

The Effectiveness of Antecedents, Control, and Differential Reinforcement of Incompatible Behavior in Treating a Childhood Eating Disorder

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Abstract– Many studies have indicated that behavior modification is effective in treating eating problems in children. However, only a few of these studies have focused on the implementation of a behavior modification approach in treating selective eating and food neophobia disorder in toddlers. The purpose of this study is to evaluate the effectiveness of antecedent control procedures and differential reinforcement of incompatible behavior in treating a toddler with selective eating and food neophobia disorder. This is a single case design study with multiple baselines across three mealtime situations. The intervention consisted of 40 sessions with pre- and post-tests to compare and measure the child's progress. The results showed that the child was able to increase her meat consumption 25% from 100 g to 125 g per day. This positive trend also occurred for her milk consumption, which increased from 200 ml to 350 ml per day. In addition, the child gained 1.7 kg of weight after the intervention. This study provides promising support for utilizing the antecedent control and differential reinforcement of incompatible behavior in treating selective eating and food neophobia disorder in toddlers.

Keywords: selective eating, food neophobia, antecedent control, differential reinforcement of incompatible behavior

Introduction

Food neophobia is the tendency to refuse new or unfamiliar food; it is one of the components of selective eating behavior (Birch, 1999; Dovey, Staples, Gibson, & Halford, 2008). Food neophobia is a common eating problem in young children (Moding & Stifter, 2016; Thompson, Burns, & Rain, 2010). According to Judarwanto (2011), 33.6% of children in Indonesia have eating difficulties. If a severe eating problem persists, it can potentially cause long-term harm to a child's development and growth, including problems such as unhealthy body weight, lethargy, pain, and low academic performance (Alarcon, et al., 2003; Ministry of Health of the Republic of Indonesia, 2014; Mitchell, Farrow, Haycraft, & Meyer, 2013).

As young children grow, they need to have an adequate and balanced diet to thrive and develop. Protein is one of the most important food groups to help accelerate the growth of young children (Ministry of Health Republic of Indonesia, 2014). Many children with food neophobia, however, may not have an adequate consumption of protein because they tend to reject new or unfamiliar foods (Maiz & Balluerka, 2016; Xue, Zhao, Chai, Yang, & Sheto, 2015). As a result, many of these children do not have a well-balanced diet to support their optimal health and development (Alarcon, et. al., 2003; Maiz & Balluerka, 2016). In order to support young children's development and reduce the developmental risks of not consuming enough nutrition, it is important to provide these children with effective intervention.

Several studies have suggested that behavior modification is an effective intervention in treating children with selective eating problems (Bachmayer, et al., 2009; Gentry & Luiselli,

2008; Najdowski, Wallace, Dhoney, & Ghezzi, 2003). Food neophobia and selective eating may be triggered by environmental factors, and behavioral modification focuses on the importance of environmental factors in shaping human's behavior. The behavioral modification approach seeks to change behavior through, first, altering the environment (Martin & Pear, 2015). Behavioral modification techniques that have been used to treat a selective eating problem in children include negative reinforcement and escape extinction. Studies have shown that the use of negative reinforcement with escape extinction techniques was effective in increasing the amount of non-preferred food (NPF) consumption in children with selective eating problems (Bachmayer, et al., 2009; Patel, Piazza, Martinez, Volkert, & Santana, 2002). However, Gentry and Luiselli (2008) claimed that the techniques are disturbing, invasive, and unpleasant. Moreover, many studies on selective eating problems only focus on children with medical or developmental disorders (Bachmayer, et al., 2009; Najdowski et al., 2003; Patel et al., 2002) when in reality, selective eating and food neophobia also occur in children with Typical Development (TD).

