The Effect of Effort and Food Preferability on Food Consumption of Obese and Non-Obese Children

by

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A Thesis Submitted to the Department of Psychology and the Faculty of Graduate Studies of the University of Manitoba in partial fulfilment of the requirements for The Master of Arts Degree.

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Abstract

The purpose of this investigation was to examine the effect of food preferability and effort to obtain food on the eating behaviour of obese and normal children. The context of the research was the theory of S. Schachter that food consumption of the obese is determined by external stimuli rather than internal states. Specifically, this theory implies that overweight subjects will eat more high preference and less low preference food than normals; as well as more easy to get food and less hard to get food than normals. The repeated measures 2 x 2 x 2 mixed design used naturally occurring weight levels (normal and obese), and manipulated two levels of preference (low and high) and two levels of effort (low and high). The high preference food was raisins, and the low, sunflower seeds. The high effort condition used a standard 30-dram pharmaceutical container with a 1 cm. hole punched in the lid, through which subjects had to shake the food. The low effort condition used an unlidded container. Subjects of the study were 5 and 6 year old boys and girls in the natural setting of a kindergarten. First their heights and weights were measured. Then, with as little disruption of the daily routine as possible, the same order of the four snacks (treatments) was administered to each of the five classes on successive days. Scores were the percentage of

food eaten in each condition. The principal analysis compared the 10 children above the 95th percentile of Canadian weight for height standards with 10 average children. While weight was not a significant variable, manipulation checks showed preference and effort as significant. Furthermore, and according to prediction, the obese ate significantly more low effort food than normals. Contrary to predictions, the obese did not eat significantly more high preference food than normals; and they did not eat significantly less low preference or high effort food than normals. In a second analysis, data from all 60 children, evenly divided into underweight, average, and overweight groups, gave no support for the experimental hypotheses. Implications of the results were discussed in terms of the Schachterian theory and of the treatment of childhood obesity.

I. INTRODUCTION

This study is concerned with whether the psychological variables of food preferability and effort to obtain food have an effect on the food consumption of children varying in obesity. This chapter will review the literature on these variables and obesity, as well as set out the rationale and hypotheses of the present research.

Obesity

Obesity has been acknowledged the commonest nutritional disorder in sedentary affluent societies (Garrow, 1974). Indeed, data from longitudinal studies and U.S. Selective Service and life insurance records appear to point to an increasing incidence and prevalence of this disease (Mayer, 1973). In Canada, an early nationwide study found 13% of males and 23% of females to be obese (Pett & Ogilvie, 1957). The more recent Nutrition Canada national survey uncovered a "very high prevalence of overweight", and concluded that, "in a significant number of adults, the degree of overweight reached the extreme of obesity" (Prince Edward Island Survey Report, 1973, p. 39). This survey also found that median caloric intakes of children from 1 through 7 years were higher than generally recommended, although it was not determined whether the surplus was reflected in greater than desirable weights.

The hazards associated with severe obesity are manifold, whether in the realm of health (abnormalities in glucose metabolism, diabetes, hypertension, and heart disease) or that of social interaction (impaired job and educational opportunities) (Petit, 1974; Bray, Jordan, & Sims, 1976; Bray, Dahms, Greenway, Marriott, Molitch & Atkinson, 1976). The risks, however, of mild degrees of obesity are not clear (Keys & Grande, 1973). Furthermore, juvenile-onset obesity, while possibly involving short-range problems, can persist into maturity; but the proportion of fat adults who were such as children is uncertain (The Prince Edward Island Survey Report, 1975; Garn, Clark, & Guire, 1975; Weil, 1975). In any case, parental obesity and obesity during childhood (beyond infancy) appear to be the major predictors of obesity in the adult (Fomon & Ziegler, 1976).

The fairly recent extension of weight reducing methods to the juvenile population is, in part, a response to the widespread occurrence of weight problems. The apparent frequent failure of such diets, the generally recognized intractable nature of this disorder, and the health risks associated with it would seem to warrant continuing investigation into all aspects, including the psychological, of this condition.

Before proceeding further, however, some definitions are in order.

The terms "obesity" and "overweight" are not synonymous. Obesity is a pathological condition characterized by an excessive accumulation of fat (Mayer, 1973). More precisely, this substance in termed adipose tissue (Garrow, 1974) and is measured by a skinfold calipers at various locations on the body. There is no fixed criterion of obesity, but one national survey has taken the 85th percentile (for one's sex and age) as the cutoff point (Garn & Clark, 1975).

The term overweight, on the other hand, refers to a person's poundage that is more or less above the population norm for one's height, sex, and age. Again, there is no fixed criterion of overweight. Persons have been considered overweight if they are above the 84th or 90th percentiles for weight. These varying criteria for overweight and obesity are one reason for the diverse estimates of the prevalence of childhood obesity (e.g., 5 to 23% in the U.S., cf. Stimbert & Coffey, 1972).

In psychological studies of obesity, weight-for-height tables have been used most often, with subjects being considered obese if they are more than 15 or 20% above ideal body weight (Leon & Roth, 1977).

This criterion originally derived from tables used by the life insurance industry which are prepared on the basis that "ideal weight" is defined as weight for height associated with the lowest mortality.

For children, there are no such tables. Instead, recently available statistics obtained from large scale nutrition surveys in Canada (Demirjian, 1980) and the U.S. (Hammill, 1977) make it possible to compare a child's weight for height with a national percentile distribution. It should be noted that both the ideal weight and the weight for height methods have the drawback that excess weight may be due to an unusual proportion of fat, or to fat, bone and/or muscle. In a volume devoted to nutritional disorders in children, however, weight for height greater than the 95th percentile of the reference data is considered as much evidence of an extreme obesity as is triceps and/or subscapular skinfold thickness above the 95th percentile value, and both scores are understood to indicate the necessity of medical treatment (Fomon & Ziegler, 1976).

A few psychological studies have used the skinfold determination of obesity. The difficulties pertaining to this method are discussed by Garrow (1974). In particular, one might mention the problems of inter-rater

reliability and of the variable ratio of skinfolds at one or two locations to total body fat. Furthermore, as late as 1976 there were no satisfactory skinfold data for children 3 to 6 years of age (Fomon, 1976).

Because of the lack of national skinfold data in Canada, and in order to promote comparability with the vast majority of psychological studies on this topic, the present research will determine each subject's degree of overweight by comparison to the Canadian national percentile distributions of weight for height for a given sex and age (Demirjian, 1980). Also, in accord with psychological tradition, "obesity" and "overweight" will be employed synonymously.

In conclusion, it can be said that the widespread distribution of obesity as well as the risks associated with it would seem to justify research in childhood obesity in the hope of formulating a preventive approach. Whether too little energy output or too much caloric input is more crucial in the etiology of regulatory obesity is not known, but, whatever the case, psychological aspects are thought, even by the physiologist (e.g., Garrow, 1974), to be at least as important as metabolic aspects. It is to a review of two of these psychological variables - effort and preferability - that we now turn.

Effort to Obtain Food

The systematic non-physiological investigation of obesity began in the 1930s with the psychiatric researches of H. Bruch, which have continued over four decades (Bruch, 1973). In the 1960s the resurgence of psychologists' interest in this human disorder was led by S. Schachter, among others. Leon & Roth's (1977) review of psychological factors in obesity was, in fact, partly organized around Schachter's theories.

