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Increasing non-preferred food acceptance using non-aversive procedures

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Increasing Non-Preferred Food Acceptance Using Non-Aversive Procedures

A Thesis Presented

by

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In partial fulfillment of the requirements

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Abstract

A preference assessment using foods from five food groups was completed to determine if a selective eater's preferences were related to the type of food or the texture of the food being presented. The results of this assessment suggested both type and texture selectivity, particularly within the fruit and vegetable food groups. A treatment package involving non-aversive procedures was then applied that included texture fading, blending, social praise, and altering the ratio of non-preferred to preferred foods presented sequentially. The treatment was successful in increasing the consumption of two solid fruits, and these results were replicated with two more fruits. Suggestions for future extensions of the treatment are presented.

Increasing Non-Preferred Food Acceptance Using Non-Aversive Procedures

Numerous feeding problems have been noted in children with developmental disabilities, including insufficient self-feeding, aberrant behaviors during mealtimes, under or overeating, selective eating, total food refusal, packing, expulsion of food, and rumination (Girolami, Boscoe, & Roscoe, 2007; Munk & Repp, 1994; Patel, Piazza, Layer, Coleman, & Swartzwelder, 2005; Rhine & Tarbox, 2009). Feeding problems may lead to related health issues with undesirable short- or long-term effects such as gagging, vomiting, tooth decay, malnutrition, dehydration, or choking (Molloy & Manning-Courtney, 2003; Patel, Piazza, Kelly, Ochsner, & Santana, 2001; Patel, Piazza, Layer, et al.; Rhine & Tarbox; Riordan, Iwata, Finney, Wohl, & Stanley, 1984). Herndon, DiGuseppi, Johnson, Leiferman, and Reynolds (2009) compared the diets of children with autism spectrum disorders to typically developing children and found that while large percentages of both groups did not meet the daily recommendations for many nutritional needs, children with autism were particularly lacking in calcium and dairy intake compared to their peers, while they tended to eat more non-dairy proteins.

Abnormal eating was one of the early diagnostic indicators of autism (Ritvo & Freeman, 1978), and though it is not listed as part of the current American Psychiatric Association Diagnostic and Statistical Manual (DSM-IV TR) criteria for autism, it is included in the proposed changes for the DSM-V as an example of a restricted, repetitive pattern of behavior (American Psychiatric Association, 2000; American Psychiatric Association, 2011). In one of the earliest descriptions of children with

autism, difficulties with feeding and abnormal eating behaviors are noted in many of the case studies (Kanner, 1943).

Both physiological and behavioral factors may contribute to feeding problems in children with autism. Dysphagia, or difficulty swallowing, may occur when there is a problem with neural control or with the physiological structures required for chewing and swallowing food (National Institute on Deafness and Other Communication Disorders, 2010). This may lead to malnourishment, choking, and other health problems impeding normal food and liquid intake. In a large study of children with and without disabilities who had all been referred for feeding problems, 23% of the children had dysphagia, which often lead to aspiration pneumonia (Field, Garland, & Williams, 2003).

Gastrointestinal (GI) symptoms such as chronic diarrhea, constipation, acid reflux, and vomiting may contribute to feeding problems as well. Molloy and Manning-Courtney (2003) found that 24% of their sample of children with autism spectrum disorder had at least one chronic GI symptom, most commonly diarrhea, but the sample population was not compared to a control group. They also found that there was no association between chronic GI symptoms and a history of developmental regression.

Williams, Gibbons, and Schreck (2005) compared children with autism to children with disabilities other than autism and typically developing children. Of their 178 participants, the children with autism had similar or lower prevalence of medical issues, including GI symptoms, as compared to the other participants.

Melmed, Schneider, Fabes, Phillips, and Reichelt (2000) examined a sample of children with a pervasive developmental disorder (PDD) compared to their neurotypical siblings and unrelated controls. In their group, 46% of children with PDD had chronic constipation, diarrhea, or both, while 18% of siblings and 10% of the unrelated sample had the same symptoms.

Ibrahim, Voigt, Katusic, Weaver, and Barbaresi (2009) compared data on gastrointestinal (GI) disorders from the medical records of children with research diagnoses of autism to age- and gender-matched control participants. The authors found that children with autism had a higher incidence of constipation and feeding issues such as food selectivity, while they showed comparable incidence of diarrhea, gastroesophageal reflux, vomiting, and abdominal discomfort or irritability. There was not a significant statistical difference in the overall incidence of GI problems between the two groups, and the authors concluded that the higher incidence of certain GI problems in the group with autism may be attributable to behavioral and medication-related factors specific to autism rather than an autism-specific organic cause. The behavioral features of autism, such as overselectivity and ritualistic or stereotypic tendencies, may affect eating. Additionally, the psychotropic medications that are sometimes used to treat symptoms of autism frequently suppress or increase appetite.

Research on the prevalence of GI problems in children with autism warrants further examination, as the results thus far have been inconclusive. Since these physiological factors are not necessarily any more prevalent in children with autism

as compared to their typical peers, for the purposes of the present study we focused on the behavioral causes of feeding problems.

As with any other behavior that we study and treat as behavior analysts, feeding problems may be sensitive to a number of variables. Descriptive and functional analyses have been used to attempt to determine the function of inappropriate mealtime behaviors. The results of these analyses help determine function-based treatments as well as suggest which treatments are contraindicated for particular cases. Ledford and Gast (2006) provide a review of feeding problem descriptive analyses as well as some common treatments for feeding problems in children with autism. They recommend that further analyses be completed based on direct observation (rather than indirect reports of behavior) and they emphasize the need for assessing the social validity of current treatment practices.

Piazza, Fisher, et al. (2003) used both descriptive and functional analysis methods to study aberrant feeding behaviors. In the first phase of their study, they conducted descriptive analyses of problem behaviors of children with severe feeding disorders and their parents during meals. They observed that inappropriate mealtime behaviors were frequently followed by attention in the form of coaxing and reprimanding, escape in the form of breaks from a meal, and tangibles in the form of preferred foods and toys. In the second phase of the study, they applied the functional analysis model to feeding problems, and found that inappropriate mealtime behaviors were most often strengthened by the contingent application of attention or escape as consequences. This study demonstrated the utility of applying experimental

conditions to determine the function of feeding problems, which can in turn inform the clinician as to possible function-based interventions to target these behaviors.

Borrero, Woods, Borrero, Masler, and Lesser (2010) conducted descriptive analyses of food refusal to determine if the conditions applied in functional analyses of feeding problems were commonly delivered as consequences during meals conducted by the participants' parents. Data were collected on food refusal and acceptance responses as well as the parent-delivered consequence for each behavior, including the delivery of attention, tangible items, and escape. The authors found that attention and escape most frequently followed food refusal, and they also noted that the specific forms of attention or escape varied with the specific type of refusal behavior (e.g., disruption was most frequently followed by coaxing or meal termination, while food expulsion was most frequently followed by reprimands or spoon/cup removal). This study points to the importance of including different topographies of the typical analogue functional analysis consequences to more accurately determine the maintaining variables of challenging mealtime behaviors.

In addition to examining the consequences delivered following challenging food-related behaviors, it is also important to consider antecedents such as variables pertaining to the food items that are delivered at mealtimes. Munk and Repp (1994) originated a procedure from which they were able to identify categories of feeding problems in a sample of children and young adults with mental retardation who exhibited limited food intake. They delivered 10 to 12 foods from a variety of food groups with one or more textures (pureed, ground, chopped, etc.) to five participants and assessed their behaviors to determine the properties of the foods that were

associated with refusal. They hypothesized that aberrant behaviors (refusal or expulsion) functioned to avoid or escape the aversive properties of food, and therefore attempted to identify what the aversive properties were for the participants. When a participant accepted most foods at a lower texture but not at a higher texture, it was identified as texture selectivity. When a participant accepted certain foods at a higher texture but not other foods, it was identified as type selectivity.

Four categories of feeding problems were determined based on their results: food selectivity by type, food selectivity by texture, food selectivity by type and texture, and total food refusal. Informed by their assessment results, the experimenters implemented a successful treatment for one of the participants who exhibited type and texture selectivity (Munk & Repp, 1994).

In a replication of that study, Ahearn, Castine, Nault, and Green (2001) used a larger sample comprised of children and teenagers with autism or PDD-NOS who had not been referred previously for aberrant eating behaviors. Similar to the results obtained by Munk and Repp (1994), they observed three response patterns in feeding sessions: food acceptance, food refusal, or selectivity by type or texture. More than half of the participants showed an overall low level of food acceptance. Among those who displayed overselectivity by type, the most commonly accepted foods were starches, while the least commonly accepted foods were vegetables.