For children with TD, it has been reported that the onset of food neophobia may be triggered by environmental factors, particularly parental feeding practices. Karr, Shapiro, Fell, and Johnson (2016) stated that negative parental feeding practices, such as low exposure to new foods or forcing children to eat certain foods, contribute to children's food rejection. Furthermore, permissive parenting has also been correlated with food neophobia. Permissive parents tend to give children the power to manage the type and amount of food they eat (Steinsbekk, Bonneville-Roussy, Fildes, Llewellyn, & Wichstorn, 2017). Several studies have also shown that parental modeling likely shapes the food preferences and eating pattern of a child with TD. Children with TD tend to imitate their parents' food preferences and choices (Dovey et al., 2008; Evans, et. al, 2018; Gregory, Paxton, & Brozovic, 2011).

This study focuses on evaluating the effectiveness of less invasive and disturbing behavioral techniques such as antecedent control and differential reinforcement of incompatible behavior (DRI) techniques in treating selective eating problems in young children. Antecedent control is effective if the environment has a significant role in the formation of individual behavior. In this method, the antecedent stimulus for selective eating behavior is manipulated and then it can be replaced with a new stimulus to elicit less selective eating behavior so that less familiar foods are likely to be consumed (Karret et al., 2016; Miltenberger, 2012).

DRI was employed to strengthen a new eating behavior. Reinforcement was given to the child when she performed the desired behavior of eating, to strengthen the tendency to perform the behavior (Kazdin, 2013; Miltenberger, 2012). Many studies have shown the effectiveness of such reinforcement techniques. Reinforcement has often been used to enhance children's motivation to consume NPF (Cooper, et. al., 1999; Brown, Spencer, & Swift, 2002; Klar, 2006; Riordan, et. al., 1984).

Thus, this study will evaluate the effectiveness of behavioral modification techniques, specifically, antecedent control and DRI to treat a young child with selective eating-food neophobia disorder.

Method

Participant

A 45-month-old girl with a selective eating and food neophobia disorder participated in this study. The child's history indicated that she had been having an eating problem since she was 12 months old. She refuses to try new foods and is very particular about the texture of the food that she consumes. She does not like food that has rough and fibrous texture such as meat and fruits. When the child was compelled to eat those foods, she would hoard it in her mouth and require continuous reminding to chew and swallow the food, and it would usually take her 1.5 to 2.0 hours to finish eating in this way. Often, when the child was given an NPF, she would spit out the food and cry. Moreover, she would often request her preferred foods, such as french fries or biscuits in the middle of her mealtime and the caregivers would mostly grant her requests. Also, the child watched television as a big part of her eating routine.

Research design

A single case experimental design with multiple baselines across settings was used in this study. The multiple baselines were done for breakfast, lunch, and dinner. The pre-and post-test method was used to evaluate the effectiveness of the intervention (Gravetter & Forzano, 2012; Kazdin, 2013).

Measurements

Measurement of the amount of meat consumed by the child was conducted by weighing and using a measuring spoon (1 tsp = 5 g), and the milk intake was assessed with a measuring cup. In addition, the researcher prepared a food diary form to record the participant's meat and milk intake. The adults (usually the child's mother or the researcher) who provided food and supervised the child during mealtime measured and recorded the participant's meat and milk intake during breakfast, lunch, and dinner. The researcher also provided a notes column on the recording form so that the adults can give remarks as to whether the food was finished or how much food was left on participant's plate at the end of the meal.

Procedure

The study consisted of four different phases: pre-assessment, assessment, intervention, and post-intervention.

1) Pre-assessment phase

In this phase, the behavioral modification proposal was submitted to the ethics board for approval. In addition, the researcher met with the parents of the participant to provide a written and verbal explanation of the child's involvement in the study. The researcher provided written informed consent for the parents to sign.

2) Assessment phase

During the assessment phase, a medical examination was conducted to rule out any medical issues that might have been affecting the child's eating problem. The child's weight was measured, and a pediatrician and nutritionist determined the nutrition needed by the child. There were no significant medical issues except that the child's weight (28.66 lbs/13 kg) was slightly below the norm for her age. The nutritionist recommended that the child consume a minimum of 125 g/2.8 lbs of meat and 350 ml/1.5 cups of milk per day.