Schachter proposes that obese individuals show little relationship between internal state and eating behavior because their eating behavior is in large part under the control of external, environmental cues, (such as smell, taste, and appearance) unrelated to the physiological state of hunger (Schachter, 1971). In an examination of the evidence up to 1975, it is concluded that, in general, support for Schachter's externality theory of obesity appears to be equivocal at best. In particular, however, studies on effort are among those that give the greatest support (Leon & Roth, 1977).

Effort can be related to external control inasmuch as to a hard-to-obtain food is more remote and therefore a less attractive and potent stimulus (Schachter, 1971).

One of the sources of this idea was the experiments showing that ventromedial hypothalamus-lesioned rats ate more than non-obese rats except when they had to work for food, in which case they ate less than their normal conspecifics.

The studies scrutinized in the above-mentioned review under the heading of effort (Hashim & Van Itallie, 1965; Nisbett, 1968a; Nisbett & Gurwitz, 1970; Schachter & Friedman, cited in Schachter, 1971; Singh & Sikes, 1974) will be considered in this section, along with other pertinent studies (Palmer, 1973; Schachter, Friedman, & Handler, 1974; Johnson, 1974).

Possibly the earliest human study of the effort variable is Hashim & Van Itallie's (1965). Modeling themselves on animal researchers, they built a machine which delivered 7.4 ml. of liquid diet each time a button was pressed that activated an electric pump. Feeding solely by this machine, two normal-weight male subjects (a 60-year-old hospital patient and a 20-year-old volunteer) maintained their customary caloric intake and their weight for a few weeks; but five grossly obese patients markedly reduced their intake and lost weight. What is more, when two of these patients were allowed to pour the liquid and drink it by cup, they increased

their intake, but still stayed far below caloric requirements.

To label these results as evidence for the proposition that the obese expend less effort than normal-weight persons to procure food is questionable because of: (a) the likely set of the obese (but not the lean) that they were being put on this machine in order to reduce intake and weight; (b) the omission of the cup condition for normals; and (if the obese do indeed favor tastier diets than normals) (c) the monotonous blandness of the fluid. All but the second of these objections apply also to a cognate study that did not use a cup condition for any subjects (Campbell, Hashim, & Van Itallie, 1971).

The first clear psychological evidence for the hypothesis linking effort and human obesity is Nisbett's (1968a) study. After a bogus monitoring task each subject filled out questionnaires at a table displaying either one or three roast beef sandwiches. Before the experimenter departed, he invited the male students to help themselves to more sandwiches from the refrigerator. In the single-sandwich condition, the normals ate significantly more than either the underweights or the overweights. Confronted with three sandwiches, however, the overweights ate markedly more than the other two groups.

The Nisbett and Gurwitz (1970) investigation is unique in that it was executed with newborns in the natural environment. The healthy bottle-fed neonates were divided according to their ponderal index. This ratio (weight divided by the cube of length) is an infrequently used measure of obesity. Mothers were given three bottles of formula for each of the two days, along with numbered nipples to be used in order, and were told that one (but not which) of the nipples had a smaller hole. The amount drunk at each feeding was recorded by the mothers.

On the first day the only weight-related finding was that underweights drank less with the smaller nipple. On the second day there was a significant interaction between the ratio and nipple type: overweights consumed less than at the other two feedings, while normals consumed about the same at all feedings. On both days there was a significant interaction between sex and nipple: the small-holed nipple decreased the females' intake while it had negligible effect on the males'.

It is not obvious why one should ignore the first day's evidence, but, if one does, the authors caution that, since the ponderal index is not generally accepted

as a satisfactory measure of obesity, the link between adiposity and effort is confounded. More importantly, as Leon and Roth (1977) remark, the results confound nipple size with possible naturally occurring variations in feeding patterns, and are thus of doubtful relevance to the effort-overweight hypothesis.

Schachter and Friedman's (cited in Schachter, 1971) procedure is reminiscent of Nisbett's (1968a). The subject sat at a cluttered desk to fill out personality inventories. In one condition the desk held a bag of shelled almonds, while in one other the nuts were unshelled. Before leaving the room the experimenter chewed a nut and invited the student to do likewise. About half the normal-weight subjects accepted the offer, for both shelled and unshelled almonds. Of the obese students, 19 out of 20 consumed shelled nuts while 19 out of 20 refused to approach the unshelled nuts. One must admit that the energy needed for cracking shells is much greater than that needed for simply taking nuts from a bag.

Singh and Sikes (1974) investigated the role of past experience of effort in obtaining food. Students were assigned to a wrapped vs. unwrapped chocolate condition, and then a wrapped vs. unwrapped cashew condition.

The brand of chocolate that was served is ordinarily foil-wrapped, while cashews are not. Faced with two bowls of chocolates, subjects were requested to eat as many morsels as necessary to ascertain which contained the fresh chocolates (or the "organically grown" cashews). In fact, of course, the bowls did not differ.

There was no significant difference between obese and normal students' consumption of chocolate in the two conditions. Things were more complicated in the cashews, however. A significant wrapping X weight interaction appeared: the obese chewed more unwrapped than wrapped nuts, and also more unwrapped nuts than did the normals.

The authors conclude that the obese are as motivated as normals to seek food, but the critical variable is whether they have been accustomed to work for the type of food at hand.

Three other studies are pertinent to the factor of effort (Palmer, 1973; Schachter, Friedman & Handler, 1974;

Johnson, 1974).

With male students Palmer (1973) replicated the Schachter and Friedman (cited in Schachter, 1971) experiment, but did not replicate their results, finding no differences in obese and normal subjects' intake of almonds. Also, he added a without shell, far almond condition which failed to differentiate obese and normal subjects.

Schachter, Friedman, and Handler (1974) visited 16 Chinese and Japanese restaurants, characterizing Occidental diners as obese or not obese, and observing whether they ate with chopsticks. 22.4% of normals and 4.7% of obese patrons used chopsticks rather than silverware. The authors concluded that fat eaters were more likely than average-weight eaters to choose the easiest way of eating. Leon and Roth (1977) remark that since in 12 of the establishments chopsticks were not on the table but had to be asked of the waiter, the results may be somewhat biased.

Johnson (1974) designed a laboratory experiment to test the externality theory of effort, by manipulating food cue prominence in two ways while making male and female students work for their lunch. Half the subjects were given a quarter sandwich before their work, and

half were not. Then portions of the subject's favorite sandwich were delivered after he/she pulled a weight (set at 50% of the subject's maximum power) on a VR50 schedule. Again, half of the subjects could see their sandwiches accumulating in transparent wrappers, while the other subjects' sandwiches were covered with opaque paper.

The significant effects were those of weight, and the weight and visibility interaction. Overall, the obese students worked harder and received more of their preferred sandwiches. In the no pre-taste condition the obese responded more when food was visible than when it was not, and more than the normal-weight food visible group. In the pre-taste condition the obese responded more than normals when the food was visible. Thus the differential performance of the obese was almost entirely related to the food-visible treatment.

