THE EFFECT OF WEIGHT ON THE VALIDITY OF

3-DAY FOOD RECORDS

A THESIS

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INTRODUCTION

Since the nutritional status of individuals and populations frequently is evaluated by dietary survey methods, it is essential to know the accuracy and limitations of these techniques. The accuracy of any method is reflected in its internal validity; that is the degree to which the experimentor is able to control potential factors which might influence the data (Drew, 1976). In order to test the internal validity of dietary assessment techniques, one must have knowledge of what the individual actually consumed. Within this fact lies a potential for interference bias in that once a subject is required to scrutinize intake, dietary habits may change (Ferguson, 1974). In addition, psychological factors of the sample can influence data. Fidanza (1974) reports that study subjects frequently make memory errors when estimating quantities of food consumed. Citing from an earlier study (Becker, Indik and Beewkes, 1960) Fidanza further concludes that "people tend to remember that which is socially acceptable as contrasted to that which is not socially acceptable." Noting these problems, Nicol (1974) recommends direct observation of dietary intake to increase accuracy in dietary surveys.

Few studies have been conducted to examine the internal validity of dietary assessment methods. In analyzing data on 24-hour recalls, Madden, Goodman and Guthrie (1976) suggest a "flat slope syndrome" is reflected in the recalls of elderly subjects--small intakes tend to be over-reported and large intakes under-reported. Gersovitz, Madden and Wright (1978) further investigated the internal validity of 24-hour recalls and 7-day food records among elderly subjects. Their data for both methods indicate that the "flat slope syndrome" of Madden et al. (1976) exists.

The use of dietary survey methods such as 24-hour recalls and daily food records to determine the etiology and treatment of obesity also is widespred. One obstacle often encountered in the use of these techniques has been the difficulty in obtaining accurate records of food intake from obese subjects (Beaudoin and Mayer, 1953; Duncan, 1976). Ball, Wunderlich and Swyter (1972) note that obese patients are almost completely unaware of how much food they eat and will report restricted dietary intakes. According to that study, obese adults will insist on the validity of reported minimal food intakes even when faced with the reality that the weights could not be maintained on the low calorie regimens. Other studies using dietary recalls suggest that obese subjects report a lower caloric consumption than that reported by normal weight individuals (Huenemann, 1972; Stefanik, Heald and Mayer, 1959). However, in none of these studies was the internal validity of the recording method tested.

Differences in dietary habits between obese and normal weight individuals have been identified by several authors. Schachter (1968) reported a number of simple environmental manipulations, all of which led obese subjects to consume more of a substance than their normal weight counterparts. Gates, Huenemann and Brand (1975) in observing food choices at a university cafeteria found that obese individuals tend to select more of their servings from high calorie foods than do non-obese subjects. In a field study on fast food selections, Birky, Dodd and Stalling (1976) observed that obese women ordered larger meals and consumed proportionally less protein than normal weight women. It should be noted that in neither of the last two studies was anthropometric appraisal of weight made.

The question thus arises as to the accuracy of actual nutrient intake reflected in daily food records maintained by subjects, particularly if weight is considered as a pot-ential bias factor. This study was conducted to determine if 3-day food records maintained by obese adults differed significantly from those maintained by normal weight adults.

PROBLEM STATEMENT

The problem investigated in this study was: Does the validity of reported food consumption vary, in a hospital setting, between obese and normal weight adults, as measured by a comparison of recorded and observed 3-day food records?

DEFINITIONS

Obese Subjects: For the purpose of this study, an obese person is an individual who is 20% or more over his recommended weight for height according to the Statistical Bureau of the Metropolitan Life Insurance Comoany.

Normal weight subjects: For the purpose of this study, a normal weight person is an individual who met his recommended weight for height according to the Statistical Bureau of the Metropolitan Life Insurance Company.

Food record: For the purpose of this study, a food record is a self weighed or measured account of all foods and beverages that a subject consumes for a given period of time.

24-hour recall: For the purpose of this study, a 24-hour recall is a dietary assessment method in which subjects recall all food and beverage items consumed within the past 24 hours.