A functional behavioral assessment (FBA) was administered to identify the antecedents, behavior, and consequences of the target behavior. A reinforcement inventory was also conducted to identify high-value reinforcers. The parents were interviewed, and direct observation of the child was conducted to obtain the information. After conducting the FBA assessment, the baseline data was collected for breakfast, lunch, and dinner on seven consecutive days, and the participant's intake of meat and milk was measured. The child's weight was also measured daily. During the baseline sessions, only NPF was served at mealtime. This food consisted of soft rice, a minimum of 100 g (approximately .25 lbs) of meat, and a minimum of 200 ml (.83 cups) of milk. Figure 1 shows the baseline data.

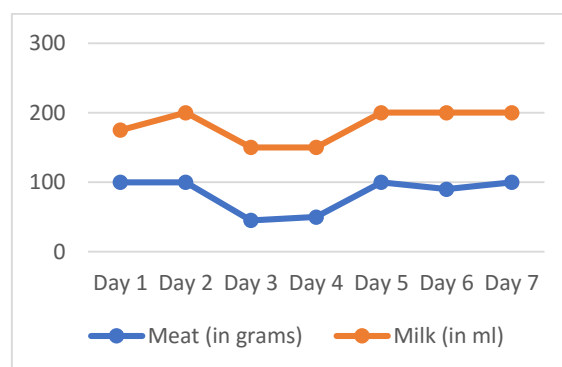


Fig. 1. Baseline Data of Meat and Milk Intake

3) Intervention phase

Antecedent control and DRI strategies were utilized during the intervention phase, which consisted of 30 sessions. The researcher had the role of program developer and coach, with the mother being the primary executor of the program. Before the start of the intervention, the researcher provided a briefing to the mother. The researcher also conducted home visits for a minimum of two visits per program phase. The visits were used to review and evaluate the sessions that have been completed.

4) Program details

a) Antecedents control

The results of the assessment indicated that there were antecedents that elicit the child's selective eating behavior. Thus, new antecedents were applied.

Table I. Antecedent Control

FBA Result			Program Plan		
Antecedents	Behaviors	Consequences	Antecedent Control Plan	Expected behavior	Consequences
Irregular meal time schedule	Complaining that she is feeling full Function: avoidance	Unfinished meal.	Implementation of a structured routine meal schedule (every 9 am, 2 pm, and 7.30 pm)	Participant consumes protein (meat and milk) until finished.	Obtain social reward and token economy reward from parents. Participant is permitted to turn on the TV and eat a snack.
Mother accedes to participant's request to consume snacks during meal time	Chooses snacks over meal Function: tangible reinforcement	Parents allow participant to consume snacks and watch TV while having her meal.	Snacks are given only if participant has finished the meal.		
TV is turned on during meal time	Chooses to watch TV and refuses to finish the meal Function: avoidance		TV is turned off until the meal is finished.		

b) Differential Reinforcement of Incompatible Behavior (DRI)

In addition to the application of antecedent control, the DRI technique was also applied as part of the intervention. The DRI application was divided into three stages. Here are the details:

Table II. Expected Target of Meat and Milk Intake Per Day

Phases (Sessions)	Expected meat and milk intake			
	<i>Breakfast</i> (meat/milk)	<i>Lunch</i> ((meat/milk)	<i>Dinner</i> (meat/milk)	<i>Total consumption in a day</i>
1 (session 1–7)	30 g / 75 ml	40 g / 75 ml	40 g / 100 ml	110 g / 250 ml
2 (session 8–17)	40 g / 100 ml	40 g / 100 ml	40 g / 100 ml	120 g / 300 ml
3 (session 18–30)	40 g / 100 ml	45 g / 100 ml	40 g / 150 ml	125 g / 350 ml

Reinforcement was used in this program in the form of provision of social attention and the establishment of a token economy. When the child was able to consume NPFs (meat and milk) within the pre-determined target, she would receive social attention directly, such as specific appreciation and hugs from her parents.