A limitation of both Munk and Repp (1994) and Ahearn et al. (2001) is that they used limited samples and did not compare feeding behaviors of children with these particular diagnoses to the feeding behaviors of children without these diagnoses. Additionally, Ahearn et al. cited the artificial feeding environment necessary to exert

experimental control in these studies as a potential limitation, since children with autism often have difficulty in generalizing behaviors between environments and parents sometimes reported their children as accepting foods at home that were not accepted under experimental conditions.

Field et al. (2003) analyzed the case files and medical records of 349 children referred to a feeding program to categorize each participant as having one or more of the following feeding problems: selectivity by type, selectivity by texture, total food refusal, oral motor delays, or dysphagia. In addition, they found correlations between various medical conditions and developmental disabilities and these different types of feeding problems. In their sample, 64% of the participants had diagnoses of developmental disabilities. In a comparison of three subcategories of developmental disabilities, participants with autism displayed much higher food selectivity by type and they were also highly selective by texture, while participants with Down syndrome and cerebral palsy presented more often with oral motor delays, total food refusal, and dysphagia, with a lower prevalence of type and texture selectivity. Their comparison between children with various developmental disabilities adds to the body of research on feeding problems by showing the particular prevalence of food selectivity in children with autism compared to some of their peers.

Schreck, Williams, and Smith (2004) attempted to remedy the dearth of research comparing the feeding behaviors of children with autism to their typically-developing peers. They assessed parental reports of the feeding behaviors of 138 children with autism as compared to 298 typically-developing children. Their statistical analyses revealed that children with autism were reported to refuse more foods overall or to

only accept foods at a low texture as compared to the typical children. Parent reports regarding children with autism also revealed that they consumed a more limited variety of foods across all major food groups as compared to reports regarding typical children. Finally, the children with autism had a tendency to require specific eating utensils or methods of food presentation as compared to the control sample. No difference was found in the variety of foods parents in the households of children with and without autism typically consumed.

Williams et al. (2005) compared caregiver surveys regarding the eating behaviors of children with autism, children with special needs other than autism, and children without special needs who were all referred to an assessment and treatment program for food selectivity. Similar to the findings of Schreck et al. (2004), they found that children with autism were more likely to require specific eating utensils and food presentation methods and had higher sensitivity to textures than the other sample groups. They also noted that children with autism were more likely to gag or vomit when new foods were presented as compared to the other groups. In contrast to the typically developing children, children with autism were more likely to cry during meals and to leave the table early. Children without special needs who had food selectivity were more likely to show signs of anxiety or obsessive-compulsive behaviors than the other groups.

Martins, Young, and Robson (2008) suggested some differences between children with autism and their peers. Their research relied on parent reports of current and past eating behaviors, comparing 195 children with autism, their siblings, and age-matched typically-developing children. All three groups of participants were equally

likely to exhibit ritualistic feeding behaviors such as requiring a specific utensil for eating, only eating in a particular setting, or only eating when fed by a specific person. The participants with autism were reported to have poorer self-feeding skills, higher food avoidance behavior, and higher resistance to trying new foods compared to their siblings and age-matched controls, but the authors noted that the results were widely distributed within each group and the differences were slight, so they hesitated to make decisive conclusions.

The area of feeding-related behaviors in which children with autism most differed from typically-developing peers was in their current likelihood to be exhibiting feeding problems and in the number of problems they were exhibiting simultaneously, though they were similar in their history of eating problems (Martins et al., 2008). The authors suggested that this difference between children with autism and their peers may be due to their resistance to change. While typically-developing children were reported to resist new foods when they were younger, they may have “grown out of” this developmentally typical behavior, while children with autism displayed this rejection of new foods more persistently. They also suggested that it might alleviate parents’ concerns to learn that the eating problems of children with autism may not actually differ markedly from their typical peers.

A number of approaches have been used to treat feeding problems in children with developmental disabilities. Some are purely antecedent- or consequence-based approaches, but more often treatments for feeding problems include the alteration of both antecedent and consequence variables. Particularly when feeding problems are severe enough to warrant hospital stays and medical interventions such as

gastrostomy tubes, researchers often take an aggressive approach to treating the problems, and when possible they may later complete a component analysis of the treatment to determine the relevant variables (e.g., Cooper et al., 1995).

Some of the antecedent-based approaches to treating feeding problems include stimulus shaping, sequential presentation of preferred and non-preferred foods, and the use of a high-probability instructional sequence (e.g., Dawson, Piazza, Sevin, Gulotta, Lerman, & Kelley, 2003; Freeman & Piazza, 1998; Kern & Marder, 1996; Shore, Babbitt, Williams, Coe, & Snyder, 1998). Stimulus shaping may take the form of altering the amount or texture of foods presented, blending preferred and non-preferred foods together, or simultaneously presenting a preferred and non-preferred food in the same bite without blending.

Freeman and Piazza (1998) attempted to increase the amount of food from all food groups consumed by a participant with total food refusal and related medical complications. Initially they presented a small amount of food from one food group, and once 50% of an age-appropriate amount was consumed they started presenting food from an additional food group until that food was consumed at 50% of an age-appropriate level as well. Additional food groups were added into the procedure until the participant was reliably consuming 50% of an age-appropriate amount of food from four food groups.

In texture fading, foods that are non-preferred at a higher texture are initially presented at a lower texture, and contingent on some pre-determined criteria the texture is systematically increased. Shore et al. (1998) examined the effects of presenting foods at gradually increasing textures on the feeding behaviors of four

children receiving treatment for food selectivity. For all participants, food was initially presented at a pureed or junior texture. Once each participant was accepting the recommended volume of food at a low texture, the experimenters increased the texture of the food presented. For two participants, the texture of the food increased steadily (e.g., junior to ground to chopped fine), while for the other two participants the experimenters blended two textures of food together in different ratios to make more gradual changes to the food presented (e.g., 100% pureed to 75% pureed/25% junior to 50% pureed/50% junior, etc.). This treatment was successful in increasing the volume and texture of foods consumed by all four participants to age-appropriate levels and demonstrated the utility of texture fading as a treatment for texture selectivity.

Patel, Piazza, Santana, and Volkert (2002) assessed the effects of texture fading on a participant who displayed selectivity by both type and texture. When the non-preferred food was presented and interspersed with presentations of other foods, consumption of all foods was lower overall. However, when the non-preferred food was excluded, consumption of the other foods was high. When the texture of the non-preferred food was decreased to a pureed form and presented with other foods, consumption of all foods was high. This study demonstrated that although a participant may display multiple topographies of selectivity, it is not always necessary to alter the presentation of all foods.

In treatments that use blending to increase food acceptance, a preferred and a non-preferred food are blended together in gradually changing ratios until non-preferred foods are readily consumed. Patel et al. (2001) used this method to gradually increase

the consumption of a powdered nutritional supplement made with milk for a participant who was previously reliant on a gastrostomy tube for his nutritional needs. The participant readily drank water, so a small percentage of the packet of supplement was initially added to the water. The percentage of the packet blended in was systematically increased once the participant met the criteria for consumption of the previous amount. Once the participant consumed 100% of the packet blended with water, milk was gradually blended in to replace the water. The treatment was successful in increasing the participant's consumption of the supplement made with milk to 100%.

Mueller, Piazza, Patel, Kelley, and Pruett (2004) also used blending to increase the food acceptance of two participants with severe food refusal. In this study, preferred and non-preferred foods were blended together in gradually changing ratios. Once the participants met a predetermined criterion for acceptance of the blend at a given ratio, the experimenters conducted probes of the non-preferred foods alone. Once the non-preferred foods were accepted during these probes, other non-preferred foods were presented to determine if the participant would accept foods not exposed to the blending treatment. If the unexposed foods continued not to be consumed, the blending procedure was completed with additional foods. For both participants, after seven or eight foods were exposed to the blending treatment, consumption of other non-preferred foods that had not been blended increased to near 100%.

Tiger and Hanley (2006) employed similar procedures to Patel et al. (2001) and Mueller et al. (2004) to increase the white milk consumption of a preschool student. In baseline, the student did not consume white milk. When it was paired with

chocolate syrup and blended into chocolate milk, the student regularly consumed an age-appropriate serving size. The amount of chocolate syrup blended into the white milk was gradually faded until the participant was drinking an appropriate quantity of white milk without chocolate. This study replicated the findings of previous studies on blending treatments and demonstrated the ease with which this procedure could be implemented in a typical school setting.