HISTORICAL PERSPECTIVE

A multitude of treatments have been devised to control the major health problem of obesity. Evaluation of obese individuals and the establishment of a trusting working relationship between the client and health care provider are essential in order to develop rational treatment programs.

Evaluation of the "obese personality" has been ascertained based upon clients seeking medical or psychiatric help for their eating problem. Of the behavioral disturbances to which the obese are subject, Stunkard and Mendelson (1967) report that "only two seem to be specifically related to their obesity. The first is overeating, the second is a disturbance in body image" (p.1296). Of their clients seeking psychiatric counseling, many reported negative to loathsome feelings toward themselves. These obese individuals viewed weight as an affective handicap and were usually preoccupied with size. The subjects had a tendency to see the world in terms of weight, envying thin people and hating other obese.

The same type of attitudinal differences were noted with obese and non-obese teenagers (Falkner and Kay, 1971). Normal physiqued males had significantly higher self concepts that did obese subjects. Non-obese subjects were also found to be more mature than their obese counterparts (Karpowitz and Zies, 1973). However, obese teens agreeing to participate in a weight control program reported significantly fewer "very troublesome" emotional problems and snacked less in a controlled environment than did those obese teens not wishing weight control.

In addition to attitudinal differences concerning self-concept, obese individuals also demonstrate eating behaviors that vary from those of normal weight subjects. It appears that the obese may be affected by external stimuli to eat (time, taste, convenience, etc.) while non-obese are more aligned with internal stimuli (gastric motility, blood constituients) (Schachter, 1968). Usually normal weight subjects report hunger coinciding with gastric motility while obese subjects do not (Stunkard, 1967). Bruch (1962) speculates that obese subjects mistake hunger for other emotional states such as anxiety, fear or anger.

Indeed, bodily states of satiety appear to have little effect in diminishing food intake in the obese. Goldman, Gordon and Schachter (1967) report that obese subjects eat more food on full stomachs than they do on empty stomachs. When an element of fear is introduced, food intakes of the obese increase while those of normal weight subjects decline. The taste of a food item will enhance or decrease the amount of food an obese person will consume. When food is dull or uninteresting, obese subjects eat virtually nothing while the taste has no effect on food consumption of non-non-obese (Hashim and VanItallie,1966). When a food is rated as tasting "good", obese subjects eat significantly more than if a food is rated as tasting "bad" (Nesbitt,1967). The taste of food has no effect on the amount consumed by normal weight subjects.

In addition to environmental manipulations that affect eating behavior, the actual method of consuming food may vary with weight. Observations conducted in natural settings (restaurants, fast food chains and cafeterias) report that obese subjects select more servings of food than do other body builds (Gates, Huenemann and Brand, 1975). Consumption of food is higher with these individuals as well. Obese restaurant patrons will order larger meals and consume significantly more food than do normal weight patrons (Marston, Londen and Cohen, 1975; Birky, Dodd and Stalling, 1976).

Intrinsic factors associated with variances in weight appear centered around self-concept and the attitudinal or behavioral differences one has toward food. Obesity occurs because of an imbalance between caloric consumption and physical exertion. However, assessment of the obese, based on self reported dietary intakes, indicate the opposite, i.e. that the obese do not consume more food than normal weight subjects and in many cases report consuming less (Johnson, Burke and Mayer, 1956; Huenemann, Hampton, Shapiro and Belinke, 1966; Mayfield and Konishi, 1966). Stunkard (1968) in reviewing problems connected with experiments on obese humans, notes that few overweight subjects present a picture of being out of control with their eating.

In describing ways to improve dietary interviewing techniques, Trulson, Walsh and Caso (1947) suggest that self-reported diet histories of obese clients may be inaccurate. These investigators further note that clients who indulge in under-reporting "may attach a great deal of importance to food, but may feel a sense of guilt or shame in admitting over indulgence of food" (p. 945). Beaudoin and Mayer (1953) while clarifying the validity of self reported food records, noted that reliable dietary information was difficult to obtain from obese women. Caloric intake for these women varied, depending on the method used to extract information. According to Beaudoin and Mayer, the value of food records:

> may be vitiated as far as the obese groups are concerned by one or both of the following factors: (a) inability of obese women to disclose their true intakes of food without prodding and (b) influence of the food record during the day studied (p. 31).