Stickers were also given when the child was able to finish the target consumption amounts of meat and milk during mealtime. The child could collect three stickers (from breakfast, lunch, and dinner time) and could exchange them for one token. These tokens could later

be exchanged for a backup reinforcer, which the researcher, parents, and child had agreed upon to be awarded after each program stage was completed. Tables 3 and 4 describe the acquisition and exchange of token in the behavior modification program:

Table III. Terms of Token Acquisition

Eating time	Amount of sticker(s)
Breakfast	1
Lunch	1
Dinner	1
Meat and milk intake meet the target	1 (Token)

Table IV. Terms of Token Exchange

Phase	Amount of token	Backup reinforcement
1	7	Activity book Disney or My Little Pony, cost IDR 50.000
2	15	Squishy pop My Little Pony, cost IDR 100.000
3	18	Drink bottle My Little Pony, cost IDR 200.000

5) Post-intervention phase

The follow-up phase was conducted three times. The first follow-up was done two weeks after the intervention; the second was completed one month following the intervention, and the third follow-up was concluded three months after the intervention.

Data Analysis

The data were analyzed using descriptive analysis. Meat and milk consumption data at the pre-test, intervention, and post-test were compared through a visual graph. Additionally, the child's body weight before and after the program was also compared to assess the effectiveness of the intervention.

Results

In general, it can be concluded that the provision of this behavior modification program was sufficient to increase the participant's meat and milk consumption. During Phase 2 of the intervention, the program procedure was altered since the child's consumption of the meat and milk did not meet the target. The researcher added five sessions each to Phases 2 and 3. Also, the researcher made some modifications in stage three since the child's milk consumption did not meet the target. First, the researcher divided the time the child drinks

milk in the morning into two phases (after waking up and after breakfast). Second, every time the child finished the milk, she was entitled to attach one sticker on her sticker book.

Based on Figure 2, the participant's meat intake increased from <100 g to 110 g and her milk intake increased from <200 ml to 250 ml per day. In Phase 2, meat consumption increased from 110 g to 120 g per day. However, on days 12 and 13, the food consumption target was not met. Other than these two days, the child's meat consumption increased daily. The participant's milk increase was inconsistent, and the intake target was not achieved on days 8, 9, 12, 13, and 14. In stage three, the child was able to increase her milk consumption even though the target was not achieved for five days. By the third follow-up session, the child had been able to consistently consume 130 g of meat, but the milk intake was due to a health issue at that time.

In regard to Figure 3, the trend lines show that the average meat intake during breakfast, lunch, and dinner increased significantly during the intervention. In Figure 4, the average milk intake during breakfast, lunch, and dinner also increased from the baseline to follow-up session 2. It was decreased slightly at the follow-up session 3.

In this study, the child's body weight was also measured, although weight is not listed as a primary success indicator for the program. According to Figure 5, the participant's body weight showed a significant increase from pre-treatment to the follow-up sessions. The child's body weight had increased by 1.7 kg (3.7 lbs) in total by the last follow-up session.

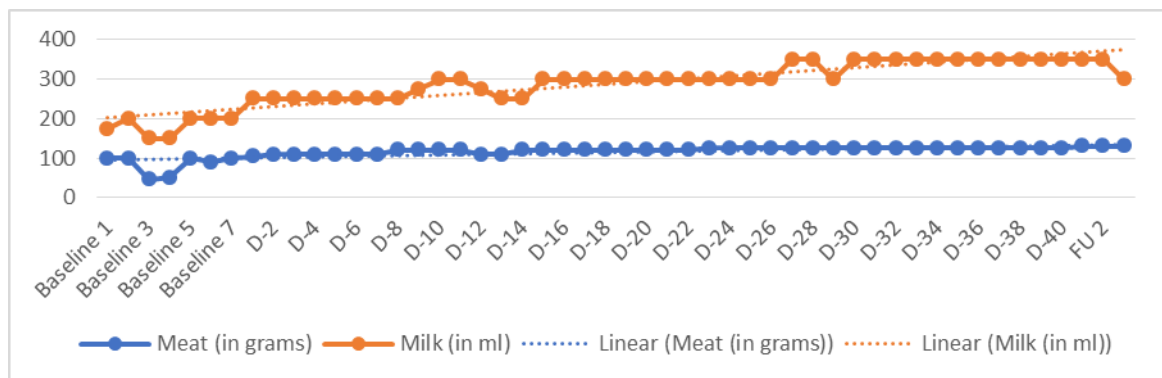


Fig. 2. The total amount of meat and milk during baseline, intervention, and follow up