Simultaneous food presentation is similar to blending in that preferred and non-preferred foods are presented together, but unlike blending, they are not mixed together. Instead they are merely presented on the same feeding utensil each in their original form. Ahearn (2003) observed food selectivity by type in one participant, noting that the participant consumed foods from the other food groups but did not consume vegetables, and it was also noted that the participant readily consumed condiments. The experimenter assessed the participant's preference for various condiments and collected baseline data on the consumption of vegetables. Following the baseline phase in which vegetables were rarely consumed, bites were presented in which a highly-preferred condiment was presented on the same spoon as a vegetable. When the preferred and non-preferred foods were presented simultaneously, consumption immediately increased to 100%. When baseline conditions were reinstated, consumption decreased to 0%, and when treatment was reinstated consumption again immediately increased to 100%. This study demonstrated the potential utility of simultaneous presentation in a participant who was mildly selective by food type.

Several studies have evaluated the efficacy of simultaneous versus sequential food presentation. Kern and Marder (1996) used a procedure comparing the effects of simultaneous and sequential presentation of preferred and non-preferred foods on the food selectivity of a boy with pervasive developmental disorder. In the simultaneous presentation condition, the non-preferred and preferred foods were combined into one bite presentation. In sequential presentation, a preferred food was delivered contingent on the acceptance of a non-preferred food. Both simultaneous and sequential presentation methods were highly effective in increasing the acceptance of previously non-preferred foods, but acceptance of the foods exposed to simultaneous presentation increased more rapidly than acceptance of those exposed to sequential presentation.

Piazza et al. (2002) evaluated similar procedures for three children with developmental disabilities. For one participant, simultaneous presentation of preferred and non-preferred foods resulted in an immediate increase in bite acceptance, while sequential presentation was effective but less immediately. For the second participant, sequential presentation was not effective while simultaneous presentation was highly effective. For the third participant, neither presentation method alone was effective, but with the addition of other procedures he eventually showed a moderate to high level of food acceptance.

Piazza et al. (2002) presented several possibilities as to why sequential presentation was less effective than simultaneous presentation. For example, participants cannot contact the reinforcer if non-preferred bite acceptance is near-zero. Additionally, preferred food may not actually function as a reinforcer for bite

acceptance of a non-preferred food. Finally, delayed access to a preferred food may not have competed with the motivation to avoid non-preferred food.

The use of a high-probability (high-p) instructional sequence has been used to increase compliance with low-probability (low-p) requests (Mace et al., 1988). McComas, Wacker, and Cooper (1998) successfully used a high-p instructional sequence to increase a toddler's compliance with low-p requests related to medical treatments. This procedure has been applied to feeding problems as well, though the results have not been as promising. McComas et al. (2000) examined the effects of the high-p instructional sequence on the compliance with the request "take a bite" of one participant with low food intake. His initial compliance with the request was low. When a series of high-p requests preceded the low-p request, his compliance with all requests was high, while compliance in the absence of high-p requests remained low initially. After five sessions, compliance was similarly high in both conditions, limiting the power of the results. Dawson et al. (2003) used the high-probability instructional sequence as well, but it was unsuccessful in increasing their participant's compliance with requests to eat.

Both studies have a number of limitations. In each study, the experimenters only used one participant to examine the effects of the high-p sequence on compliance during feeding (Dawson et al., 2003; McComas et al., 2000). Additionally, both participants had severe food refusal behaviors that were related to organic causes (GI symptoms and short-bowel syndrome), though they were likely further complicated by behavioral symptoms. Further research into this potential treatment is warranted,

perhaps with participants with less severe food selectivity or with less severe medical conditions.

One final consideration is the alteration of antecedent conditions that are related to food, but that involve no direct manipulation of the food. Sharp, Harker, and Jaquess (2010) compared food acceptance and consumption across three food presentation methods, an upright spoon, a flipped spoon, and a Nuk brush. The participant expelled all bites presented on an upright spoon, but had fewer expulsions during the flipped spoon and Nuk brush presentations. It is possible that in addition to the aversive properties of particular foods, some aspect of the feeding situation may function as an aversive stimulus that a child with feeding problems may attempt to escape or avoid.

Some of the consequence-based approaches used to treat challenging feeding behaviors include response cost, negative reinforcement contingencies, positive reinforcement contingencies, and various escape extinction procedures (e.g., Ahearn, Kerwin, Eicher, Shantz, & Swearingin, 1996; Cooper et al., 1995; Kahng, Boscoe, & Byrne, 2003; Kahng, Tarbox, & Wilke, 2001).

Kahng et al. (2001) used response cost and differential reinforcement of bite acceptance to treat the food refusal of a child with mental retardation. In this study, highly preferred toys were accessible during feeding sessions, but were removed contingent on non-acceptance or problem behaviors during food presentations. The toys could be earned back contingent on bite acceptance. The treatment was successful in increasing his bite acceptance, decreasing his challenging mealtime behaviors, and his family members were successfully trained in implementing the

procedure as well. The authors theorized that the removal of highly preferred items functioned to decrease problem behavior and increase acceptance in two ways. First, the removal of toys contingent on problem behavior may have functioned as Type II punishment, in which the removal of a stimulus following problem behavior decreased the future occurrence of that behavior. Second, the removal of toys following non-acceptance functioned to increase future acceptance to avoid the aversive state created by the removal of the item.

Kahng et al. (2003) explored the use of a negative reinforcement contingency as treatment for a participant with severe food refusal. In two baseline conditions, the therapist delivered praise contingent on acceptance and either escape or non-removal of the spoon contingent on refusal. The participant continued to refuse all food. In the next phase, the therapist delivered praise for acceptance and physical guidance contingent on either nonacceptance or refusal behaviors. The participant's food acceptance did not improve. Finally, the experimenters implemented a differential negative reinforcement of alternative behavior contingency in which tokens were earned for bite acceptance, and the acquisition and exchange of a pre-determined number of tokens resulted in termination of the feeding session. They were able to steadily increase the participant's food acceptance to 15 bites per meal, and once her acceptance of the initial food met the terminal criterion, other foods were exposed to the procedure with similar success.

The majority of treatments for food selectivity and refusal include some form of escape extinction. In the literature, escape extinction of food refusal is typically implemented in one of three ways: non-removal of the feeding utensil, physical

guidance, or re-presentation of expelled foods until they are accepted and consumed (Ahearn et al., 1996; Cooper et al., 1995).

Cooper et al. (1995) implemented treatments successfully for four participants with feeding problems, and then completed a component analysis of each program to determine the active variables responsible for the improved feeding behaviors of each participant. For all four participants, escape extinction in the form of non-removal of the spoon was found to be an essential part of successful treatment.

Ahearn et al. (1996) compared the effectiveness of non-removal of the spoon versus physical guidance as escape extinction procedures to be used with three children hospitalized for food refusal. In baseline, differential positive reinforcement of food acceptance was implemented, and all three participants accepted little to no food. In treatment, both non-removal and physical guidance procedures were similarly effective in increasing food acceptance, though one participant continued to expel food following most acceptances. Parents reported that they preferred to implement the physical guidance procedure.

Dawson et al. (2003) used the high-probability instructional sequence with or without escape extinction, and found that escape extinction was a necessary part of the treatment package in decreasing food refusal. In this study, non-removal of the spoon was used to prevent escape.

Patel, Piazza, Martinez, Volkert, and Santana (2002) explored the use of differentially reinforcing food acceptance versus food consumption with or without the use of escape extinction. When escape extinction was used, the therapists implemented non-removal of the spoon as well as re-presentation of food until it was

accepted. Independent of the reinforcement contingency that was in place, food acceptance increased when escape extinction was part of the treatment package.

Piazza, Patel, Gulotta, Sevin, and Layer (2003) also combined escape extinction procedures with other procedures to treat severe food refusal. When they completed a component analysis of the treatment packages they implemented for their four participants, the inclusion of escape extinction was a necessary part of treatment for each of the four, though for some participants other components were important variables as well. For two participants, non-removal of the spoon was used as an escape extinction procedure, while for the other two, physical guidance was implemented.

Positive reinforcement has been explored as a component of treatment for feeding problems, though results have been mixed. In their behavioral economic analysis of feeding problems, Kerwin, Ahearn, Eicher, and Burd (1995) discussed how the use of other procedures, such as escape extinction and negative reinforcement contingencies, could be useful in bringing a child with feeding problems in contact with positive reinforcement contingencies. Positive reinforcement may not initially be successful in changing a child's eating behaviors, but it may be helpful long-term in maintaining these behaviors.

In the component analysis completed by Cooper et al. (1995) following successful treatment, the authors found that for one participant, delivery of toys contingent on food acceptance was also partially responsible for his increased food intake, while praise contingent on food acceptance did not appear to be an important variable.

