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Effects of Sugar Ingestion Expectancies on Mother–Child Interactions

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This study tested the hypothesis that commonly reported negative effects of sugar on children's behavior may be due to parental expectancies. A challenge study design was employed, in which thirty-five 5- to 7-year-old boys reported by their mothers to be behaviorally "sugar sensitive," and their mothers, were randomly assigned to experimental and control groups. In the experimental group, mothers were told their children had received a large dose of sugar, whereas in the control condition mothers were told their sons received a placebo; all children actually received the placebo (aspartame). Mothers and sons were videotaped while interacting together and each mother was then questioned about the interaction. Mothers in the sugar expectancy condition rated their children as significantly more hyperactive. Behavioral observations revealed these mothers exercised more control by maintaining physical closeness, as well as showing trends to criticize, look at, and talk to their sons more than did control mothers. For several variables, the expectancy effect was stronger for cognitively rigid mothers.

Traditionally, the practitioners of both folk wisdom and medical science have been interested in the effects of diet on behavior. One such effect is the hypothesized influence of sugar on children's activity levels. Because sugar consumption has been implicated in a variety of health problems, including diabetes, hypoglycemia, and obesity, it is a natural target for the explanation of behavioral symptoms. Despite the early enthusiasm over hy-

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pothesized behavioral effects of sugar, this hypothesis has lacked empirical support, with the large majority of well-conducted studies failing to show a sugar effect (Milich, Wolraich, & Lindgren, 1986).

Numerous double-blind "challenge" studies have tested the hypothesis that sugar ingestion leads to increased activity levels in children. These carefully controlled studies have generally failed to show behavioral effects of sugar, even when employing children identified by their parents as "sugar sensitive" (Behar, Rapoport, Adams, Berg, & Cornblath, 1984) or children diagnosed with attention deficit hyperactivity disorder (ADHD; Milich & Pelham, 1986; Wolraich, Milich, Stumbo, & Schultz, 1985).

Overall, the evidence has failed to support the notion that sugar ingestion leads to negative behavioral reactions in children. Nevertheless, many parents and physicians are convinced that consumption of sugar leads to problem behavior in children (Bennett & Sherman, 1983; Varley, 1984). This belief often leads to dietary restrictions to control the inappropriate behavior. Why do parents continue to believe that sugar affects their children, when the empirical evidence clearly suggests that it does not?

It may be that the sugar response notion is so generally known and accepted that parents use it to explain behavior that is not easily interpreted otherwise. Parents may attribute their children's high activity levels, which are often associated with treats, to the sugar rather than to the excitement and low structure common to snacktime situations (Goldman, Lerman, Contois, & Udall, 1986). In addition, in some cases parents may be motivated to attribute their children's behavior to external, "controllable" causes such as sugar, rather than to internal causes such as a psychological or behavioral problems. Similarly, parents may feel more comfortable attributing their children's behavioral problems to a dietary factor rather than to social environmental or familial factors. Whatever the explanation, the question remains, how do parents maintain such a belief against disconfirming situational evidence?

Expectancy Effects

One explanation is that placebo or expectancy effects are operating (Milich & Pelham, 1986; Spring, Chiodo, & Bowen, 1987). A main hypothesis of the current study was that the expectation of a sugar effect by parents may itself bring about significant behavioral changes in their children. This type of self-fulfilling prophecy (Merton, 1948) has been well documented in teacher–student interactions, and has been shown to be of some practical importance (Harris & Rosenthal, 1986; Jussim, 1989; Rosenthal & Rubin, 1978).

In addition to self-fulfilling prophecies, it was hypothesized that parents may engage in perceptual confirmation (Darley & Fazio, 1980) such that even if their children's behavior is ambiguous or disconfirming, parents may perceive it as confirming the expectancy. A great deal of evidence has accumulated showing that people see what they expect to see (e.g., Darley & Gross, 1983) while selectively ignoring disconfirming information (Swann & Ely, 1984; Swann & Snyder, 1980).