One can conclude that sight is a stronger cue than taste, or, as Johnson would prefer, that a temporally proximate external cue is more potent than a remote one, and thus that the external control notion is supported.

In conclusion, a tally of the nine studies reviewed in this section showed three directly (Nisbett, 1968a;

Schachter & Friedman, cited in Schachter, 1971; Schachter, Friedman, & Handler, 1974) and one qualifiedly (Singh & Sikes, 1974) in favor of the idea that obese people expend less effort than normals for hard-to-get food. One replication (Palmer, 1973) found nothing to support the hypothesis. Another study (Johnson, 1974) found that the obese will work for their lunch if food cues are potent; in fact, they worked harder than normals (see further discussion of this study in the next section). Three publications (Hashim & Van Itallie, 1965; Campbell, Hashim & Van Itallie, 1971; Nisbett & Gurwitz, 1970) are not clearly applicable to the effort variable.

Though the interpretation of effort studies is moot, the factor itself appears to be relevant to the psychological understanding of obesity. In the following section another factor, food preferability, will be discussed.

Food Preferability

In his 1971 article on the similarities between obese humans and rats, Schachter considers the effect of "good" and "bad" tasting food. This effect is illustrated in experiments wherein ventromedial hypothalamic-lesioned rats consumed less feed adulterated with quinine and more feed altered with dextrose, than non-lesioned animals.

Another example is Decke's (cited in Schachter, 1971) observations that obese humans drank more of the "decent-tasting" milkshake and less of the quinine milkshake, than normal-weight subjects.

Since taste is an external cue, these results can be interpreted according to Schachter's theory of externality, such that good taste appears to stimulate the obese to eat more than normals, while bad taste has the reverse effect.

A more general concept than taste is food preferability, which encompasses the visual as well as the gustatory and olfactory appeal of food. Thirteen studies have been concerned with the effect of taste or preferability on the consumption habits of normal and obese subjects. Four of these are field studies and will be examined later.

Of the nine experiments or quasi-experiments, all but one (Nisbett & Gurwitz, 1970, understandably, since they were working with neonates) were presented to subjects as tests of taste or food preferability. Nisbett and Gurwitz found that heavy infants imbibed significantly more of a sucrose-sweetened formula than medium and lightweight babies. Because, as the authors point out, the ponderal index by which infants were divided is not an

adequate measure of obesity, this study cannot be used to support the taste theory.

Of the eight remaining studies employing food preference rating, three do not favor the Schachterian hypothesis (McKenna, 1972; Price & Grinker, 1973; Grinker, Note 1 in Leon & Roth, 1977). McKenna (1972) found that obese male students ate significantly more of both the high- and the low-valence food (homemade chocolate chip cookies and semi-sweet greenish-gray shortbread) than did normals.

Price and Grinker (1973) found that hospitalized weight-problem males nibbled significantly more of all five varieties of crackers than did normal, non-hospitalized volunteers; which difference may have been attributable to the patients' restricted institutional diet. However, they also found that each group ate significantly more of its highest-rated than of its lowest-rated crackers. Nonetheless, when the obese group was split into the heaviest versus the lighest weights, a significant weight X preference interaction surfaced: the former ate more best-liked and fewer disliked crackers than the latter.

Finally, Grinker (Note 1 in Leon & Roth, 1977) demonstrated that, for sucrose solutions, the rated

pleasantness and the amount drunk were correlated, in three male and female groups (extremely obese outpatients, moderately obese outpatients, and normal-weight subjects).

The findings of five other experimental investigations appear to lend some weight to part or all of Schachter's food preferability theory (Nisbett, 1968b; Nisbett, 1972; Decke, cited in Schachter, 1971; Johnson, 1974; Hill & McCutcheon, 1975).

Under the guise of testing a new "vanilla bitters" product, Nisbett's (1968) administration of either fancy French vanilla icecream or poor-quality quinine-saturated icecream to three groups of male students, effected significant differences. The overweights ate much more good ice than underweights and normals, while the normals ate less bad ice than the two other groups. Nisbett (1972) found a similar pattern in subjects tasting cake: the overweights ate far more cake rated as highly palatable than did the other subjects, but approximately the same amount of the less tasty sample. (Decke's study, cited in Schachter, 1971, was referred to above.)

Though not meant as direct tests of Schachter's taste theory, two other experiments are relevant to it.

Johnson's (1974) donation of a lunch of the subject's favorite sandwiches was contingent upon the pulling of a weight (see section on effort, above). The obese group labored significantly harder than the normal one and was thus rewarded with more of the preferred sandwiches. Pairing obese and normal male students according to meal preference, Hill and McCutcheon (1975) found a significant weight and preference interaction: the obese ate more grams of the high-preference meals and less of the low-preference meals than non-obese subjects.

A recent review of direct observations of eating behavior (Stunkard & Kaplan, 1977) mentions three field studies that bear on food preferability, inasmuch as they assessed the amounts of food chosen (and, therefore, the amounts of preferred food) in the natural environment (Gates, Huenemann, & Brand, 1975; Dodd, Birky, & Stalling, 1976; Wooley, Tennenbaum, & Wooley, cited in Stunkard & Kaplan, 1977).

In the first (Gates et al., 1975), 720 students going through a university cafeteria line were visually appraised on body build (slender, sturdy, stocky, or obese) and number of servings per tray. Body build had a very strong significant effect, with the obese on the average choosing a full portion more than the other groups.

This is also the only field study to have made explicit control for height.

Secondly, at a fast food chain outlet Dodd et al. (1976) visually assessed weight and meal size of female customers. The caloric intake (as calculated from charts supplied by the restaurant) of the obese patrons was significantly greater than that of the normal-weight patrons.

Thirdly, Wooley et al. (cited in Stunkard & Kaplan, 1977) observed 2731 males at two cafeterias. The obese selected more food than normals at the "fancy" food restaurant, but not at the cafeteria dispensing less savory "institutional" food. Also, the obese were over-represented at the fancy restaurant and under-represented at the other one.

The assumption in these three studies was that food chosen is generally food eaten. A check was made by Dodd et al. (1976) of this assumption; in a restaurant, they observed that about three-quarters of the normal-weight patrons finished their sandwiches while almost all of the obese patrons did so. In addition, by Marston, London, Cooper, and Cohen's (1975) count, 80% of obese eaters at a public cafeteria cleaned their plates, as compared to 20% of the "noticeably thin" eaters.

Likewise, at an elementary school cafeteria, Marston, London, and Cooper (1976) observed that thin children left significantly more food on their plates than fat children. These studies seem to show that food selection is a valid index of food consumption, especially for obese eaters.

A final field study (Goldman, Jaffa, & Schachter, 1968) examined university records to find out relative weights of male freshmen and whether they continued on a dormitory food plan (which had received many complaints) in their sophomore year. 86.5% of fat students let their contracts expire, as compared to 67.1% of normal-weight freshmen. If one agrees that the domitory plan presented food of low preferability, then one might interpret these results as support for the externality theory.

At the outside, then, nine of the studies of diverse obese populations reviewed in this section tend to confirm Schachter's externality concept of food preferability. Thus, obese persons consume less low-preference food (Goldman et al., 1968), more high-preference food (Johnson, 1974; Gates et al., 1975; Dodd et al., 1976; Wooley et al., cited in Stunkard & Kaplan, 1977), or both (Decke, cited in Schachter, 1971; Nisbett, 1968b, 1972; Hill & McCutcheon, 1975).