Levin and Carr (2001) explored the effects of motivating operations on the food selectivity of children with developmental disabilities whose problem behavior was maintained by negative reinforcement. They found that their participants' consumption of non-preferred food items only increased once the children were deprived of preferred foods prior to experimental sessions as well as received preferred foods contingent on acceptance during sessions (i.e., the Premack principle). There were no programmed consequences for food refusal during any condition of this study. This study successfully used both antecedent- and consequence-based interventions to increase food acceptance and demonstrated that when motivating operations were altered, particularly the establishing operation of deprivation, positive reinforcement could be an important component of treating food selectivity.

Piazza, Patel, et al. (2003) also explored the contribution of positive reinforcement to successful treatment of feeding problems. In baseline, positive reinforcement in the form of attention and toys was delivered, which did not increase food consumption. They found that while escape extinction was a necessary and sufficient procedure for increasing their participants' food consumption, the addition of positive reinforcement to the treatment package was associated with a decrease in negative vocalizations.

Kahng et al. (2003) used praise contingent on refusal or nonacceptance as a potential reinforcer in their study, and food acceptance did not increase. Contrary to other research, the addition of physical guidance was also unsuccessful. Ultimately,

differential negative reinforcement was the successful component in increasing their participant's food acceptance.

Though contingent delivery of praise or preferred items has not been shown to be a successful treatment option on its own, it is a relatively simple component of a treatment package to implement. Since positive reinforcement is often the first procedure we turn to as behavior analysts when trying to alter a behavior, combining it with other procedures may help decrease the overall aversiveness of the feeding situation, both for the feeder and the eater.

One way that we may conceptualize selective eating in children with autism is to view non-preferred foods as aversive stimuli. If we look at a difficult feeding situation as containing a negative reinforcement contingency, when non-preferred foods are presented and the child successfully avoids or attenuates the aversiveness of the food, the future probability of these avoidance behaviors increases.

Alternatively, we can look at this as a Type I punishment process. If the child has previously opened his mouth to accept foods but then an aversive stimulus is delivered, the future probability of food acceptance may decrease.

According to the literature on punishment, some of the major factors influencing the strength of an aversive stimulus to suppress behavior or to increase avoidance behavior are the intensity of the aversive, the schedule according to which the aversive is applied, and the discriminability of the aversive (Azrin & Holz, 1966; Lerman & Vorndran, 2002). These authors also discuss some of the potentially undesirable effects of the delivery of aversive stimuli. Their use may produce disruptive emotional states, behavioral contrast in which the suppression of one

problem behavior may result in the increase of another problem behavior, or an increase in escape and avoidance behaviors such as aggression. Additionally, the use of escape extinction procedures may initially lead to an extinction burst, in which a behavior intended for suppression initially increases beyond baseline levels before decreasing (e.g., Goh & Iwata, 1994).

Though methods involving presenting the aversive stimulus (a non-preferred food) and altering the consequences for non-acceptance have been effective in increasing food acceptance, prior to using potentially aversive presentation methods, it is important to attempt to alter food acceptance using less aversive procedures for ethical and behavioral reasons.

To increase the acceptance of a non-preferred food, we can try to decrease its aversiveness by making it less discriminable from preferred foods, delivering it infrequently relative to preferred foods, and using smaller amounts and lower textures to decrease the intensity. For example, rather than delivering large pieces of a non-preferred food that looks, tastes, and feels very different from preferred foods on a continuous schedule, we can deliver a small piece of a non-preferred food that is similar in appearance, taste, or texture to preferred foods occasionally while delivering preferred foods frequently.

In the present study, the use of non-aversive procedures such as texture fading, blending, positive reinforcement, and sequential presentation of preferred and non-preferred foods were used. In addition, food presentations were programmed to maximize the likelihood that errorless learning of an acceptance response will be

acquired, while non-acceptance will be viewed as an error in the instructional sequence (Touchette & Howard, 1985).

Selective eating, particularly when whole food groups are excluded from a child's feeding repertoire, can lead to poor nutrition and potentially a host of related physical problems. Therefore, the purpose of this study was to increase the variety of foods consumed by a child with autism who exhibited both type and texture selectivity using non-aversive procedures.

Method

Participant and Setting

The participant was Faris, a 4-year-old boy diagnosed as on the autistic spectrum. With the support of a behavior therapist, he attended a general education classroom full-time. Faris was a self-feeder who exhibited type and texture selectivity according to anecdotal reports from his family and teachers.

Prior to this study, teachers used tangible and social reinforcement to attempt to increase both the quantity and variety of foods consumed. When this study began, Faris was regularly eating meals at school that included white bread with cheese, plain crackers, fried foods, and fruit juice, but despite regularly being presented with a selection of fruits and vegetables, he did not consume these foods during school meals.

All sessions were completed in Faris's regular classroom at a table that was visually separate from where the other students were eating. Sessions took place in the classroom at the beginning of the regularly scheduled snack and lunch times at

approximately 9:30 a.m. and 12:15 p.m., with one to two sessions per day, three to four days per week.

Materials

The materials used were a table, two chairs, a video camera, a timer, unmarked containers of food, small spoons, a data sheet, and a pen. During self-feeding probes a plastic plate was used as well. The food containers were kept out of sight of the student throughout the sessions. There were also regular educational materials present in the environment, but out of the student's reach.

In baseline sessions four foods which were a variety of colors and textures, were used. These foods were categorized according to five food groups: grains, proteins, dairy, fruits, and vegetables. They were chosen based on what Faris regularly brought to school for meals and what his family expressed interest in adding to his diet. In treatment sessions, terminal texture probes, and maintenance sessions, three food items were used. In self-feeding probes one previously non-preferred food was used.

Dependent Variables

The behaviors measured were acceptance, refusal, expulsion, and negative verbalization. The occurrence or non-occurrence of each behavior was recorded for each bite presentation.

For all sessions apart from self-feeding probes, acceptance was defined as the participant opening his mouth and allowing placement of food in the mouth within 5 s of the initial spoon presentation, and if this did not occur a refusal was recorded. In self-feeding probes, acceptance was defined as the participant picking up the spoonful

of food within 5 s of the initial directive “Take a bite” and depositing food in the mouth within 5 s of picking up the spoon. If either of these did not occur within the time limit, a refusal was recorded. Expulsion was defined as the appearance of food past the border of the lips at any time after an acceptance of food (including spitting food out or allowing food to fall from the mouth). Negative verbalization was defined as the participant making one or more negative statements occurring during the presentation of food, including statements in English or Arabic such as “No” or “No thanks.” Verbalizations occurring at any other time were ignored and not recorded.

Response Measurement and IOA

Throughout each session, the experimenter recorded data by hand on acceptance, refusal, expulsion, and negative verbalization. Percent acceptance for each food was calculated by dividing the number of acceptances by the total number of presentations of that food. Percent expulsion, refusal, and negative verbalization were calculated using the same method. In baseline, these percentages were calculated across both sessions in which each food was presented. In treatment, these percentages were calculated for each session.

Interobserver agreement (IOA) data on acceptance, refusal, expulsion, and negative verbalization were collected in 33.3% of all sessions. The experimenter functioned as the primary observer, and a second trained observer watched videos of sessions to collect IOA data. IOA was scored for each behavior by dividing the total number of agreements per session by the number of agreements plus disagreements and multiplying by 100%. The mean IOA scores for acceptance, refusal, expulsion,

and negative verbalization across all sessions were 100%, 100%, 100%, and 95.2% (range, 80% to 100%) respectively.

Procedures

Baseline. In the baseline phase, 44 foods and beverages from the five major food groups were presented that included a variety of tastes and textures. For example, in the fruit and vegetable food groups, raw and canned solid foods, baby foods, and juices were presented. In each baseline session, four foods were presented in quasi-random order five times each, for a total of 20 bites per session. Each food item was presented 10 times total across two sessions.

At the beginning of each trial, a small piece of solid food (e.g., a piece of cracker or fruit) on a spoon or a level spoonful of lower textured food (e.g., yogurt or juice) was presented approximately 2.5 cm from the participant's mouth for 5 s. If the participant opened his mouth within 5 s, the item was delivered into the participant's mouth and the experimenter gave verbal praise for bite acceptance. If the participant did not open his mouth within 5 s, the spoon was removed and there were no other programmed consequences. Approximately 3 months prior to the initiation of this study, a reinforcer assessment was completed for Faris and verbal praise was shown to function as a reinforcer for a free operant response (hand raising).