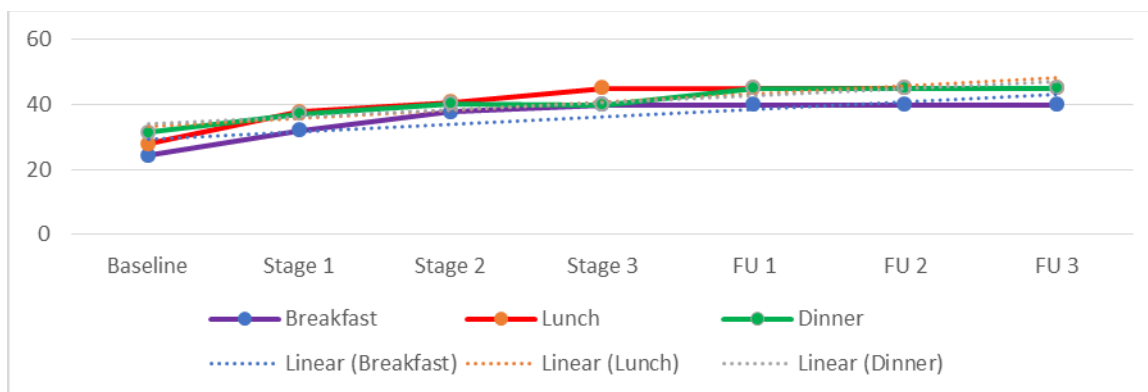


Fig. 3. Average meat intake during breakfast, lunch, and dinner across baseline, intervention, and follow up

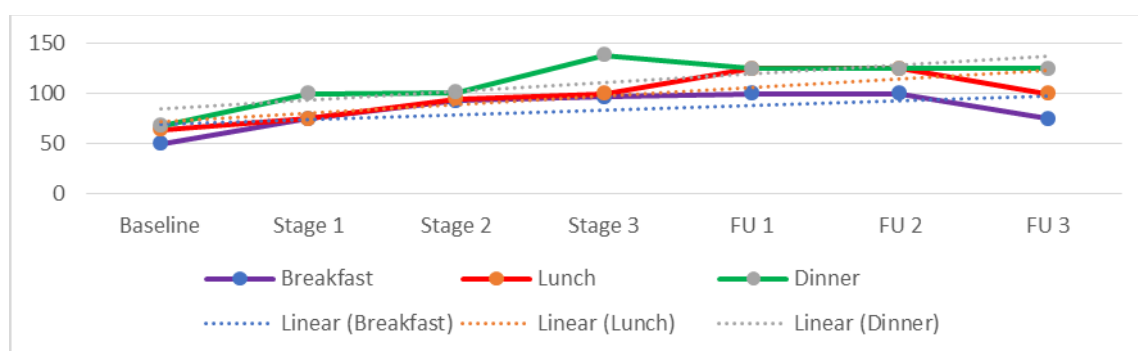


Fig. 4. Average milk intake during breakfast, lunch, and dinner across the baseline, intervention, and follow up

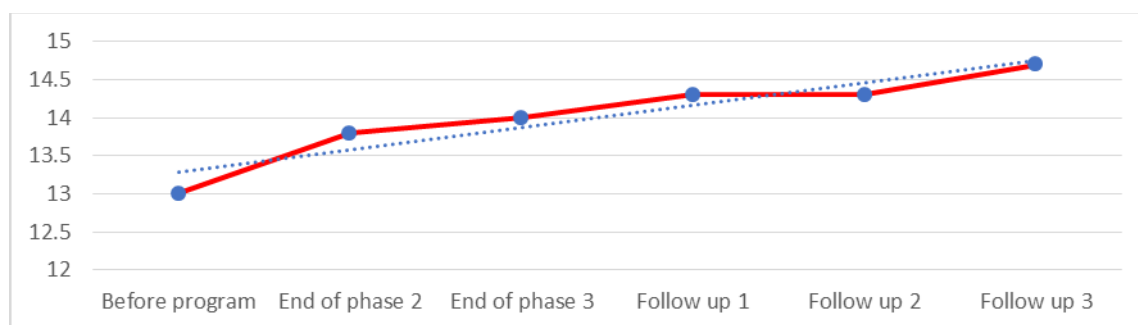


Fig. 5. Child's body weight before the program, during the program, and at follow-up