Personality Moderators of Expectancies. Individual differences have been found in the degree to which expecters hold and communicate expectancies (Brophy & Good, 1970; Cooper & Hazelrigg, 1988). The search for personality moderators of expectancies has provided evidence that cognitive rigidity, dogmatism, and related personality traits in expecters lead to more change in expectancy-related behavior on the part of expectees (Harris, 1989; Harris & Rosenthal, 1986). Jussim (1986) suggested that expectations which are confidently and rigidly held are more likely to result in self-fulfilling prophecies than those which are less confidently held (see also Cooper & Hazelrigg, 1988, and Hazelrigg, Cooper, & Strathman, 1991).

In summary, the current study examined the hypothesis, heretofore untested, that expectancy effects influence mothers' assessments of their children's behavioral sugar sensitivity and thereby influence their subsequent interactions. In order to analyze these effects and how they are mediated, mothers were observed interacting with their sons after being informed that their children had ingested either sugar or a placebo (aspartame). However, both the "experimental" and "placebo" groups received the placebo. Further, a maternal personality characteristic, "cognitive rigidity," was assessed for its potential moderating influence on the expectancy.

METHOD

Subjects

Data were collected on a total of thirty-one 5-to 7-year-old boys and their mothers. Subjects were recruited through newspaper advertisements, flyers distributed in the community, and public service radio announcements, asking for children who are behaviorally affected by sugar. Before acceptance into the study, mothers were interviewed over the phone about the effects of sugar on their children, and were included in the study only when they voiced a clear sugar expectancy.

The mother–child pairs were randomly assigned to the experimental conditions: 16 dyads were in the sugar expectancy condition and 15 in the placebo expectancy group. The groups were found to be similar in terms of the children's age [sugar M = 6.46 years; placebo M = 6.43 years; $t(29) = .10, p = .92$], maternal education level [sugar M = 14.31 years; placebo M = 15.53 years; $t(29) = 1.41, p = .17$], and paternal education level [sugar M = 15.33 years; placebo M = 15.27 years; $t(29) = .06, p = .95$]. Three of the 31 children in the study previously had been referred for evaluation or treatment of behavior problems.

Further, the groups were not significantly different in mother reports of the children's symptomatic behavior on the Eyberg Child Behavior Inventory (ECBI; Eyberg & Ross, 1978) Intensity scale [sugar M = 124.37; placebo M = 115.80; $t(29) = 1.18, p = .249$] or Problem scale [sugar M = 13.0; placebo M = 10.13; $t(29) = 1.01, p = .330$]. The average Intensity score for all subjects in the current study was 120.23, the average Problem score was 11.28. These scores fell within 1 standard deviation of the mean of the 6- to 8-year-old norms and, on average did not meet the cutoff for conduct problems established by Burns and Patterson (1990).

Procedures

During an initial phone interview with mothers, they were briefly informed of the procedures and told that their children would be given either sugar or aspartame (Nutra Sweet®) as part of the study. If they chose to participate, mothers were instructed to have their children fast beginning at bedtime the night before the study and that data would be collected in the morning before their children had eaten a meal, as is commonly done in sugar challenge studies. This was designed to promote the expectancy of a rapid and strong sugar effect.

Preinteraction Phase. Upon arriving on the day of the study, mothers and sons were taken to separate rooms by research assistants who were blind to experimental condition. All of the boys were then given a "challenge" drink (*i.e.*, Kool-Aid®) flavored with aspartame. The expectancy manipulation was then delivered to the mothers. In the sugar expectancy condition, mothers were told their son would receive a large dose of sugar in a drink tasting like very sweet Kool-Aid®. They were also told that they would wait one-half hour to give the drink "time to work" and then they would be observed playing with their sons and while asking them to do certain identified tasks.