When using a record method to obtain dietary data, obese women tend to underestimate the amounts that they eat.

One-day food records were compared to research interviews on obese pregnant women in 1954 (Van den Berg and Mayer). Again the diet interviews resulted in greater caloric, fat, protein and carbohydrate intakes than did the one-day food records. The authors attribute under-reporting to inaccurate descriptions of the food amounts and pointed out that one-day food records may not be representative of long term habits, i.e., "the mere fact of recording the food eaten acts as a check on intake" (p. 1243).

Several studies have compared eating patterns and activity levels of obese and non-obese adults using 7-day food and activity records (Mayfield and Konishi, 1966; Lincoln, 1972; and Mayer and Pudel, 1972). No significant differences in caloric consumption or activity levels were found between obese and non-obese subjects. Reise (1973) using research interviews compared food intakes of obese and normal weight adults. Again, no significant differences in caloric or nutrient consumptions were found. These authors suggest that the obese may underestimate intake and recommend that new techniques for obtaining dietary information be devised.

During the 1950's and 1960's, a number of studies were conducted using teenagers as the subjects to assess the relevance of food intake and physical activity in the development of obesity. Johnson, Burke and Mayer (1956) found that obese high school girls reported consumption of less food than their normal weight counterparts. Again, the authors note that the assessment of caloric intake in the obese is very difficult due to the tendency of these subjects to underestimate food intake. Huenemann, Hampton, Shapiro and Mitchell (1967) reported on variations in nutrient intake in teens using 7-day food records. Average sized males and lean males reported higher caloric intakes than did other body builds. In this study, no correlation was found between caloric intake and weight. The authors note that obese individuals may have been motivated to eat less than usual during the recording periods.

Ball, Wunderlich and Swyter (1972) interviewed hospitalized obese concerning daily food intake. These investigators report that the obese individuals were "almost completely unaware of how much they ate" (p. 87). When asked to keep a food record, the authors likened the results to low calorie diet patterns that the clients may have been on in the past. These writers suggest that retrospective diet histories are almost useless in evaluation of the obese. Bray, Zachary, Dahms, Atkinson and Oddie (1978) compared direct measurment of food intake to diet histories on hospitalized obese patients. In this study, the recalled histories were found to be as much as 30% below true caloric intakes.

The most common problem in the studies reported in the previous literature involves the basic doubt of investigators that dietary records submitted by obese clients truly reflect actual food intake. It has been difficult to ascertain the validity of food records and 24-hour recalls even when removing an individual's weight as a bias factor.

Scrutiny of home intake is used as a basis for analyzing nutritional status of populations and developing nutritional programs to deal with the results. Commonly used methods for obtaining dietary information include: weighed food records, 3-,7-,and 14-day food records using household measures, interview diet histories, 24-hour recalls and one-day food records (Burke, 1947).

Sources of error occur in all types of recording methods. Turner (1940) concludes that food records can be inaccurate because of poor estimates in amounts eaten, poor measurment of food (unstandardized tools), estimation rather than actual measurment of food, omission of commonly used foods and variations in the way foods are prepared or stored. McHenry,Ferguson and Gerland (1945), in a study using 7-day food records, further note that exceptional dietary intakes can occur when subjects are being watched because eating patterns change. Two conclusions of these authors are: (1) that records kept for less than seven days decrease in reliability, and (2) that the validity of any food record should be questioned in terms of whether it presents a true picture of sustained food habits. Beal (1967) compared food consumption data procured from 24-hour recalls, food records and diet interviews taken from children. Obtaining valid information was noted to be difficult due to errors of "observation, memory and consciously or unconsciously exaggerating or minimizing intake" (p. 426). Findings by this author suggest that subjects do not like to keep records for longer than three days and that records frequently omit staple foods such as "butter, gravy, salad dressings and beverages" (p. 427). Beal notes that 24-hour recalls administered without warning are "simple memory tests rather than nutritional surveys" (p. 427) because few people have reason to remember what they eat. Fidanza (1974) basing his conclusions on randomly administered 7-day food records and 24-hour recalls used for cardiovascular research in Italy, finds dietary surveys of limited use for evaluation of individual nutritional status because of thr following possible errors:

(a) measurment and evaluation of food stuffs consumed--errors in weighing, using and reading scales, recording the weights, calculation of quantity of food consumed.

(b) supression or distortion of memory in recall methods--people forget information at a negatively increasing rate. They also supress memories of situations which do not match their general image.

(c) surveys cover limited periods of time--
records of less than seven days are limited
to use where diets are homogeneous and
one is interested in group rather than
individual means.

(d) utilization of nutrients by the body varies.

(e) composition tables used for the calculation
of nutrient intakes usually do not compare
with the composition of the food consumed. (p.105).

Questions concerning how may and which days of food records should be accepted for study were addressed by Chalmers, Clayton, Gates, Tucker, Wertz, Young and Foster (1952). Using 7-, 8-, and 14-day food records, interview diet histories and 24-hour recalls, these investigators compared the methods for daily differences. When evaluating group means (population intakes) it was found that the results from the one-day records were not significantly different from those of 7-day records and were sufficient to indicate a population's nutritional status. For group evaluations, there were no significant differences found among records obtained on different days of the week. The authors thus concluded that one-day records taken on any day of the week would give an accurate picture of a group's intake and that rather than increase the number of days in a survey, it was more beneficial to increase the number of subjects to obtain accuracy. However, when evaluating an individual's status, it was found that the length of surveying and the days used vary from individual to individual. For this type of assessment, the authors recommend using consecutive days and recording periods of more than one day.

Duration of food records was also examined by Trulson (1955). Comparing 3-day and 7-day food records obtained from children, the author concludes that intragroup variations in daily intakes are great and recommends using study periods of more than three days to increase the stability of group means. In comparing results obtained from 24-hour recalls, 7-day food records and interview diet histories, Young, Hagen, Tucker and Foster (1952) found that 24-hour recalls reported simuliar intakes as those of 7-day food records. However, estimates of food intake obtained from diet interviews were significantly higher than those obtained from the records or recalls. Using the diet history as a basis of comparison with 24-hour recalls, 3-day recalls and 7-day food records, Trulson (1954) examined the dietary intake of seven to twelve year old children. Again the records and recalls were found to disagree with the diet interviews by at least 20% for every nutrient and usually underestimated intake.

In addition to concern over the duration of recording periods, intraindividual variations in daily or weekly food consumption have been cited as reasons for inaccurate analysis of food records. Generally, for group comparisons, there are no significant differences between food intakes on different days of the week (Adelson, 1960; Balough, Kahn and Medalie, 1971). However, for individual assessment, there are significant differences between food intake on different days of the week (Adelson, 1960; Hankin, Reynolds and Margen, 1967). These investigators indicate that the large differences in daily eating patterns will lead to inaccurate results when assessing an individual's nutritional status.

Thus far in this review, research reported on dietary survey methods has been limited to recounts of the methods' inaccuracies, concerns over how many and which days to include, and intraindividual eating differences which cause heterogenous diets to be studied. Validity tests of these survey methods are few in number due to the difficulty of creating a situation where intake can be observed without disrupting normal lifestyle. In other words, tests for internal validity require that the record, interview or recall be compared to intake ascertained without the subjects' knowledge or to some method of chemical analysis on the same foods consumed by the subject.

Using chemical analysis as a baseline, Bransby, Daubney and King (1948) conducted a validity study comparing the accuracy of weighed food records, 24-hour recalls and measured food records in obtaining dietary information from ten to fifteen year old children in an institutionalized setting. When compared to chemical analysis, the recalls and records overestimated intake for all nutrients except iron and protein. However, when compared to one another, the recalls and records were in good agreement as to intake.