Attempts to move away from the spoon, push the spoon away, and negative verbalizations were all ignored. The experimenter tried to keep the spoon approximately 2.5 cm from the participant's mouth for the full 5 s. Regardless of acceptance, rejection, expulsion, or negative verbalizations, there was a 25 s inter-trial interval.

Foods that were accepted in 90% or greater of the opportunities in which they were presented were categorized as preferred (P) foods, while those accepted in less than 50% of opportunities were categorized as non-preferred (NP) foods.

Treatment. In the treatment phase, NP foods were used that were also available in two types of preferred-food form. In baseline, peach, pineapple, mango, and banana were all identified as NP foods, but yogurts and juices of those flavors were identified as P foods. Therefore, in each food set containing one NP and two P foods, there was the fruit itself as well as juice and smooth yogurt.

For treatment, probe, and maintenance sessions, the inter-trial interval was decreased to the amount of time it took the experimenter to prepare the next bite of food. The two P and one NP foods were presented in quasi-random order throughout each session, the NP food was never presented first or last in a session, and no more than two bites of the NP food were presented consecutively.

In Level 1, the NP food was presented at a mashed texture blended 50/50 with yogurt of the same flavor, and the ratio of bites presented of the NP blend to the two P foods, juice and yogurt, was low. At Step 1, 10% of the bites presented were the NP food blended with yogurt and 90% of the bites presented were the P foods. In subsequent steps the ratio gradually increased until 50% of the bites presented were the NP food blended with yogurt (see Table 1 for feeding program).

Following two consecutive sessions in which the NP bites were accepted in at least 80% of presentations, the ratio of NP to P foods increased. Following two consecutive sessions in which the NP bites were accepted in less than 50% of

presentations, the ratio of NP to P foods decreased to the previous step or remained at Step 1.

The terminal goal for each level was for 50% of the bites, or 10 out of the 20 bites, to be the NP blend or food. Once 50% of the 20 bites presented in each session were the NP blend or food and they were accepted in at least 80% of presentations for two consecutive sessions, the feeding program moved up a level.

In Level 2, the NP food was still presented at a mashed texture, but was blended 75/25 with yogurt. Due to the high percentage of acceptance in Level 1, in Level 2 feeding sessions began at Step 3, with 20% of bites presented as the NP food. When the second two NP foods were introduced, feeding sessions began at Level 1, Step 3.

Terminal texture probes. Following the successful completion of Level 2, two probe sessions per food set were conducted that were structured the same as the final step of each level, with 50% of bite presentations as the NP food. However, rather than presenting the NP food at a low texture blended with a P food, the terminal texture was presented, which was a solid bite-sized piece of fruit. Once probe sessions were successfully completed for the first two foods, two additional foods were probed, and when they were not accepted at the terminal texture, treatment began.

Maintenance. Once the participant accepted the NP foods at the terminal texture in at least 80% of bite presentations, maintenance sessions were completed one to two times per week that were structured the same as the terminal texture probe sessions.

Self-feeding probes. Self-feeding probes were conducted for each food to determine if the participant would pick up a spoon containing one of the four

previously NP foods, deposit it in his mouth, and consume the bite. In each self-feeding session, 10 bites were presented consecutively and were not interspersed with other foods.

At the beginning of each session, the experimenter placed a plate on the table directly in front of the participant. The experimenter then placed a solid bite-sized piece of fruit on a spoon, set it on the plate, and gave the directive “Take a bite.” If the participant picked up the spoon within 5 s of the directive and deposited the food in his mouth within 5 s of picking up the spoon, the experimenter gave verbal praise for bite acceptance. If the participant did not pick up the spoon or put the food in his mouth within the time limit, the spoon was removed and there were no other programmed consequences. The next bite was prepared and presented in the same manner until 10 bites had been presented.

Results

The results show that Faris demonstrated type and texture selectivity in baseline, but when NP foods were exposed to the experimental procedures, acceptance of those previously NP foods increased rapidly. These results were initially obtained with two foods then replicated with two additional foods. Expulsions did not occur during baseline or treatment, so data for that behavior are not included in the results.

Hereafter, the term “consumption” will replace the use of the word “acceptance.”

Baseline. Table 2 shows a summary of the results from baseline sessions. In the grain food group, Faris consumed all flavors of crackers as well as some other foods for at least 90% of bites presented. In the proteins food group, Faris consumed both foods for at least 90% of bites presented. In the dairy food group, Faris consumed all

flavors of yogurt and milk for at least 90% of bites presented, but did not accept string cheese. In the fruit food group, Faris consumed all flavors of juice in at least 90% of presentations, but did not accept any baby foods or solid fruits. In the vegetable food group, Faris only consumed fried potatoes, and did not accept any baby foods or solid vegetables. When the data within the fruit food group is examined, Faris demonstrated texture selectivity in that he accepted some flavors at one texture but not at another (e.g., he consumed apple juice but not apple baby food or raw apple).

Figure 1 shows the baseline results sorted by food group as well as the occurrence of negative verbalization following bite presentations. (Note that the number of foods presented varied across food groups, so the data are represented as the percentage of total bites consumed for each food group.) Negative verbalizations accompanied most bite rejections; additionally, negative verbalizations were high for the food groups in which consumption was low. Faris consumed greater than 80% of bites presented for all proteins and dairy, but less than 50% of the bites for all fruits and vegetables, thus showing food type selectivity.

Because of the low percentage of acceptance at multiple textures, fruits were chosen as the first food group to target. Additional considerations included the availability of two P foods that would be similar in taste to the NP food, and the ease with which fruits can be mashed and blended to appear similar to a P food.

Treatment and terminal texture probes. Figures 2-5 show the results from treatment, maintenance, and probe sessions with four fruits that were originally non-preferred. Faris did not engage in negative verbalization or expulsion during

treatment, probe, or maintenance sessions, so those data are not included in the figures.

Peach (see Figure 2) and pineapple (see Figure 3) were selected to be the first two NP fruits to be exposed to the treatment. Neither fruit was consumed in baseline, but juice and yogurt of those flavors was consumed in at least 90% of presentations.

In Level 1 for the peach and pineapple sets, the participant consumed 100% of bites of the P foods (yogurt and juice) and the NP foods (mashed fruit blended 50/50 with yogurt) in all ratios. Due to the high level of bite consumption in Level 1, Level 2 began at Step 3 to determine if the feeding program could be successfully implemented in fewer sessions.

In Level 2 for the peach and pineapple sets, the participant accepted 100% of bites of the P foods and the NP food in all ratios. Therefore, probe sessions were conducted using the terminal texture, solid fruits, and the terminal ratio, 50% NP to 50% P bites. In the probe sessions for peach and pineapple, all bites of the P foods and the NP solid fruits were accepted.

Once consumption of peach and pineapple was successfully established, two additional fruits were probed to determine if Faris's consumption of other previously NP fruits had increased. Banana (see Figure 4) and mango (see Figure 5) were exposed to probe sessions using the terminal texture and ratio. In the first banana probe session, 100% of bites were consumed, but in the second probe session, 0% of bites were consumed. In both mango probe sessions, 0% of bites were consumed.

Banana and mango were chosen as the second two fruits to be exposed to the feeding program. Due to the rapid success with the first set of fruits, treatment of

banana and mango began at Step 3 in both levels. The results from peach and pineapple treatment were replicated in the data for the banana and mango sets.

In Levels 1 and 2 for the banana and mango sets, the participant accepted 100% bites of the P foods and the NP foods in all ratios. When probe sessions were conducted, all bites of the P foods and NP solid fruits were accepted. Acquisition of banana and mango occurred in four fewer sessions than for peach and pineapple.

Maintenance. Maintenance sessions that were identical to the probe conditions were conducted one to two times per week. For all four sets of foods, Faris continued to consume 100% of the bites presented of the solid fruits as well as the yogurts and juices of the same flavor.

Self-feeding probes. Two self-feeding probe sessions were conducted per fruit. For all four fruits, Faris independently picked up the spoonful of food and consumed it in 100% of opportunities (i.e., he fed himself 10 consecutive bites of the solid fruit in each self-feeding probe).

Discussion

This procedure, designed to decrease the aversiveness of non-preferred foods, increased a selective eater's total food consumption and variety of non-preferred foods he ate. Texture fading, blending, positive reinforcement, and sequential presentation of preferred and non-preferred items were all simultaneously applied to foods that the participant did not accept in baseline sessions. Following successful treatment for two non-preferred fruits, two more fruits were exposed to the treatment, replicating the results obtained from the first set of fruits. Probes were also

conducted to determine if the participant would feed these fruits to himself without additional training, and he independently consumed all four fruits.