In the placebo condition mothers were given the same information but were told their children had been selected for the placebo group and

would therefore have Kool-Aid® flavored with NutraSweet®. They were asked not to mention this to their children and told that NutraSweet® does not have behavioral effects on children.

All mothers then received free play and task instructions for the upcoming interactions (adapted from Forehand, King, Pied, & Yoder, 1970). They were told that the researchers would be videotaping their sons' behavior for 25 min. In the first 10 min, they were instructed to allow their sons to play with toys in the room and to "feel free to play with him." In the last 15 min, the task segment of the interaction, the mothers were to get their sons to pick up the toys, copy some simple geometric drawings, and then build a Lego® house together.

Following the informed consent, expectancy induction, and interaction instructions, mothers were given a Sugar Expectancy Questionnaire, designed for the present study to assess the strength of mothers' initial expectancies about the effects of sugar on their children. Just prior to the interaction phase, mothers were given a manipulation reminder. Mothers in the sugar expectancy group were told, "O.k., [Billy] had his sugar drink about half an hour ago and now we can get started." In the placebo condition, mothers were reminded, "O.k., [Billy] has had his NutraSweet® Kool-Aid® and now we can get started."

After the informed consent and challenge drink, the boys were questioned briefly about their knowledge of the study and then allowed to play with toys and watch a Winnie the Pooh cartoon while waiting for their mothers to complete the questionnaires.

Interaction Phase

Each mother and child were then placed together in a room equipped with a video camera and various toys and games. The entire 25-min interaction was videotaped for later analysis of both mother and child behavior. Following the interactions mothers were taken back to their room to complete a Post-Interaction Questionnaire (PIQ), designed for the study, regarding their perceptions of how the interactions went. Mothers also filled out a cognitive rigidity scale. Mothers and sons were then separately debriefed regarding the true nature of the experiment and experimental hypotheses and given $10.00 for participating.

The Rigidity Scale. The study employed a slightly modified version of the Wesley Cognitive Rigidity Scale (Robinson & Shaver, 1973; Wesley, 1953), a paper and pencil, true-false inventory. The alpha coefficient for the scale in the current study was .50. In the original validation study (Wesley, 1953), college student subjects who scored high on this scale took

significantly longer to shift sets and gave more perseverative responses on a card-sorting test. Thus, Wesley asserted that it measures cognitive and behavioral rigidity.

Dependent Measures

Post-Interaction Questionnaire (PIQ). The PIQ, developed for the present study, is a questionnaire similar to those used in previous investigations of children's expectancy effects (Harris, Milich, Corbitt, Hoover, & Brady, 1992; Harris, Milich, Johnston, & Hoover, 1990). The mothers were asked to rate items regarding how they felt the interactions went, on a scale from 1 to 9. The items were rationally constructed and tapped various areas of mother–child interaction. These included enjoyment of the interaction, ratings of the children's activity levels and compliance, and the effort expended in the tasks.

Following data collection, items from the PIQ were combined by content into three scales: Hyperactivity, Affect, and Effort. The Hyperactivity scale consisted of six items (alpha = .79) asking about the children's activity levels, silliness, talkativeness, bossiness, and compliance. The Affect scale consisted of two items (alpha = .55) that asked mothers about their enjoyment of the time with their sons. The Effort scale consisted of three items (alpha = .38) asking for mothers' ratings of the difficulty of playing with their sons during the interaction period.

Observational Data. Videotapes of the interaction sequences were coded by independent raters blind to experimental condition. The following verbal and nonverbal behaviors were coded: (a) commands—the number of command statements given by mothers; (b) proximity—operationally defined as the percentage of time the mother and child's bodies overlapped on the videotape; (c) criticisms—number of negative evaluative remarks made by mothers to their children; (d) talking—frequency of utterances, as well as proportion of interaction time that that mother spent talking; and (e) friendliness/warmth—global rating of each partner's positive overtures and warmth toward the other. Several other variables were coded (*e.g.*, child noncompliance, talking time by child), but due to unacceptably low reliabilities (i.e., <.70), they were dropped from the analyses.