On the other hand, three studies seem not to confirm the externality theory (McKenna, 1972; Price & Grinker, 1973; Grinker, Note 1 in Leon & Roth, 1977). One study (Nisbett & Gurwitz, 1970) is not applicable.

On balance, therefore, food preferability appears to be a worthwhile factor in investigations of overweight persons.

One caveat should be entered here. While Leon & Roth (1977, p. 122) conclude that "The greater responsiveness of obese persons to the external cue of taste appears to be substantiated in a variety of obese subject populations...", they also admonish that a number of these results may be confounded by the experimental instructions relating to a test of tasting. In other words, obese persons may be more or less certain of their likes and/or dislikes than normal persons, although research results on this point, as cited by Leon & Roth, are not persuasive one way or the other.

The Present Study

To this point, several areas have been reviewed. First, obesity is an endemic nutritional malady in many Western countries and its health risks are manifold. Secondly, psychologists as well as nutritionists, physicians and physiologists have an essential role in

the investigation, control, and prevention of obesity. Third, among the psychological variables relevant to food consumption, both food preferability and effort to obtain food have received a fair amount of substantiation from researchers. Lastly, data on these variables can be understood to lend support to the Schachterian external control theory of obesity.

This study is considered a further test of the variables connected with Schachter's theory. Specifically, it asks whether effort and food preferability, which have been found to differentiate adult populations, are more obviously operable in younger subjects, who have been little studied. Presumably, preschoolers' food consumption is under the influence of biological hunger, parents, the media, and peers, through not necessarily in that order. It is suspected, however, that, at the moment of eating, they will not have the same self-consciousness either about their corpulence or about their eating habits and that, unlike adults, they will proceed to eat with little thought about, and therefore effect from, the views of others.

The choice of effort and food preferability occurs for two reasons. First, these variables, among those in the Schachterian explanation of obesity, appear to have received a good deal of research support.

Second, combining them will help to show whether they potentiate or otherwise interact with each other, as well as which is the stronger determinant of eating practices of the obese.

Schachter's theory should be most clearly evident in highly overweight subjects. Therefore, in the principal analysis, data from only the obese at the extreme of the group were used. Since it was likely that this criterion would insure only a handful of obese children, it was not thought possible to divide into smaller groups for the various treatments, and thus a repeated measures design was made necessary.

In order to approximate typical feeding habits, the site of this field study was a kindergarten, and every-day routine was disrupted as little as possible. The dependent variable, food consumption, was not confounded by requests to participants to make taste ratings or by other sham procedures.

By studying the entire kindergarten the maximum number of highly overweight subjects was expected to be obtained. Rather than being singled out from among their classmates, obese subjects snacked in their usual class groups. This procedure also had the advantage of being a preventive to experimenter bias.

With direct measurement of both degree of overweight and amount of food, the inaccuracy of the eyeball ratings of body type and food portions used in some field studies was avoided. It was therefore expected that firmer conclusions would be rendered.

In summary, this field study is a quasi-experiment using a repeated measures design. The variables of food preferability and effort were manipulated in a sample of obese and normal preschool children. The following hypotheses were tested.

Hypotheses

1. It was hypothesized that obese children would consume more high preference food than normal children.

2. It was hypothesized that obese children would consume less low preference food than normal children.

3. It was hypothesized that obese children would consume more low effort food than normal children.

4. It was hypothesized that obese children would consume less high effort food than normal children.

II. METHOD

Subjects

In order for the experiment to approximate typical eating habits, an entire kindergarten of 107 children aged 5 and 6 received the treatments. The 20 children absent on one or more testing dates did not receive all four treatments. Of the remaining 87 preschoolers, the 10 most overweight were compared to 10 of average weight.

The kindergarten or "Head Start", located in a small town (Summerside, P.E.I.), was at the time the largest such facility serving the largely rural area. Its clients were mainly families of British Isles and Acadian ethnic origin. In the opinion of the staff, the children represented a cross-section of the local socio-economic community. During the nine-month school year, each child attended a 2-hour class period in the morning or afternoon, five days a week. The primary purpose of the kindergarten was the social and academic preparation of the children for entry into first grade the following fall.

The full cooperation of the Director of the kindergarten, as well as of her two teachers, was secured. The procedures of the experiment and the general nature of the research ("psychological factors and overweight"), but not

the hypotheses, were explained to the Director. In previous years a snack period had been part of the schedule, and it was agreed to reinstate a similar period over the five experimental days.

A letter (see Appendix I) informing parents of the study was pinned to each child's clothing in the week before testing. The letter requested parents to sign a statement if they did not want their child to participate. No parent objected. Three expressed interest in learning more about the research after its execution.

Procedure

The study was constructed on a 2 x 2 x 2 mixed design with repeated measures. There was one group or between-subjects factor ("weight"), and two within-subjects factors ("preferability of food" and "effort to obtain food"). Weight had two levels: normal and obese. Preferability had two levels: high preference and low preference food. Difficulty also had two levels: high effort and low effort food. Thus, both weight groups received the four treatments.

The problem of the order of treatments deserves some discussion. Since reference data on overweight (Demirjian, 1980) were not available till later, the number of obese and normal children in each of the five

classes was unknown when the research was carried out. But there was no prior reason to believe that any class held an imbalance of obese children. Possible training effects were regarded as minimal because of the elementary nature of the behaviors (shaking, chewing and swallowing). Furthermore, sequence effects were expected to be slight, partly because children were presumed to have had a history of some familiarity with the foods used. In any case, the probability was that either type of effect would balance out between the two groups. For all these reasons, it was felt that all children could receive the same order of treatments. The high preference conditions were given first. Within both preference conditions, the high effort condition was given first. Thus, the order of treatments was: 1) high preference high effort, 2) high preference low effort, 3) low preference high effort, and 4) low preference low effort.

Weight

Height and weight measurements were taken by the experimental assistant, a registered nurse experienced in dealing with children, who followed accepted anthropometic techniques (Fomon, 1976) to the degree possible. Children wore light underclothing only.

For height, the subject stood with back and heels against a wall to which a measuring tape had been affixed. One end of a 2" by 4" by 12" block of wood was placed against the tape at a right angle to the wall while the block was lowered to the subject's crown, and the reading taken to the nearest millimeter. Body weight was measured with a beam scale. With the subject standing in a central position on the scale, the nearest 100 grams was read from the calibrated beam.

The measurements of the 87 children present for all four treatments were compared to Canadian weight-for-height reference data (Demirjian, 1980; see Appendix II). Ages in these standards represent the midpoint, e.g., "5 year old" refers to a child chronologically aged 4½ to 5½ years. With subjects in this study treated accordingly, the 10 children falling above the 95th percentile for their sex and age formed the obese group, and 10 children randomly selected from the 44 falling between the 25th and 75th percentiles formed the normal group.

Preferability of Food

An important feature of the foods to be used in this study was that they be of pellet size in order for the children to be able to shake them through the hole in the lid of the container (i.e., in the low effort condition).

Two pellet-size snacks were selected as appropriate: seedless Sultana raisins, and shelled sunflower seeds which had been neither roasted nor salted.