The results of this study confirm the utility of assessing a child's food selectivity and choosing treatment procedures according to the type of selectivity displayed (Munk & Repp, 1994). Similar to the results obtained in previous studies, altering the non-preferred food's texture, blending it with a preferred food, and interspersing it with other preferred foods was a successful treatment package (Kern & Marder, 1996; Mueller et al., 2004; Patel, Piazza, Santana, et al., 2002). Additionally, providing positive reinforcement for food consumption in the form of verbal praise may have contributed, though past research has shown little support for positive reinforcement as a major contributor to increasing food consumption (Piazza, Patel, et al., 2003). Although the participant was physically separate from his classmates for the duration of the feeding sessions, the procedure was relatively simple to implement in a general education environment and the participant did not engage in any disruptive behaviors that would be stigmatizing once returned to his peer group.

Unlike many treatments for feeding problems, this study did not include an escape extinction component, refuting many studies suggesting that escape extinction is a necessary part of treating feeding problems (e.g., Cooper et al., 1995). Escape extinction in any form, including non-removal of the eating utensil, physical guidance, or re-presentation of expelled foods, is more intrusive than procedures that just alter the antecedent conditions, and as behavior analysts we typically try to use the least intrusive procedures that are still effective in changing behaviors. Though escape extinction may have produced more rapid behavior change with this

participant, his food selectivity was not significantly impairing his health and therefore it was preferable not to use a potentially aversive procedure.

Additionally, when aversive control techniques are used the consequences are altered but not the actual aversive properties of the stimulus, making these techniques difficult to fade out and therefore potentially undesirable. The procedures used in the present study were successful not only in increasing the participant's food acceptance, but also in increasing his responsiveness toward previously aversive stimuli. The positive results obtained in the self-feeding probes demonstrated that the previously non-preferred foods no longer functioned as aversive stimuli, even once they were returned to their full texture.

There are some limitations to the present study. There was only one participant, which limits the generality of these findings to other participants. Faris did not display severe food refusal, but selectivity based on type and texture. His food repertoire included many foods that could easily be blended or altered in some way to shape food acceptance. Additionally, only four foods were exposed to the procedure and they were all fruits. It is possible that the same success would not be observed with other previously non-preferred foods of vastly different textures. However, it was anecdotally noted by both Faris's teachers and his family that his willingness to try new foods and to consume a variety of fruits and vegetables increased during the course of this study.

Another limitation of this study is that food preparation and the procedure itself were time-intensive. The second two foods, mango and banana, were each acquired in four fewer sessions than the first two foods, peach and pineapple, so perhaps in the

future participants who are showing similarly high acceptance could start at a higher step, increase a step after each successful session rather than after every two sessions, or complete probe sessions earlier in the procedure.

Future research could evaluate the utility of these procedures with a more highly-selective participant and with a larger group of participants. This study demonstrated that non-aversive procedures alone may be sufficient to increase food acceptance, but for participants with more difficult feeding challenges, escape extinction-type procedures may continue to prove more efficient and effective. Additionally, more foods could be probed with the current participant to determine if there is a threshold at which he might start accepting more previously non-preferred foods once enough foods have been exposed to the treatment procedures. The efficiency of the procedure could potentially be improved upon as well, particularly with a participant who is showing high acceptance once the non-preferred foods are exposed to the early steps of treatment. Finally, a component analysis might be completed to determine which parts of treatment were instrumental in increasing food acceptance and which parts might be eliminated to simplify the procedures. For example, it is possible that fading the texture of the fruit alone would have been sufficient without also blending it with yogurt.

Children with developmental disabilities often show some type of feeding problems, and there are many strategies to identify the functions and appropriate treatments for these problems. The current study specifically evaluated the use of non-aversive procedures to increase the acceptance of foods in a participant who demonstrated type and texture selectivity in his mealtime behaviors. Due to the

mixed results of previous studies, it is important for research to continue in this area to determine effective and efficient methods to improve the mealtime behavior of children with feeding problems.

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Table 1

Feeding Program

Level	NP blend/fruit	Step	Ratio NP to P bites
1	Mashed fruit and yogurt blended 50/50	1*	10/90
		2	15/85
		3 ^Δ	20/80
		4	30/70
		5	40/60
		6	50/50
2	Mashed fruit and yogurt blended 75/25	3	20/80
		4	30/70
		5	40/60
		6	50/50
Terminal texture probes	Solid fruit		50/50
Self-feeding probes	Solid fruit		100/0

*Peach and pineapple food sets began treatment at Level 1 Step 1

^ΔMango and banana food sets began treatment at Level 1 Step 3

Table 2

Preferred and Non-Preferred Foods in Baseline

<u>Grains</u>	<u>Proteins</u>	<u>Dairy</u>	<u>Fruits</u>	<u>Vegetables</u>
<u>Crackers</u>	<u>Other</u>	<u>Yogurts</u>	<u>Baby foods</u>	<u>Baby foods</u>
animal*	chicken	apricot*	apple ^Δ	mix vegetable ^Δ
garlic*	nuggets*	mango*	mix fruit ^Δ	potato ^Δ
onion & chive*	fish sticks*	peach*	pear ^Δ	<u>Vegetables</u>
plain*		pineapple*	<u>Fruits</u>	carrot ^Δ
<u>Other</u>		plain*	apple ^Δ	corn ^Δ
banana muffin*		rhubarb*	banana ^Δ	cucumber ^Δ
plain bread*		strawberry*	peach ^Δ	<u>Other</u>
oatmeal ^Δ		<u>Milks</u>	pineapple ^Δ	fried potato*
pretzel ^Δ		banana*	purple grape ^Δ	
plain pasta ^Δ		chocolate*	<u>Juices</u>	
		strawberry*	apple*	
		white*	banana*	
		<u>Other</u>	grape*	
		string cheese ^Δ	mango*	
			mixed fruit*	
			peach*	
			pineapple*	

*Preferred food (accepted in at least 90% of opportunities)

^ΔNon-preferred food (accepted in less than 50% of opportunities)

Figure Captions

Figure 1. Baseline results (acceptance and negative verbalization) by food group.

Figure 2. Feeding program treatment results for NP1 (peach).

Figure 3. Feeding program treatment results for NP2 (pineapple).

Figure 4. Feeding program treatment results for NP3 (banana).

Figure 5. Feeding program treatment results for NP4 (mango).

