be an appropriate treatment. For individuals who refuse all foods, interventions may need to include manipulation of establishing operations (e.g., increase hunger by delaying liquid supplements, feed in a novel and quiet setting), preventing escape (e.g., using a prolonged presentation in which each bite is placed near the individual's mouth), and reinforcement for accepting and swallowing food.

Despite the encouraging results of the assessments reported here, further research is needed to establish the parameters for effective use of this procedure. In this study, we conducted one assessment per subject. In the future, repeated assessments over an extended period of time would help to determine the stability and reliability of identified food preferences. Other investigations might randomize or counterbalance food types or textures across repeated presentations.

One potentially fruitful area for study is the expansion of the current assessment model to include systematic changes in consequences for the subject's behavior. Manipulating the consequences for rejection or expulsion may allow identification of environmental variables (e.g., termination of presentation, a change to preferred food, social attention) that maintain the behavior. Finally, more data on the effects of treatments based on assessment results are needed. Our procedure was not designed to identify the types of reinforcement contingencies that were maintaining feeding problems; however, to the extent that feeding problems are maintained by negative reinforcement, the identification of stimulus (food) dimensions (type or texture) that differentially affect food acceptance may be useful in guiding the design of treatments.

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