Each variable was completely and independently coded by two sets of 2 to 3 raters. Ratings by 2 to 3 coders were combined into a set which was correlated with another set of 2 to 3 coders to provide interrater reliability estimates. The friendliness/warmth variable, because of its subjective nature, was completely coded by four sets of raters to improve interrater reliability. All variables except talking were coded separately for

the free play and task segments of the interaction. Examination of the Spearman–Brown effective interrater reliability coefficients for each observational variable revealed that they showed adequate reliability (.70 or higher).

Actometers. Wrist and ankle "actometers" were placed on the boys just prior to the interaction. These were modified self-winding calendar wristwatches which allow free movement of the watch hands and are sensitive to the motor activity of the wearer. Activity level is thus recorded in minutes. Actometers have been used in many studies of children's activity levels, and have been shown to differentiate ADHD from non-ADHD clinic-referred boys (e.g., Milich, Loney, & Landau, 1982).

RESULTS

Questionnaire Data

The three scales of the PIQ were subjected to Condition × Rigidity ANOVAs. The rigidity factor was created by dividing high and low scorers via a median split (median = 21). Interestingly, scores on the Rigidity Scale were positively correlated with mothers' initial ratings on the Sugar Expectancy Questionnaire ($r = .339, p = .031$). Thus, mothers ranking higher in cognitive rigidity tended to have a stronger initial belief in the sugar reactivity of their sons.

Table I provides the means and standard deviations, by condition and rigidity group, for the PIQ. For the Hyperactivity scale, there was a significant main effect for condition, $F(1, 30) = 7.78, p = .01$, effect size $r = .46$. The mothers in the sugar expectancy group rated their sons as significantly more hyperactive ($M = 4.37$) during the interactions than did the placebo group mothers ($M = 3.32$). There was also a trend for a Condition × Rigidity interaction, $F(1, 30) = 3.19, p = .085, r = .31$. Examination of the means suggests that mothers in the high rigidity status accounted for much of the variability in the dependent measure. The hyperactivity ratings of the high-rigidity mothers who received the sugar expectancy ($M = 4.65$) were higher than those of high-rigidity mothers who received the placebo expectancy ($M = 2.92$), simple effects $t(12) = 3.17, p < .05$. There was little difference between low-rigidity mothers' ratings in the two experimental conditions (sugar expectancy $M = 3.92$; placebo expectancy $M = 3.47$), $t(14) = .365$.

On the Effort scale of the mother questionnaire, there was a trend for mothers in the sugar expectancy condition to rate the task as being more difficult ($M = 6.12$) than mothers in the placebo condition ($M =$

Table I. Means, and Standard Deviations (in Parentheses) by Condition and Rigidity Status for the Parents' Post-Interaction Questionnaire (PIQ) Scales

	Expectancy condition			
	Sugar		Placebo	
	High rigidity (n = 10)	Low rigidity (n = 6)	High rigidity (n = 4)	Low rigidity (n = 11)
Mothers' PIQ scales				
Hyperactivity	4.65 (0.97)	3.92 (0.74)	2.92 (1.1)	3.47 (0.90)
Affect	7.05 (1.3)	7.33 (0.61)	7.88 (1.0)	7.05 (0.65)
Effort	6.27 (1.2)	5.89 (0.78)	7.08 (0.55)	6.42 (0.20)

6.60; higher scores indicated less effort expended), $F(1, 30) = 3.31$, $p = .08$, $r = .32$. No significant main effects or interactions were found for the Affect scale of the PIQ.

Observational Variables

The observational variables were analyzed in the same way as the questionnaire data, with each variable subjected to a 2 × 2 (Condition × Rigidity) analysis of variance. The free play and task segments were analyzed separately for all variables except talking. For this variable, analyses were computed on the frequency and proportion of the behaviors across both task segments. Table II presents means and standard deviations for the observational variables.