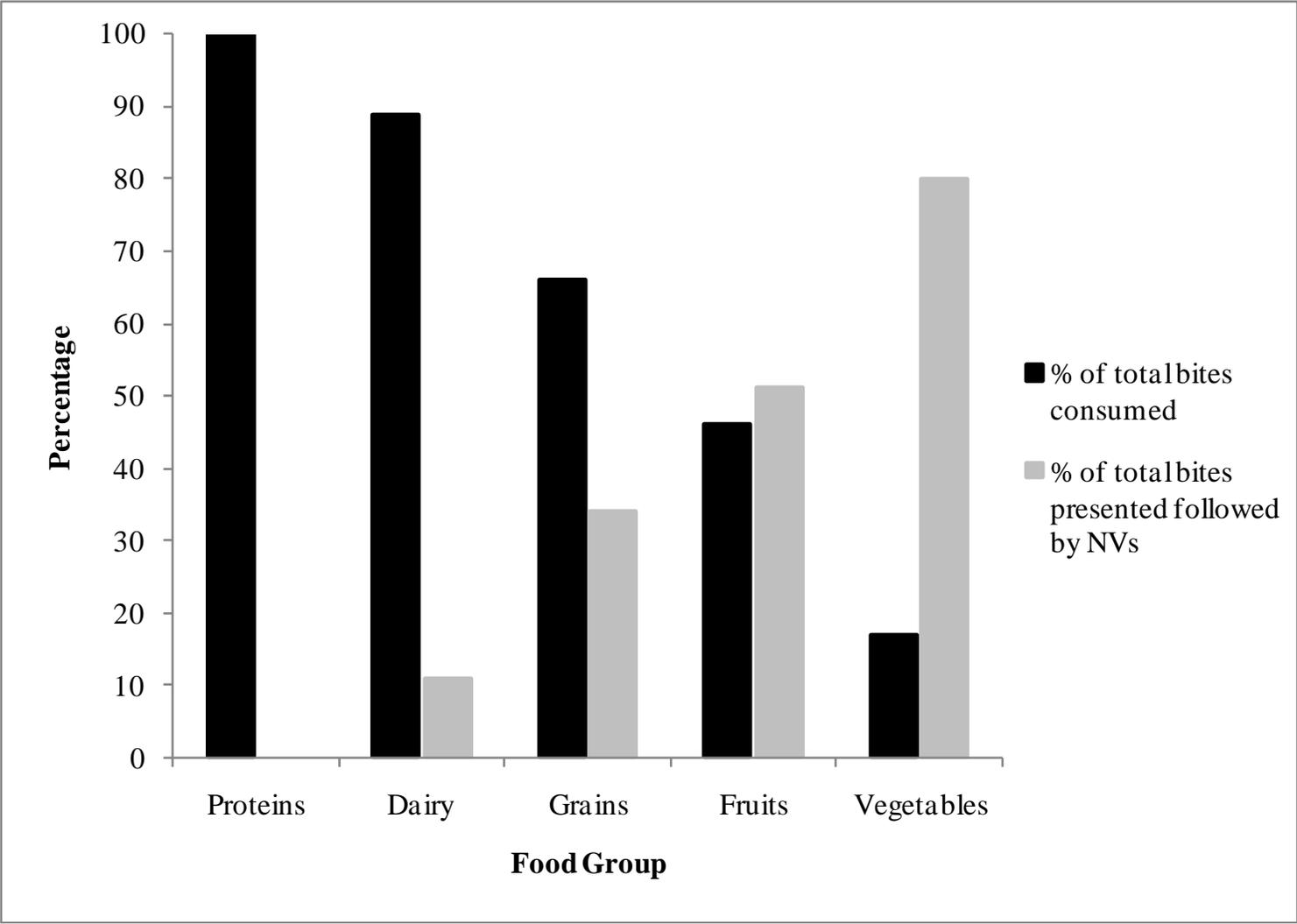


Figure 1

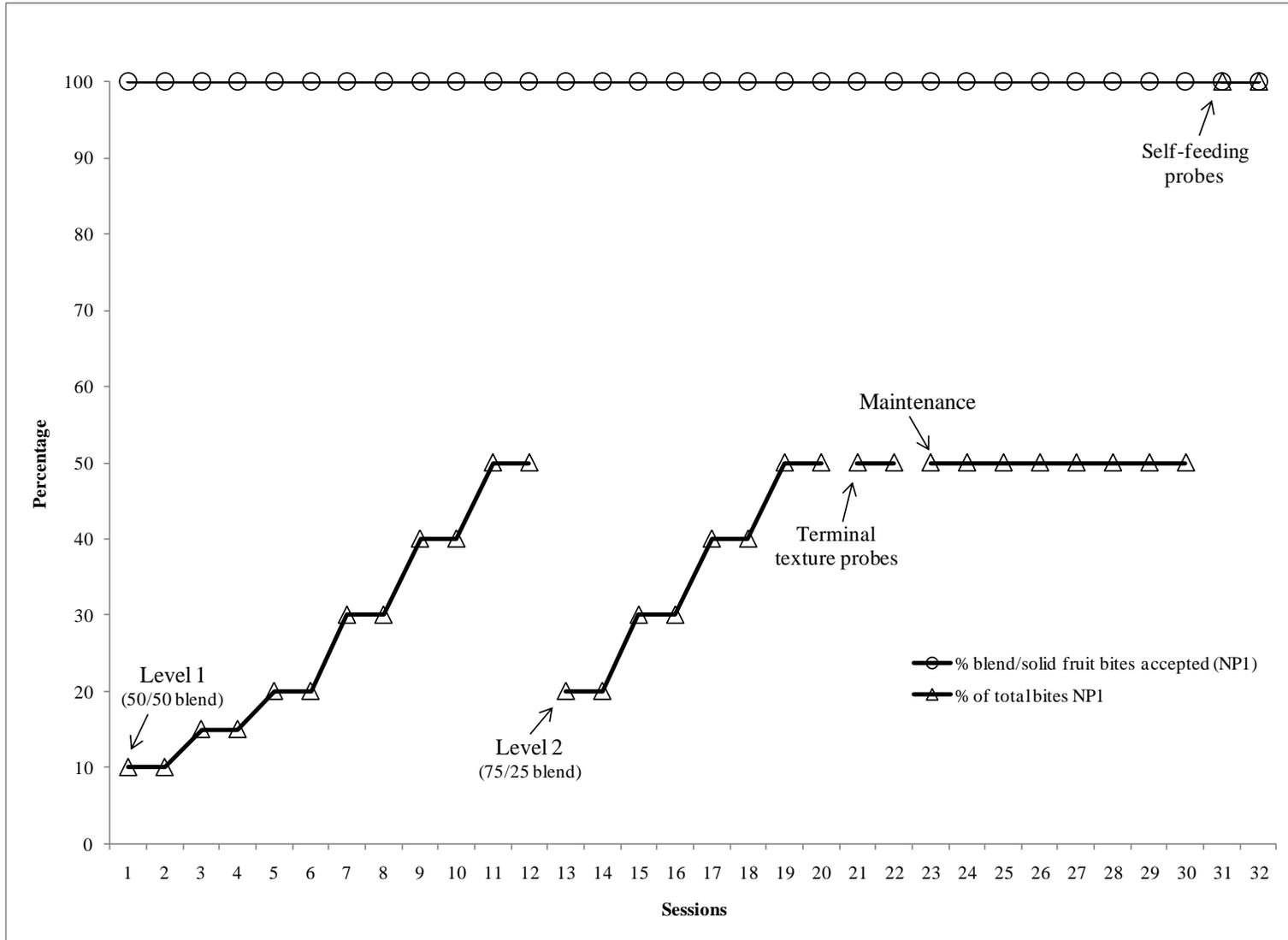


Figure 2

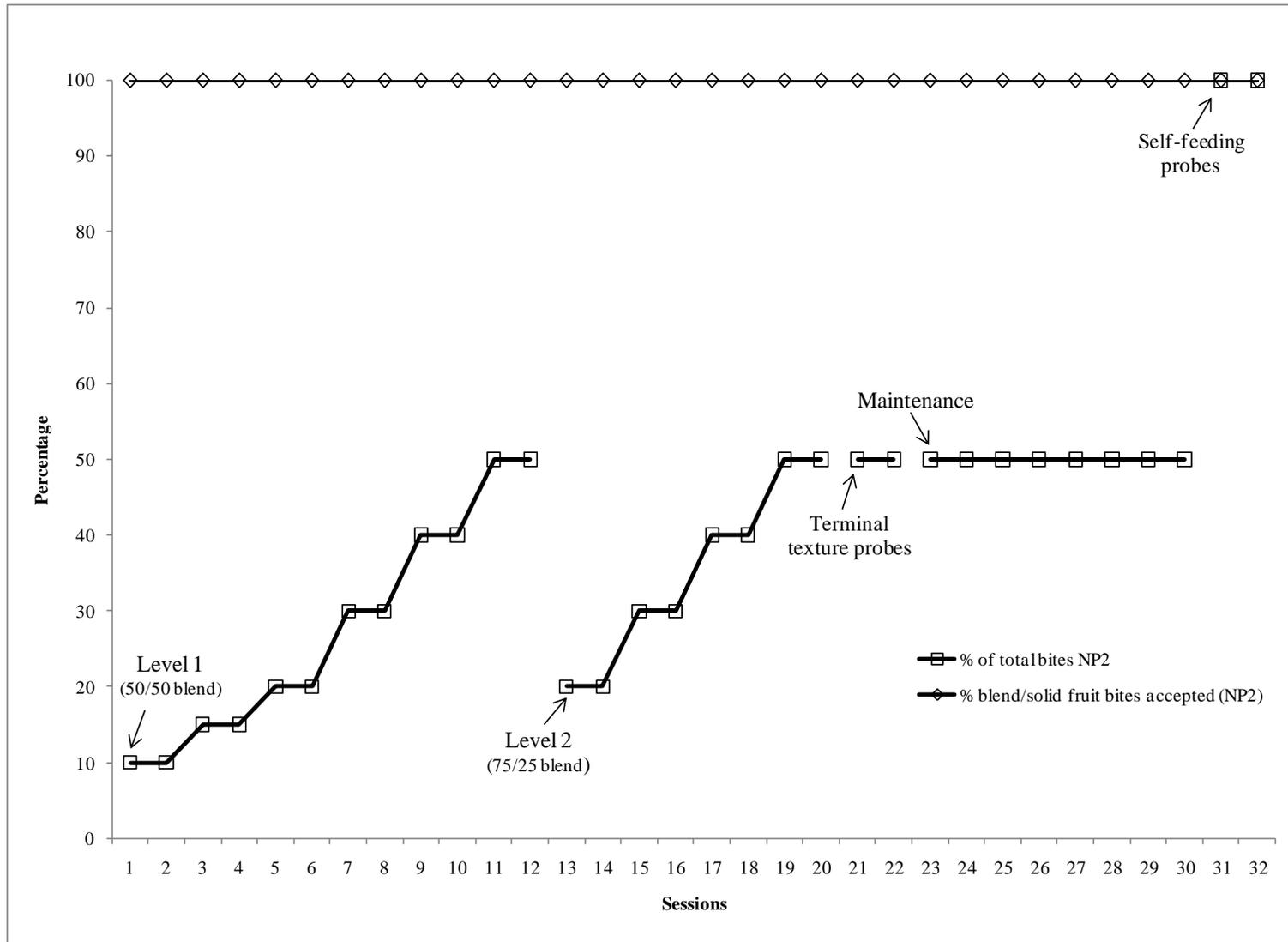