Discussion and Conclusion

The results of this study show a significant increase in meat and milk consumption in a child with selective eating and food neophobia after the implementation of the behavior intervention of applying the antecedent control and DRI techniques.

Kesuma, Novayelinda, and Sabrian (2015, pp. 953–961) stated that parents tend to have poor feeding practices and poor behavior mismanagement techniques or children with eating problem behaviors. They may, for example, provide PF rather than NPF (Bachmayer, 2009, pp. 43–50). Parental control is needed to help keep the child from disregarding the NPF.

Antecedent control presents as a technique to manipulate the environment to trigger the appearance of desired behavior (Bahcmayer, 2009; Miltenberger, 2012). In addition to helping maintain the desired behavior, DRI is effective in treating selective eating problems by giving the child access to a preferred stimulus. The participant showed an increased acceptance of her NPF after she learned that she would get a reward after eating it. The participant's reward consisted of have the right to exchange token with tangible reinforcement after she was able to collect some targeted token. This motivation triggered the participant to complete her meal. The quality of the reinforcer is one of the most important factors to be considered in setting up a behavior modification program (Kazdin, 2013).

Another factor that contributed to a successful result was the careful planning of the meat and milk consumption target. Several smaller goals were first set as checkpoints before getting to the final target. This allowed the participant to adapt slowly to the increased meat and milk consumption.

Although this study showed improvement in the child's food intake, several limiting factors should be considered and improved upon for future study. Many of the studies on behavior modification have indicated that parental consistency and control toward child eating behavior is the key to the success of the intervention (Weaver, 1992; Mitchell et al., 2013, pp. 85–94; O'Connor, et. al., 2017). In conducting the study, the procedures should be conducted consistently across breakfast, lunch, dinner, and during the weekend. Also, since the researcher was not able to supervise dinners, it was left to the parents to follow the mealtime procedures during that time. This left room for inconsistencies, such as the child's father watching television while the participant was trying to finish her meal. Also, in session 9 to 14, the participant's mother was not able to carry out the intervention optimally because of the absence of her household helper. The mother was unable to get the child to finish some of her meals at that time because she was distracted with housework. Thus, it is essential to provide more supervision time in order to increase consistency and control.

Additionally, in Indonesia, mothers tend to be dependent on social support to complete her household chores and in taking care of the child (Amalina, 2015). This situation affected the research when the child's mother was having difficulty providing optimal care without the help of the household worker. A study done on young mothers in Indonesian by Sari (2010) and Amalina (2015) revealed that for these young mothers, the help of a household worker needs to be figured into the planning of research.

In future studies, it would be helpful to identify the child's consumption capacity for food at the beginning of the intervention, and then the program could be designed with that capacity in mind. This would likely make the process more efficient and ultimately more successful (Reilly, 2018). In the current study, since the researcher did not identify the capacity of the participant's consumption when the child complained, "*I'm full*" and could not finish her food, there was no basis of comparison to know how likely it was that she was actually full.

Finally, the importance of a psycho-education session about the purpose of the intervention procedures and being consistent with them cannot be stressed enough. This is especially

crucial if the researcher will not be able to provide supervision and coaching at all of the meal times during the intervention. It is also important that the parents fully understand the techniques and procedures of the intervention so that they can be correctly applied.

However, despite the need for improvements in future studies, the current study can provide support for the effectiveness of a behavioral intervention in treating eating problems in toddlers. This study provides promising support for treatment of selective eating and food neophobia problems.

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