Free Play Segment. The analyses of the proximity variable revealed a significant Condition × Rigidity interaction in the free play segment, $F(1, 30) = 10.57$, $p = .003$, $r = .52$. Examination of the means suggests that high-rigidity mothers ($M = 30.40$) remained physically closer to their sons following the sugar expectancy manipulation compared to low-rigidity mothers ($M = 20.00$), $t(14) = 2.71$, $p < .02$. On the other hand, there was no significant difference between low-rigidity mothers' proximity in the sugar expectancy ($M = 20.00$) and placebo ($M = 27.59$) conditions, $t(15) = .70$. No other variables yielded significant differences in the free play segment.

Task Segment. There was a trend for a rigidity main effect on the commands, variable in the task segment of the interaction, $F(1, 30) = 2.90$, $p = .10$, $r = .30$. In this segment, high-rigidity mothers ($M = 20.42$) tended to give more commands than low-rigidity mothers ($M = 14.06$).

Table II. Means, and Standard Deviations (in Parentheses) by Condition and Rigidity Status for the Observational Variables

	Expectancy condition			
	Sugar		Placebo	
	High rigidity (n = 10)	Low rigidity (n = 6)	High rigidity (n = 4)	Low rigidity (n = 11)
Free play segment				
Commands	7.50 (4.2)	7.17 (4.1)	4.00 (3.3)	6.45 (4.7)
Criticisms	2.00 (3.0)	.33 (0.6)	0.25 (0.5)	0.64 (1.4)
Friendliness/warmth (son)	6.10 (0.9)	6.00 (0.9)	5.69 (1.6)	6.36 (1.1)
Friendliness/warmth (mother)	6.52 (1.3)	6.96 (0.8)	5.88 (1.8)	6.95 (0.9)
Task segment				
Commands	21.80 (9.2)	15.50 (5.4)	13.32 (6.0)	13.27 (5.9)
Proximity	39.90 (22.8)	48.25 (20.7)	22.13 (8.9)	34.77 (16.9)
Criticisms	4.10 (4.7)	.17 (0.3)	1.13 (1.3)	1.41 (1.7)
Friendliness/warmth (son)	5.57 (1.2)	5.54 (1.0)	5.31 (1.7)	5.75 (1.2)
Friendliness/warmth (mother)	5.80 (1.7)	5.83 (0.7)	5.25 (1.1)	6.09 (1.1)
Talking—mothers				
Frequency	274.45 (58.3)	238.08 (34.2)	203.75 (45.0)	237.23 (56.2)
Proportion	.26 (.07)	.22 (.05)	.20 (.06)	.23 (.02)

Results for the proximity variable in the task segment of the interaction showed a main effect for condition, $F(1, 30) = 4.29, p < .05, r = .36$. Overall, mothers in the sugar expectancy condition ($M = 43.03$) maintained significantly more physical closeness with their children during the task segment than mothers in the placebo condition ($M = 31.40$).

The results of analyses of the criticisms variable in the task segment showed a trend for a rigidity main effect. Mothers high in rigidity ($M = 3.25$) gave more criticisms than low-rigidity mothers ($M = .97$), $F(1, 30) = 3.39, p = .077, r = .32$. There was also a trend for a Condition × Rigidity interaction in the task segment $F(1, 30) = 3.42, p = .075, r = .32$. The pattern of means shown in Table II suggests that high- ($M = 1.13$) and low- ($M = 1.41$) rigidity mothers gave equal numbers of criticisms under the placebo expectancy. However, under the sugar expectancy, high-rigidity mothers gave more criticisms ($M = 4.10$) then low-rigidity mothers ($M = .17$); $t(14) = 2.60, p < .05$.

