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Relationship Between Diet and Self-Injurious Behavior: A Survey

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This study examined the relationship between self-injurious behavior and caloric intake. Behavioral, dietary, and weight/height indices obtained on 80 neurodevelopmentally disabled and autistic clients revealed that maintenance on high caloric diets significantly predicted the occurrence of self-injurious behavior in male clients. Male clients with self-injurious behavior were also outside their recommended weight to height index. Systematic studies are needed to assess the relationship among diet, the endogenous opioid system, and self-injurious behavior.

KEY WORDS: diet; self-injurious behavior; neurodevelopmental disability; autism.

INTRODUCTION

Increasing evidence suggests that disregulation of the endogenous opioid system contributes to self-injuring symptoms observed in neurodevelopmentally disabled and autistic patients (Baron and Sandman, 1983; Sandman, 1988; Sandman and Kastin, 1990). For example, administration of naloxone and naltrexone (opiate blockers) attenuated self-injury in these patients (Barrett *et al.*, 1989; Bernstein *et al.*, 1987; Davidson *et al.*, 1983; Herman *et al.*, 1987; Kars *et al.*, 1990; Richardson and Zaleski, 1983; Sandman *et al.*, 1990; Sandman *et al.*, 1983; Sandyk, 1985).

Opioids have been associated with the regulation of food intake in human subjects. When compared to control subjects, B-endorphin was significantly elevated in plasma and in cerebral spinal fluid of obese subjects

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(Atkinson, 1987). Former heroin addicts treated with methadone had higher caloric intake (ranging from 2000 to 13,500 cal/day) while maintaining a low weight-to-height index (Tallman *et al.*, 1984). These studies suggested that stimulation of the opiate system may lead to increased calorie intake, and that high caloric intake may participate in the maintenance of elevated opioid levels.

Opioid receptors have been identified at all levels of the visceral and gustatory pathways (Mantyh and Hunt, 1984) and appear to be involved in processing gustatory (taste) information. For example, rats (LC-2) that exhibit high levels of intracranial self-stimulation and excessive intake of saccharin also were tolerant to morphine. Release of beta-endorphin (BE) increased in rats following highly palatable foods (chocolate milk or candy) (Dum *et al.*, 1983; Lieblich *et al.*, 1983). Similarly, chronic administration of morphine altered the dietary selection of rats by doubling fat intake over baseline levels (Ottaviani and Riley, 1984). Blocking the opioid receptors with naloxone decreased the amount of fats (Marks-Kaufman and Kanarek, 1981) and saccharin (Lynch, 1986) ingested by rats.

Anecdotal observations suggested that SIB patients consumed more calories than patients without SIB. Diet may contribute to the maintenance of SIB because caloric intake reflects the activity of the opioid system, and opioids may regulate SIB. The aim of this study is to survey the relationship between SIB and caloric diets.

METHOD

Subjects

Subjects were 80 profoundly and severely mentally retarded clients (46 males, 34 females) from two randomly chosen residences at Fairview Developmental Center, a state operated facility in Costa Mesa, California. Clients ranged in age from 22 to 46.

Procedure

Clients were separated and coded into four behavioral groups: SIB only, aggression only, SIB and aggression, and no SIB or aggression. SIB was defined as any behavior causing tissue damage. Aggression was defined as harm inflicted on others or violent outbursts resulting in the destruction of property. SIB and aggression were assessed annually with a state-wide

databased system (CDER) by primary care givers who were unaware of group membership or the aim of the study.

Dietary information was obtained from the clients' nutritional evaluation. Each client was prescribed a daily allowance of calories by the nutritionist in order to attain or maintain the normal height to weight index. Five dietary classifications described the range of possibilities: quarter calorie diets, half calorie diets, regular calorie diets, double calorie diets, and triple calorie diets.

Weight and height data were recorded from the clients' monthly weight-height log and were assigned scores of 1, 2, or 3, respectively, for weights below, within, or above the weight to height index.

Diet Analysis

Chi-square analyses tested the association between behavioral groupings, diet groupings, and weight ranges over a 6-month period. Separate analyses were performed for males and females.