Figure 3

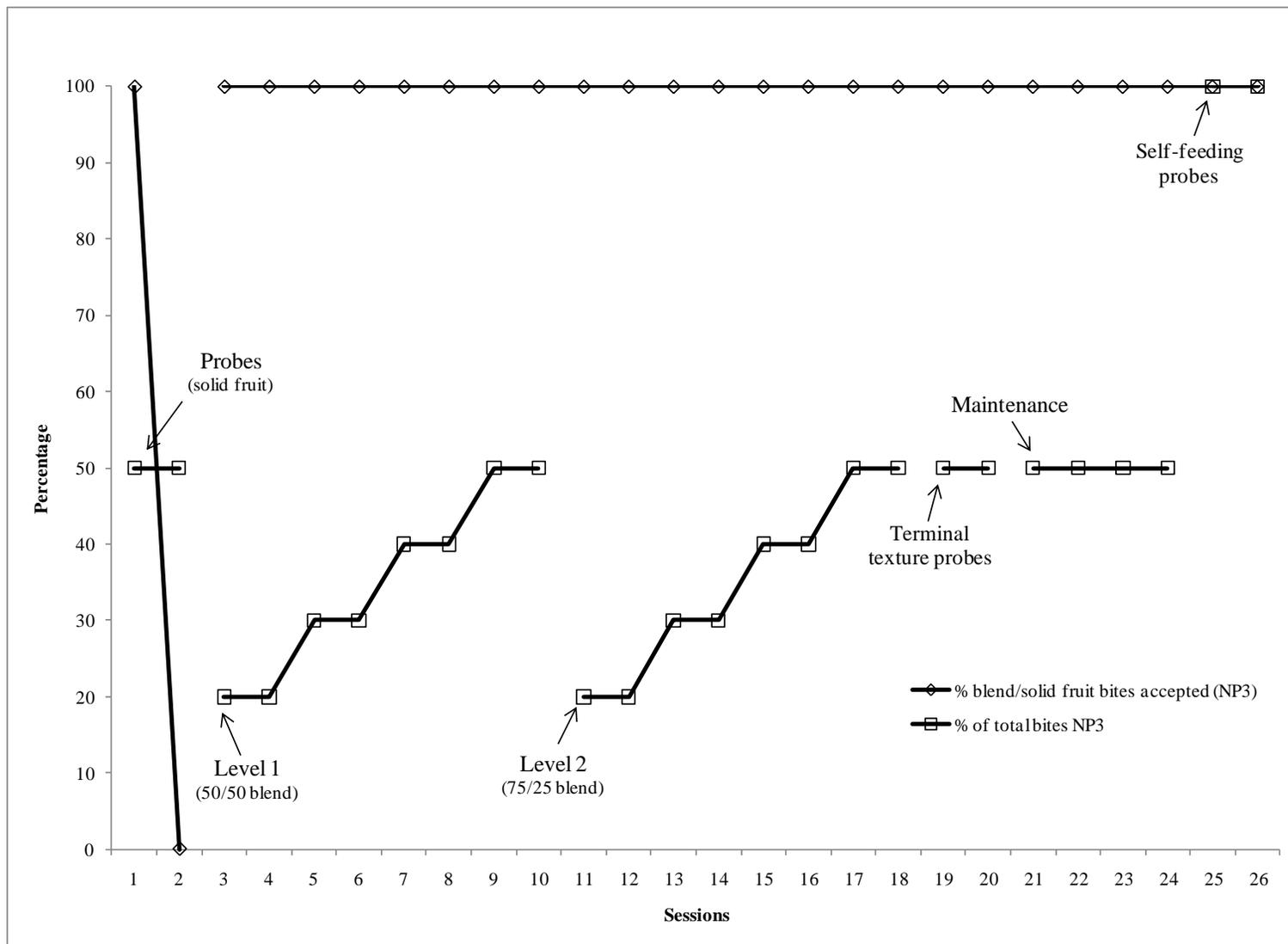


Figure 4

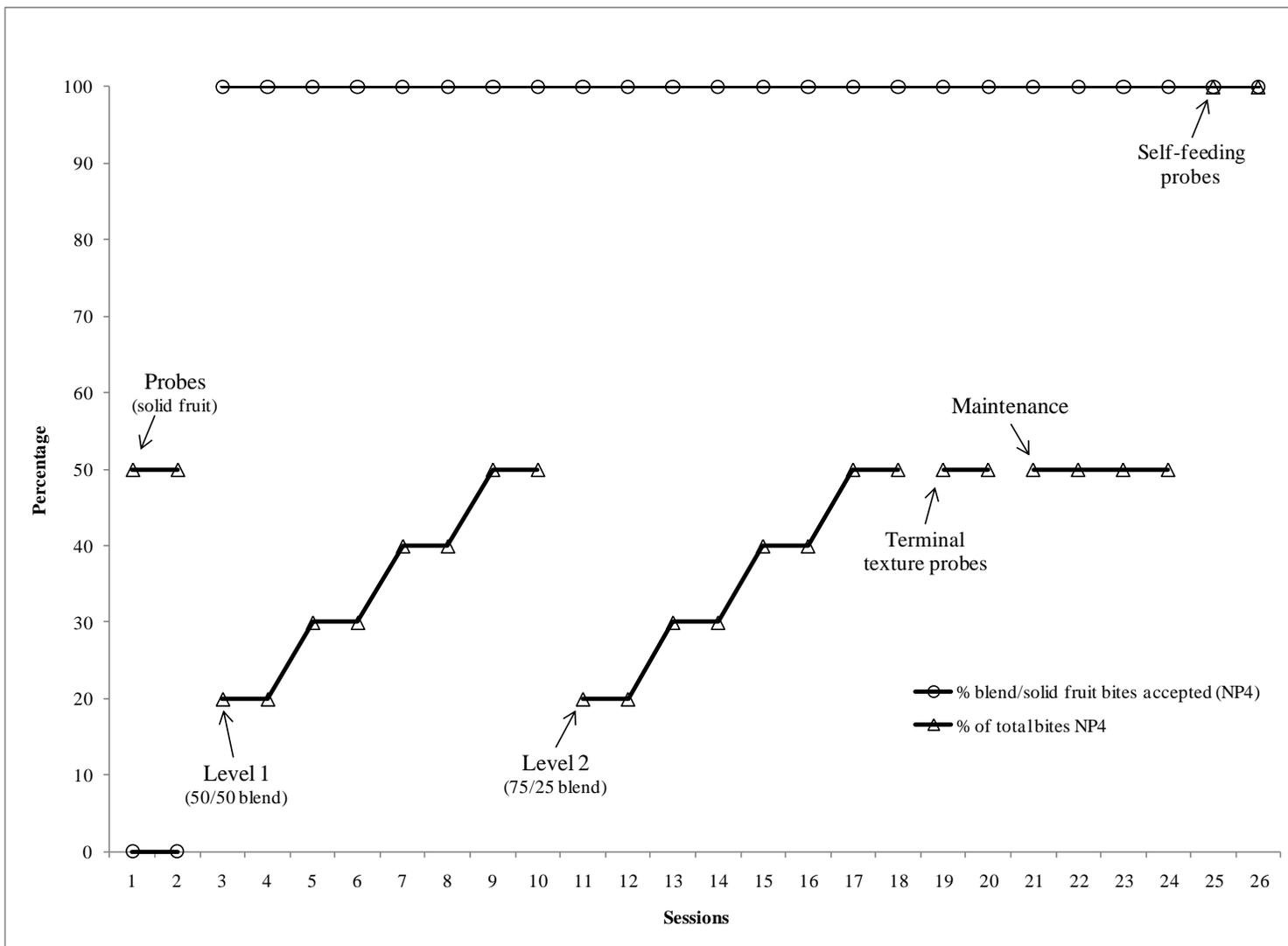


Figure 5