The rationale for this choice was that raisins were judged to be more attractive to children because of their sweetness and availability in colourful packages in many stores. By contrast, sunflower seeds were estimated to be less familiar to children. Also, when displayed for commercial purposes the seeds are most often (except in health food stores) fairly appetizing, i.e. they have been roasted and salted, while the seeds used here were unprocessed, grayish in colour, and relatively bland to taste. Furthermore, casual observation of the kindergartners' snack behaviour seemed to indicate their preference for raisins over the unattractive seeds.

Thus, for purposes of this study, raisins were the "high preference" and sunflower seeds the "low preference" food.

Pilot studies showed that the maximum amount a child could eat in a two minute period was about 124 raisins or 280 sunflower seeds. These, then, were the amounts contained in the high and low preference conditions. Now, on a torsion beam scale, the average weight of a raisin had been found to be 345 milligrams, and of a

sunflower seed, 58 milligrams. Thus, the weight of the food in the high preference condition (42.78 grams) was more than two and one-half times that of the low preference food (16.24 grams). Presumably, it is the dryness of the seeds and their greater crunchiness that require a longer consumption time than that needed for an equivalent weight of raisins. In order to make the two conditions comparable for analysis, the percentage rather than the absolute number or weight of items eaten was taken as the subject's score. For example, if a subject consumed half the raisins (i.e., 62), the score would be 50. Likewise, if a child ate 140 seeds, i.e., half of the amount in the container, the score would be 50%.

Effort to Obtain Food

A clear plastic, 30-dram pharmaceutical container was used to hold the food. In pilot studies it was learned that children could easily grasp this size container and pour out the contents. It was also shown that when the container had been fitted with the usual white plastic, "child-proof" lid in which a hole 1 cm. had been punched, children could, with some difficulty, shake out the contents. The high effort condition, therefore, refers to the lidded container, and the low effort condition to the unlidded container.

Effort was defined as shaking because this behaviour is readily available to children long before age 5 (Munsinger, 1971).

Snack Routine

As the kindergarten was divided into five classes, each class as a whole received each experimental condition. The experiment was conducted over five successive school days.

At mid-morning or mid-afternoon the teacher having announced a snack period to the children, led them into another classroom and asked them to be seated at the small desks. The experimental assistant (the nurse with whom the children were already acquainted through the height and weight measurements), standing at the front of the room, recited the instructions contained in Appendix II.

When the assistant had distributed the containers, each inscribed with the child's name on masking tape, she said, "Now you may eat". After two minutes had elasped, she told the children, "Now put down the containers and place your hands on your lap", and they were led from the room by their teacher. The assistant then collected each container, including any food remaining on the desks, and later counted the contents.

The number of seeds or raisins was subtracted from the original number, and, as mentioned above, the subject's score was the percentage eaten of the amount of raisins (or seeds) originally in the container.

III. RESULTS

Subject Demographics

The 87 children present for all four treatments were divided into three groups according to Canadian weight for height standards (Demirjian, 1980). Twenty children fell below the 25th percentile, 44 between the 25th and 75th percentiles, and 23 above the 75th percentile. To achieve three equal groups, data used were those of the 20 "underweight" children along with those of 20 children randomly selected from the "average" group and 20 likewise chosen from the "overweights".

Mean weights and heights of these three groups totalling 60 children (32 males and 28 females) are shown in Table 1. The overweight group is the heaviest, while the average group is the tallest. Underweight subjects are, on average, the slightest as well as the shortest.

Age and sex distributions of the 60 children are shown in Table 2. While there are four times as many 6 year olds (48) as 5 year olds (12), each age is roughly equivalent in sex. Furthermore, the overweight group is predominantly male, the underweight group predominantly female, and the average group even.

Table 1

Mean Weights and Heights of 60 Children

Group[a]	Weight(kg)	Height(cm)
Underweight	18.22	110.64
Average	20.97	114.25
Overweight	22.27	112.70

[a]Each group contains 20 subjects.

Table 2

Frequency Distribution of 60 Children by Age and Sex

Group	Age 5		Age 6		
	Boys	Girls	Boys	Girls	
Underweight	5	1	1	13	(20)
Average	2	3	8	7	(20)
Overweight	0	1	16	3	(20)
Totals	7	5	25	23	

Table 3 gives the complete breakdown of percentile rankings by age and sex. The 10 children above the 95th percentile formed the "obese" group, while an equal number randomly selected from the 20 between the 25th and 75th percentiles formed the "normal" group. Heights and weights of these two groups are given in Table 4, which makes clear that, on the average, the obese were more than 2.5 kilograms heavier, while being slightly shorter than, the normal group. The ages and sexes of 14 boys and 6 girls are shown in Table 5.

Amount Eaten

The mean number of grams consumed by the obese and normal groups is found in Table 6. The actual scores used, i.e., percentage of food consumed (out of the total in each container), are found in Table 7, and the results of the analysis of variance of the percentage scores (performed through a BMDP-77 program) in Table 8.

Although the obese sample consumed about 22% more food than the normal (means of 52% vs. 42.6%), this difference, and thus the main effect of weight, is not significant, $p > .05$.

Over 42% more food was eaten in the high preference (mean=55.6%) as compared to the low preference (mean=39.0%) conditions. Furthermore, about 28% more food was consumed

Table 3

Percentile Rankings of 60 Children According to Canadian Weight for Height Standards (Demirjian, 1980)

%ile	Age 5		Age 6		(Cumulative)
	Boys	Girls	Boys	Girls	
0 - 5	1			3	(4)
5 - 10	1			1	(6)
10 - 25	3	1	1	9	(20)
25 - 50		1	6	4	(31)
50 - 75	2	2	2	3	(40)
75 - 90			2		(42)
90 - 95		1	6	1	(50)
95 - 100			8	2	(60)

Table 4

Mean Weights and Heights of 20 Children

Group[a]	Weight(kg)	Height(cm)
Normal	21.04	115.03
Obese	23.68	114.1

[a]Each group contains 10 subjects.

Table 5

Frequency Distribution of 20 Children

by Age and Sex

Group	Age 5		Age 6		
	Boys	Girls	Boys	Girls	
Normal	1	2	5	2	(10)
Obese			8	2	(10)

Table 6

Mean Number of Grams of Food Consumed

by Normal and Obese Children

Group	Low Preference		High Preference	
	Low Effort/High Effort		Low Effort/High Effort	
Normal	5.93	5.32	22.29	21.01
	(2.62)	(2.63)	(11.21)	(12.12)
Obese	7.96	6.17	32.09	19.73
	(3.08)	(3.87)	(11.91)	(8.07)

Note. Standard deviations are in parentheses.

Table 7

Percentage of Food Consumed

by Normal and Obese Children

Group	Low Preference		High Preference	
	Low Effort	High Effort	Low Effort	High Effort
Normal	.365	.327	.521	.491
	(.161)	(.162)	(.262)	(.283)
Obese	.490	.379	.750	.461
	(.190)	(.238)	(.278)	(.189)

Note. Standard deviations are in parentheses.