Talking. For the mothers' frequency of talking variable, there was a trend for a Rigidity × Condition interaction, which is consistent with pre-

viously discussed results, $F(1, 30) = 2.93$, $p = .099$, $r = .30$. Examination of the means suggests that high-rigidity mothers gave a higher number of utterances to their sons in the sugar expectancy condition ($M = 274.45$) than in the placebo condition ($M = 203.75$), $t(12) = 2.28$, $p < .05$. For the low-rigidity mothers, there was no difference in the sugar expectancy ($M = 238.08$) and placebo ($M = 237.23$) conditions, $t(12) = .003$.

Actometer Data. There was a main effect for condition on the wrist actometer, such that children in the sugar expectancy condition ($M = 1139.50$) showed significantly lower activity levels than those in the placebo condition ($M = 1548.33$), $F(1, 30) = 8.35$, $p = .008$, $r = .47$). The ankle actometer results were not statistically significant, probably because of the children's limited opportunity for movement. They tended to sit on the floor during the entire interaction, with little movement about the room.

Correlation Analyses

In order to examine the reciprocity of the subjects' interactions, as has been done in previous interaction-based expectancy studies (Harris *et al.,* 1992; Harris *et al.,* 1990), ratings of mothers' and sons; friendliness/warmth were correlated separately within the two conditions. Mother–child correlations were compared across conditions to examine whether expectancy-induced disruptions in reciprocity occurred. There appeared to be significant reciprocity in mother–child friendliness for both the sugar ($r = .80$, $p < .0001$) and placebo ($r = .72$, $p < .0001$) conditions during the task period. However, there was significantly greater reciprocity in friendliness for the placebo condition ($r = .87$, $p < .0001$) than for the sugar condition ($r = .49$, $p < .05$) in the free play period, $Z = 1.99$, $p = .026$. Thus, there appeared to be much more reciprocity in terms of global warmth between mothers and sons under the placebo expectancy than following the sugar expectancy manipulation.

DISCUSSION

The findings of the present study indicate that the common reporting of behavioral sugar effects in children may be due, in part, to parents' perceptual biases. Mothers who were told their children had ingested sugar rated their children as engaging in significantly more hyperactive behavior than did control mothers. These mothers acted on their expectancies by maintaining more physical proximity to their sons, giving more criticisms,

and talking more frequently to them, in an apparently "hovering" or controlling manner.

Regardless of how mothers may form their sugar expectancies, it is suggested here that they act on these expectancies and interpret their son's behavior as being consistent with the expectancy. This type of perceptual confirmation (Darley & Fazio, 1980; Miller & Turnbull, 1986) occurred in the present study even though the children's behavior was actually shown by actometer readings to be more subdued in the sugar expectancy group. A similar degree of perceptual confirmation may occur in naturalistic situations, as some studies have found sugar to have a subduing effect on children (e.g., Conners *et al.,* 1983), yet mothers continue to see the opposite.

The findings of this study show a large discrepancy between mothers' perceptions and their children's actual behavior. This may be accounted for in several ways. First, these findings support the already abundant evidence that perceptual confirmation often occurs in the face of behavioral disconfirmation (e.g., Bond, 1972; Farina & Ring, 1965; Swann & Snyder, 1980). Another possible explanation for the discrepancy between mothers' ratings and the children's behavior is that mothers in the sugar expectancy condition perceived themselves as expending extra effort and thus rated their sons as more active based on their perceptions of how difficult the interactions were. This is consistent with previous expectancy studies in which perceivers reported themselves as expending more effort when interacting with the target of a negative expectancy (Harris *et al.,* 1992; Harris *et al.,* 1990).

As the present study shows, mothers with strong sugar expectancies can interpret even relatively calm and subdued behavior as being hyperactive when they believe their sons have had sugar. Such expectancies may be quite resistant to change and may account for the persistence of the notion of behavioral sugar effects despite the lack of empirical support for such effects.