RESULTS

There was a significant but expected proportion of low calorie (quarter) diets for clients above their weight range and high calorie (triple) diets for clients below their weight range ($\chi^2_{(df = 8, N = 80)} = 23.65, p < .01$). Males, but not females, maintained this pattern when analyzed separately ($\chi^2_{(df = 8, N = 46)} = 22.77, p < .01$) (see Table I). Male clients who had higher caloric diets (double and triple density) were significantly more likely to display SIB than males without SIB ($p < .05$) (see Table II). Moreover, of the males above or below their prescribed weight range ($n = 17$), 13 displayed SIB ($p < .05$). Three out of four males below their weight range had triple density diets and SIB (see Table III). These patterns were not significant for female clients.

DISCUSSION

The presence of SIB in males was associated with high caloric intake and with the tendency to be either below or above ideal height/weight index. Reports that stimulation of the opiate system increases calorie intake and that high calorie intake can stimulate beta-endorphin (BE) are consistent with the presumed relationships among diet, the BE system, and

Table I. Relationship Between Diet and Weight Range for Total Sample and Males Only[a]

	Total sample[a]			Males only[b]		
	Below weight	Within weight	Above weight	Below weight	Within weight	Above weight
Quarter diet	0.0	8.0	38.0	0.0	0.0	31.0
Half diet	0.0	8.0	11.0	0.0	4.0	15.0
Regular diet	16.0	56.0	31.0	0.0	60.0	15.0
Double diet	33.0	14.0	14.0	25.0	20.0	23.0
Triple	50.0	14.0	6.0	75.0	16.0	15.0

[a]Note. The values represent percentages. $n = 80$.
[b]$n = 46$. $p < .01$.

SIB. Both increased caloric intake (Atkinson, 1987) and SIB (Barron and Sandman, 1983; Gillberg *et al.*, 1985; Sandman *et al.*, 1990) are related to stimulation of the opioid system. In the current study, the association between high caloric diets and SIB was most apparent in underweight males. This pattern may be related to two separate observations: (1) high caloric intake and SIB are both associated with elevated endogenous opiates; (2)

Table II. Binomial Distribution Analysis of Behavior Versus High Density Diets (Double and Triple) in Males Only[a]

	Double	Triple
SIB	5	5
Aggressive	5	2
SIB/aggressive	1	1
Neither	2	2

[a]Note. Combined SIB and SIB/aggressive males have 12 out of 18 of the high caloric diets.

Table III. Binomial Distribution Analysis of Aggressive Range Versus Behavioral Ratings[a]

	Below	Within	Above
SIB	3	11	8
Aggressive	0	9	1
SIB/aggressive	0	2	2

[a]Note. Combined SIB and SIB/aggressive males have 12 out of 17 abnormal weight indices. The three out of the four males who were below their weight range also display SIB and have triple density diet.

addiction to opiates is associated with low body weight (Tallman *et al.*, 1984) and reflects tolerant opioid receptors.

Patients seeking high density diets may regulate dysfunctional receptors with increased calories (caloric intake increases opioids) (Tallman *et al.*, 1984) perhaps resulting in stimulus seeking behavior (e.g., SIB). The observation that SIB was frequent in three of four underweight patients with triple density diets is consistent with this possibility. This supports anecdotal observations that SIB outbursts tend to occur after meals in some patients.

The results of this survey are preliminary and the study has several weaknesses. First, it is difficult to determine precisely all the calories a patient receives because they may be given food reinforcers on an irregular basis which are not included in the nutritional assessment. Second, it is not probable that all patients with SIB have disregulated opiate systems. Neuromodulator activity in the dopamine (Breese *et al.*, 1984; Castells *et al.*, 1979), gamma aminobutyric acid (Baumeister and Frye, 1984), and serotonin systems (Breese *et al.*, 1984; Castells *et al.*, 1979) have been implicated in SIB. The interaction of nutrition, SIB, and these neurochemical systems are unknown. The fact that a significant trend was found in this survey warrants further studies of the diet-SIB relationship.

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