Table 8

Analysis of Variance of Percentage Data of Obese and Normal Subjects

Source	SS	df	MS	F
Weight(A)	.177	1	.177	2.8
Preference(B)	.545	1	.545	7.43**
Effort(C)	.272	1	.272	8.87**
A x B	.001	1	.001	.01
A x C	.138	1	.138	4.49*
B x C	.036	1	.036	1.01
A x B x C	.043	1	.043	1.20

*$p < .05$

**$p < .01$

in the low effort (mean=53.1%) as compared to the high effort (mean=41.5%) condition. The manipulation checks of these effects of preference and effort show both to be significant, $p < .01$. Therefore the assumptions underlying the design of both the preference conditions and the effort conditions, appear to be well founded.

As for the four interactions, only the weight x effort one is significant, $p < .05$. This interaction is illustrated in Figure 1, where it can be seen that in the high effort condition the obese and normals consumed about the same amount (42% vs. 40.9%). There is a considerable difference, however, in the low effort condition, with the obese consuming almost 40% more food than normals (62% vs. 44.3%). The method of the least-significant difference (Winer, 1971) was used to compare the differences among these four means (the formula is

$$t = \frac{\bar{T}_i - \bar{T}_j}{\sqrt{2\, MS_e / n}}).$$

The MS_e for this interaction is .03067 and n=10. The obese high effort mean was found to differ by more than the lsd (=13.5%) at p of $< .05$ from the other three means, and therefore these differences are significant at that level. Most importantly for the hypotheses, within the low effort condition the obese ate significantly more than normals.

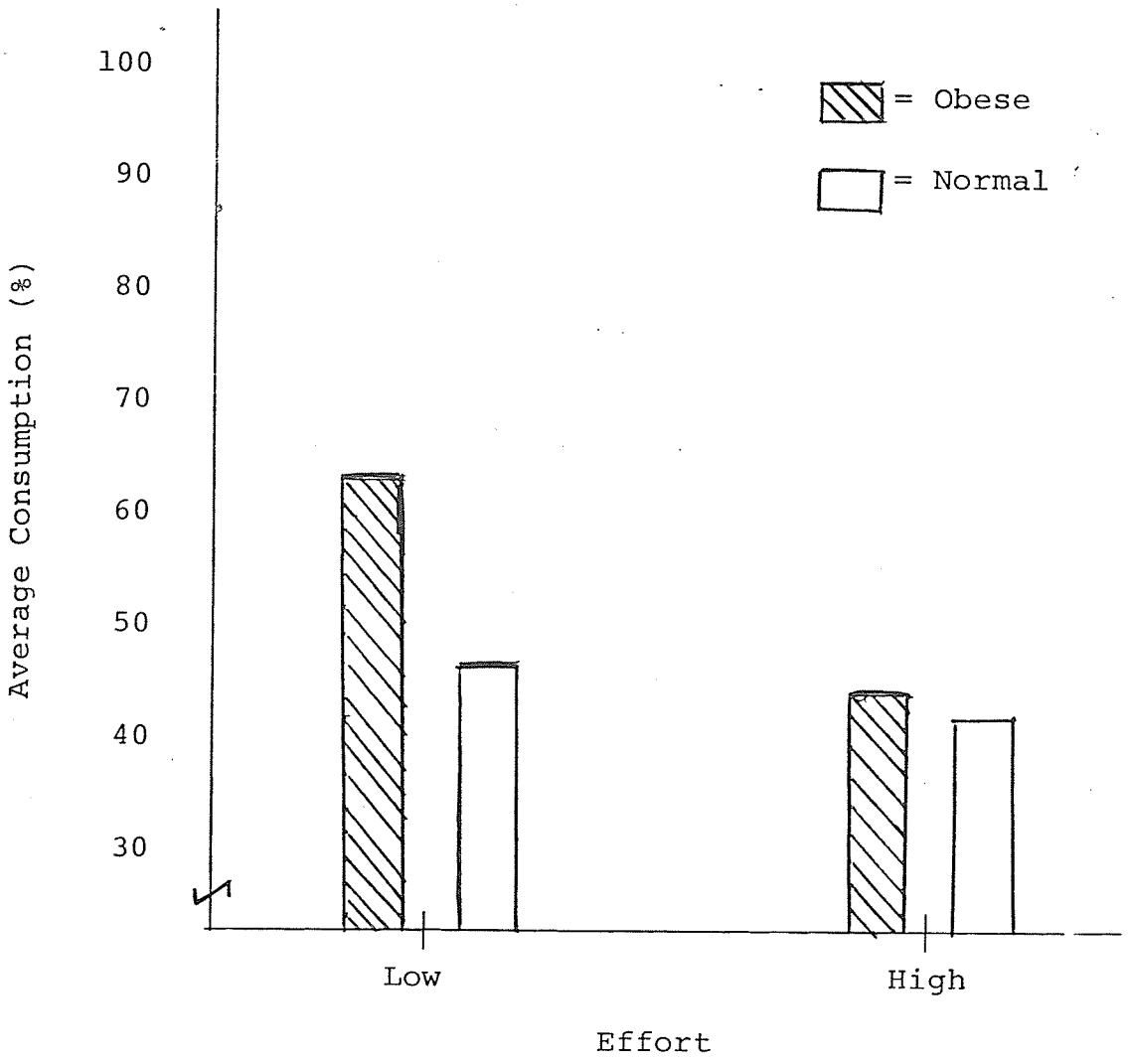

Figure 1. Obtained weight x effort interaction.

Furthermore, the obese, but not the normals, ate significantly more in the low than in the high effort condition. Of the three other interactions, none attained significance. In the weight x preference interaction, the obese ate about 26% more than normals in the low (43.5% vs. 34.6%) and 19% more in the high (60.5% vs. 50.6%) preference conditions, $p > .05$. Secondly, although no prediction was made about the preference x effort interaction, it may be noted that the difference between the low preference, low effort (42.8%) and high preference, high effort (47.6%) means, while appreciably smaller than the difference between the high preference, low effort (63.5%) and low preference, high effort (35.3%) means, is not significant, $p > .05$. Thirdly, the weight x preference x effort interaction, shown in Figure 2, did not attain significance, $p > .05$.

In sum, the results of the principal analysis reveal that the obese ate significantly more low effort food than did normals. But, contrary to predictions, the obese, compared to normals, did not eat significantly less food in the high effort and low preference conditions, nor significantly more food in the high preference condition. Thus, hypothesis 3 is supported, while hypotheses 1, 2 and 4 are not.