The Mediation of Sugar Expectancies

Besides shedding light on the question of behavioral sugar effects in children and their relation to parental biases, the present results provide information about how mothers' sugar expectancies are mediated. After receiving the sugar expectancy, these mothers responded by acting toward their sons in an apparently hovering manner suggestive of control or restraint. The sugar expectancy also appears to have disrupted the reciprocity of global warmth in mother–child interactions during free play. This is consistent with previous expectancy research (e.g., Harris *et al.,* 1990), which

has shown disruptions in reciprocity between partners due to a prior negative expectancy induction.

The mothers' apparent controlling behavior was in line with their expectancy of increased hyperactivity and is similar to behavior commonly exhibited by parents of ADHD children. These parents have been shown to give high rates of criticisms and commands (Forehand *et al.*, 1970; Tallmadge & Barkley, 1983), controlling responses (Barkley, Karlsson, & Pollard, 1985), and active support (Campbell, 1973) to their children.

As mentioned previously, the expectancy-mediating behavior of the mothers in this study appeared to have a notable effect on their sons in the sugar expectancy condition. The boys showed a significantly lower activity levels, as measured by wrist actometer readings, than placebo subjects. Though the mothers' and sons' behavior was apparently an effect of the expectancy, it did not reflect a self-fulfilling prophecy or behavioral confirmation, which was initially hypothesized would occur in this study. Rather, the boys' behavior actually disconfirmed the expectancy of hyperactivity.

Cognitive Rigidity as an Expectancy Moderator

Several controlling behaviors were exhibited by sugar-expectant mothers, particularly those who were high in cognitive rigidity. The effects of mothers' rigidity in this study are consistent with the literature on personality moderators of expectancies. This research has shown that cognitive rigidity, dogmatism, "desire for control," and other similar personality traits in perceivers lead to stronger expectancy effects (e.g., Harris, 1989; Harris & Rosenthal, 1986; Hazelrigg, Cooper, & Strathman, 1991). According to these studies, perceivers who possess high rigidity and dogmatism are more likely to act on their expectancies and interpret the targets' behavior as consistent with the expectancy. Of further relevance are the findings by Cooper and Hazelrigg (1988) that the more long-standing the interactions between the perceiver and the target, the more personality factors are related to expectancy outcome. The mother–child relationship is certainly one of long-standing intimacy in which the personality of the mother may have a considerable impact on expectancy mediation.

Limitations and Future Directions

Perhaps the strongest criticism of this study is the possibility that the main findings were the results of demand characteristics. However, this study provides evidence that mothers in the sugar expectancy condition

acted in a more controlling and restraining manner toward their sons. It seems unlikely that mothers who were trying to display the hyperactivity of their children in response to the demand characteristics of the study would act in a restraining manner toward their sons. It seems more likely that they were responding to their sons in a manner consistent with their expectancies.

In addition, it could be argued that the significant findings reported here might merely be due to chance based on the large number of overall comparisons. However, examination of the effect sizes for the nonstatistically significant results reveals that many of the comparisons would have reached statistical significance with even a minimal increase in power. Further, the fact that even the marginal findings are in the same direction and are consistent with the initial hypotheses makes it unlikely that they were due to chance alone.

Another limitation of the present study concerns the cognitive rigidity measure employed. The results obtained regarding this personality measure, although theoretically intriguing, must be interpreted cautiously for several reasons. First, the scale only exhibited marginal internal cohesiveness in the present study. Second, the median split of the scale produced unequal cell sizes, with two of the cells showing quite small *n*s. Finally, the rigidity scale was administered after the experimental manipulation was done, so that it is possible that responses on the scale were influenced by the assignment to condition.

This research provides a powerful paradigm to account for perceived diet–behavior relations. These results explain such phenomena at least as well as previous sugar challenge studies and other investigations of diet–behavior relations. Future research might productively explore the effects of parental expectancies regarding other dietary substances and psychopharmacological medication (such as Ritalin, for example). Of further interest would be the effects of children's expectancies about sugar's effects on them. A factorial design could vary both mothers' and children's sugar ingestion expectations simultaneously and explore the effects of subsequent interactions.

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