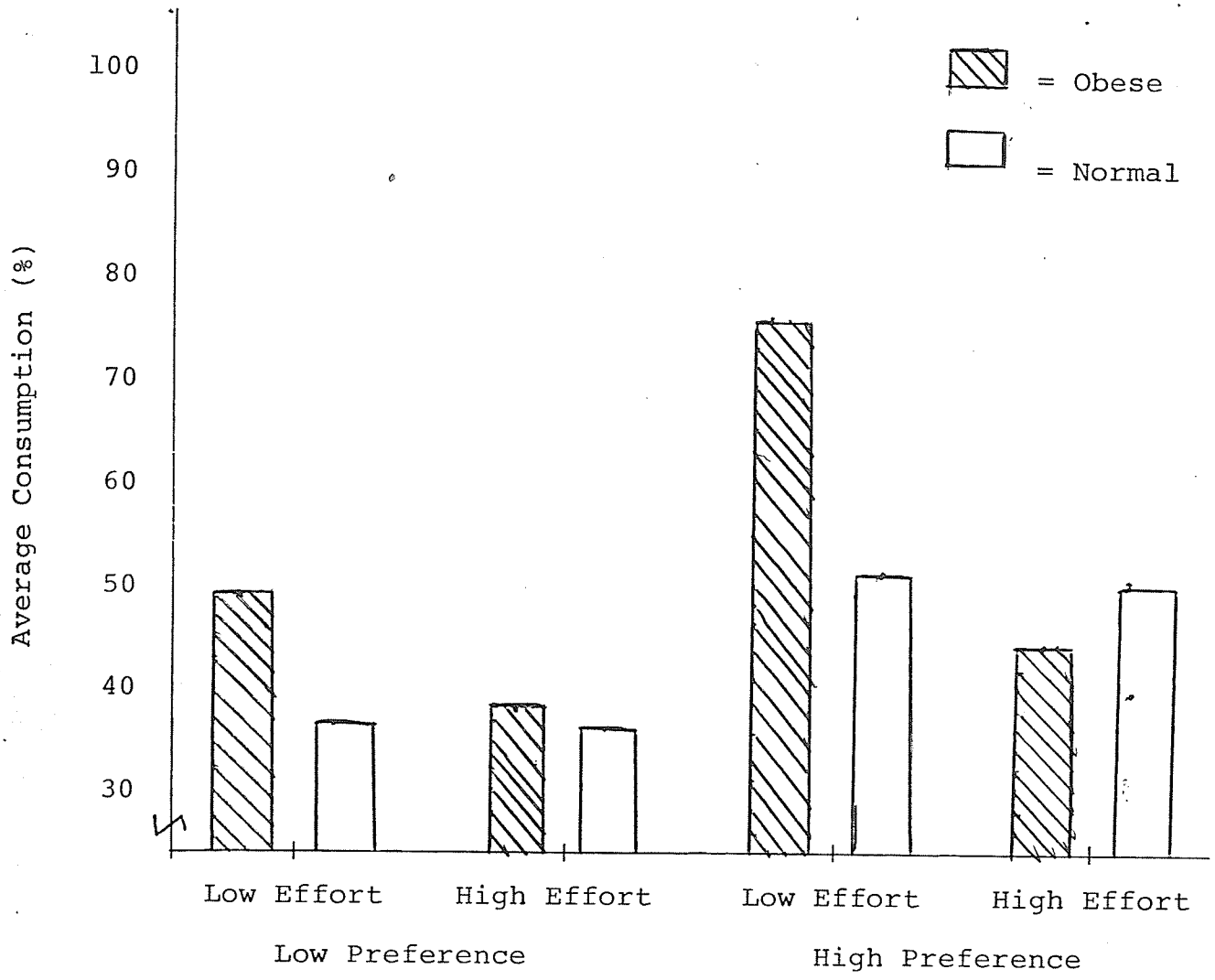

Figure 2. Obtained weight x preference x effort interaction.

A Further Analysis

Since data were available not just from the 10 obese and 10 normal subjects, but from 60 subjects spread over the weight spectrum, a second analysis using the same computer program was performed. Its purpose was to answer two questions: whether any relationships found in the smaller sample held for less overweight subjects; and whether inclusion of an underweight group would throw light on the relationships between weight and the psychological variables.

The 60 children were, as mentioned above, divided into three equal groups (underweight, average, and overweight). Height, weight, age, sex and percentile data were displayed in Tables 1 to 3. Table 9 gives the grams of food consumed by the three groups, and Table 10 the percentage consumed. Results of the analysis of variance of the latter data are given in Table 11.

Data from the 60 subjects show significant main effects of preference and effort, $p < .001$. Thus, as in the analysis of the two smaller groups, the design of the preference and effort conditions appears justified. There are no other significant effects. Therefore in a large group of children varying over the entire weight for height spectrum, none of the experimental hypotheses is borne out.

Table 9

Mean Number of Grams of Food Consumed by 60 Children

Group	Low Preference		High Preference	
	Low Effort	High Effort	Low Effort	High Effort
Underweight	7.13 (3.91)	4.37 (3.78)	23.93 (8.54)	15.63 (8.33)
Average	6.12 (2.47)	5.09 (2.68)	22.53 (10.18)	17.60 (10.07)
Overweight	7.69 (2.87)	5.50 (3.41)	22.75 (13.16)	19.30 (10.69)

Note. Standard deviations are in parentheses.

Table 10

Percentage of Food Consumed

by 60 Children

Group	Low Preference		High Preference	
	Low Effort	High Effort	Low Effort	High Effort
Underweight	.439	.269	.559	.365
	(.241)	(.233)	(.200)	(.195)
Average	.377	.313	.526	.411
	(.152)	(.165)	(.238)	(.235)
Overweight	.474	.339	.578	.451
	(.177)	(.210)	(.307)	(.250)

Note. Standard deviations are in parentheses.

Table 11

Analysis of Variance of Data

of 60 Subjects

Source	SS	df	MS	F
Weight	.150	2	.075	1.06
Preference	.771	1	.771	14.04*
Effort	1.079	1	1.079	31.86*
A x B	.003	2	.0015	.03
A x C	.086	2	.043	1.28
B x C	.008	1	.008	.22
A x B x C	.009	2	.004	.13

* $p < .001$

IV. DISCUSSION

The major findings of the present investigation provide small support for the externality theory of obesity. Three of the four hypotheses relating effort and preference to obesity are not supported. The only weight given to the Schachterian theory is in the data showing that obese children consumed significantly more low effort food than did children of average weight. And when the same hypotheses were tested in a large group of pre-schoolers varying in overweight, not even the weight x effort interaction reached significance.

Some of the special features of this study, i.e., the direct measurement of weight and height and of amount eaten; the age of the subjects, which rendered them rather invulnerable to experimental reactivity; and the quasi-natural setting, would seem to give these results added weight.

Sex differences have been noted (e.g., by Leon & Roth, 1977) as being important in the psychological study of obesity. Because of the sex imbalance within and between the obese and normal groups, it was not feasible to analyze snack consumption by sex.

The order of treatments deserves a word here. In the absence of adequate reference data for obesity determination

at the time of the experiment, and on the presumption of minimal order effects, all subjects received the same sequenced of treatments. Thus, sequence effects are confounded with variable effects. In other words, and strictly speaking, results are generalizable only to subjects receiving foods varying in the experimental order of preference and effort. If sequence effects are as presumed, then this confounding is of little moment and the results are generalizable to subjects receiving any order of foods. The children's prior history of familiarity with the behaviours of shaking and eating, as well as with the foods used, would argue for inconsequential order effects. The assumed relative novelty of seeds, coupled with their visual unattractiveness, would seem to have contributed to their low preference status. It appears immaterial, however, whether seeds preceded raisins, or, as in the experiment, vice-versa.

Obesity

One difficulty encountered by the present study lay in the determination of obesity. At the time the study was launched Canadian standards were not available for either of the two commonest methods of measuring overweight. In 1980, weight for height data were published (Demirjian), and it was the highest available percentile (the 95th)

that was taken as the index of obesity. To the present writer's knowledge, Canadian skinfold reference data are still not available.

It is somewhat surprising that, in a sample of 60 children, 10, or more than 16% were above the 95th percentile of weight for height. This number may indicate a sample bias or an increasing trend toward obesity in the ten years since the national survey was done.

Had skinfold been the determinant of obesity, experimental results may have differed somewhat, since the two methods do not correlate prefectly (Garn & Clark, 1975). Nonetheless, what these differences might have been is impossible to say.

The obese consumption of 22% more food than normals, while not significant, is easily enough to cause obesity over a period of time (Garrow, 1974, maintains that a difference in intake of only a few percentage points can effect an energy imbalance leading to obesity).

Preference and Effort

The difference between the two preference conditions held significantly in analyses of both the smaller and the larger groups. A more thorough pretest may have revealed foods with a preference differential greater than that of the 42% found in 20 children between raisins and seeds.

One can hardly speculate, however, on the effect such a differential would have made. The ideal would be use of foods individually tested as to preferability; however, such a procedure would be difficult to carry out even for 20 subjects.

A further question arises as to the comparability of raisins and seeds on all counts. For one thing, pilot testing showed that, in a limited time period, children could not consume nearly as many grams of seeds as of raisins. In the experiment, the 10 obese and 10 normal children averaged 23.78 grams of raisins and 6.34 grams of seeds (for the 60 children the corresponding figures are 20.62 and 5.99). It could be argued that this more than threefold difference was due to the greater time necessary for eating seeds rather than to a lesser preference for seeds. It was for this reason that the percentage of total seeds or raisins was used in analysis. That is, when the children were given a limited consumption time, scores of how much of the total snack was consumed would indicate relative preference for the two foods, and not relative ease of consumption.

Furthermore, the sunflower seeds, being smaller and less sticky than raisins, appeared to be more accessible than raisins in the high effort condition. The somewhat

less shaking needed to procure the seeds, however, did not diminish the difference between the effort conditions to below statistical significance.

In their review, Leon & Roth (1977) stated that, in some studies in which food preferability was shown to have interacted with obesity, the former was also contaminated by possible taste sensitivity differences between the obese and normals, brought into play by experimental instructions on taste testing. The results of this study, which did not involve tests of taste, suggest that preference or preferability of food is not a variable reliably distinguishing obese and normal populations.

The difference between the high and low effort conditions was significant in both analyses. The lidded containers, nonetheless, were not so formidable as to prevent the consumption of all raisins or seeds by a few children.

A question that arises with respect to the significant weight x effort interaction is why the obese worked as hard as normals in the high effort condition (contrary to prediction) but consumed significantly more than normals in the low effort condition (according to prediction). One possibility is that the experimental task involved

only a small amount of effort, while a tougher task would have deterred obese consumption.

Although the results of this study do not completely agree with most of the previous research on effort, this variable appears to remain important in the psychological understanding of obesity.

Theory and Practice

If, as it seems, the obese consume more readily available food than do normals, the question remains as to whether obesity precedes or follows such a consumption pattern. On the face of it the latter is the more logical alternative. Furthermore, such a pattern may be more obvious in the young of the human species because adult weight, though showing age-related trends (Garn & Clark, 1976) is relatively stable from year to year (Garrow, 1974).

The past three-quarter century increase in the prevalence of obesity in affluent countries can be related not only to the more sedentary nature of work but also to the year round availability of a great variety of foods, the proliferation of "fast food" outlets and "convenience" foods, the enticing advertisement of foodstuffs (much of it directed toward children), and the lesser proportion of family income used on food. All these social factors may be interpreted as making food easier to get and, possibly, as promoting

obesity.

Because of its social, psychological and medical costs, research is urgently needed for the understanding, prevention and treatment of this disorder. The question of which methods work best with children is still unanswered (LeBow, 1977).

The tenacious and addictive nature of obesity calls for a multidisciplinary approach to treatment and control. Some of these attempts include nutrition education, consumer awareness, social dieting (e.g., Weight Watchers), and physical activity. Within psychology, there are behavior modification plans, programs to develop a more internal orientation in the overweight, and those which make eating more of a chore (e.g., weighing or measuring one's intake, or increasing the number of chews per bite).

The results of the present study suggest that this type of approach, i.e., using the effort variable, might be useful in the treatment of the obese child.

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Appendix I: Letter of Information to Parents

Date:

Dear Parent:

The St. Paul Kindergarten has approved a small experiment to be carried out by Mr. Frank Lechowick of Summerside. The research has four parts:

a) taking the height and weight of children

b) offering the children small amounts of nutritional snacks

c) observing what kind of snack children prefer

d) measuring how much of the snack children will eat (not more than a few ounces will be given to each child).

If you have any objection to your child's participation in this project, please sign your name on the dotted line below and return this form to the kindergarten tomorrow. If you have any questions, phone _____ or _____.

Thank you.

I do not want my child to take part in this study

.....
(Signature)

Appendix II: Canadian Weight for Height Reference Data

(reprinted from Demirjian, 1980, pp. 70 & 71)

Table 55

Frequency distribution of weight (in kg) for a given height by intervals of 5 cm, for Canadian boys and girls of 5 years of age (National)

X AND :GHT	Percentiles 5	10	25	Median	75	90	95
.00M	14.6	14.6	14.6	14.9	14.9	15.3	15.3
)-105M	15.2	15.2	16.1	17.2	17.7	18.3	18.3
5-110M	17.0	17.0	17.3	17.8	19.2	19.2	19.4
)-115M	18.0	18.5	20.0	21.1	22.0	22.9	23.6
5 + M	18.7	18.7	19.8	20.0	25.0	27.1	27.1
.00F	11.5	11.5	11.9	11.9	15.9	16.2	16.2
)-105F	14.4	15.0	16.1	16.3	17.2	17.3	17.3
5-110F	15.2	15.5	16.7	17.7	18.8	20.3	20.8
)-115F	18.5	19.1	19.9	22.2	22.5	22.5	22.8
5 + F	17.7	17.7	19.7	21.0	23.6	23.6	69.0

Table 57

Frequency distribution of weight (in kg) for a given height by intervals of 5 cm, for Canadian boys and girls of 6 years of age (National)

AND GHT	Percentiles 5	10	25	Median	75	90	95
-110	16.7	16.9	17.5	18.3	18.5	18.5	19.2
-115M	15.5	17.1	18.6	18.9	20.2	20.2	20.8
-120M	18.8	19.7	19.7	22.0	22.9	25.3	25.3
-125M	20.2	20.2	20.2	23.5	24.5	24.9	24.9
05F	13.4	14.0	14.8	14.9	17.1	20.6	20.6
-110F	17.0	17.0	18.2	19.4	19.4	20.0	20.0
-115F	18.3	18.4	19.5	19.9	22.4	22.4	23.9
-120F	17.7	19.5	20.3	20.9	23.0	24.1	24.1
-125F	21.8	21.8	22.9	31.4	35.6	35.6	35.6

Appendix III: Statement of Experimental Assistant to Subjects.

"I have a snack for you. Please put your hands on your lap. I will call out your name and you will raise your hand. Do not touch the snack until I say."