Tests on record validity were conducted to compare calorie intake as reported from food records and calculated from standard food samples to calories as measured by bomb calorimeter (Groover, Boone, Houk and Wolfe, 1967). When compared to the bomb readings, 7-day food records of supervised and unsupervised volunteers overestimated caloric intake as did calculations on the food samples using composition tables. Although the authors admit to some inaccuracies with the calorimeter, the speculation was made that errors in food records occur due to mistakes made in collecting data from subjects and erroneous use of composition tables.

24-hour recall accuracy was assessed by Emmons and Hayes (1973). Using school children, these investigators compared recalled intake to that reported by mothers and actual observed intake from school lunch trays. Mothers and children generally agreed upon the number of times servings from a certain food group were eaten. When comparing recalls to observed intake, some items were omitted from the recalls while others, presumably from a previous meal, were added. Secondary items like butter, bread, etc. were harder to recall concurring with Beal (1967) that staple food items are omitted from memory.

Using paired t-tests and regression analysis, Linusson, Sanjur and Erickson (1974) conducted a validity test on 24-hour recalls. Recalls taken from hospitalized, lactating women were compared to weighed portions of food served and not eaten by the same subjects. Comparisons of quantities were made for food categorized into 14 groups. The t-test results showed that 24-hour recalls underestimated intake on eight of the fourteen groups. Regression analysis demonstrated that recalls underestimate when food consumption is high and overestimate when food consumption is low.

Using elderly subjects, Madden, Goodman and Guthrie (1976) also attempted to validate 24-hour recalls. These investigators compared recalled dietary intake to that obtained by observation of actual intake at a congregate meal setting (lunch). Paired t-test results indicated no significant differences between the recall and actual observed intake except for caloric consumption. For that nutrient, the recalls underestimated actual intake. When regression analysis was used, significant differences between recall and actual intake were found for protein, calories and Vitamin A. This analysis also demonstrated a "flat slope syndrome" where small intakes were over-reported and large inatkes under-reported.

Goodman, Madden and Wright (1978) tested the validity of 24-hour recalls and 7-day food records as compared to observed intake at a congregate noon luncheon. Paired t-test results showed that the 24-hour recalls overestimated all nutrient intakes but only to a significant level for protein. The same test results for the 7-day food records showed an underestimate of intake, to a significant degree only for calories and thiamine. Linear regression analysis for both methods again showed the "flat slope syndrome"--high intakes were under-reported and low intakes over-reported. The first few days of the food records were less prone to the syndrome. Validity decreased sharply with the fifth, sixth and seventh days. Gersovitz, et al. suggest that records kept for longer than three or four days are inaccurate. These authors also note that the current methods for collecting nutritional data can result in false negatives in studies used to assess the impact of nutritional programs. The methods are prone to under-estimates of food comsumption by subjects.

In summary, the literature suggests that there are differences between obese and normal weight individuals in terms of the body image attitudes and their eating behaviors. Though obesity is generally thought to occur because of excessive caloric intake, studies comparing the reported food consumption of obese individuals with their normal weight counterparts show no significant differences between the two groups. This has led investigators to speculate that the obese either do not accurately record intake or that eating habits change during the recording period.

This type of error has been noted, regardless of a subject's weight, in many methods of obtaining dietary data. Validity studies on 24-hour recalls and 7-day food records suggest that subjects either overestimate or underestimate intake. Other authors have suggested various lengths of recording periods to help increase the accuracy of food records. It appears that as the recording period lengthens, however, accuracy decreases. The recording periods of two to six have yet to be throughly evaluated.

HYPOTHESES

The statistical hypotheses evaluated in this study at the $p < .05$ level of probability are stated as follows:

1. No significant difference exists between the intakes of obese and normal weight subjects analyzed for nine nutrients.

2. No significant difference exists between the self-recorded and observed actual intakes of all subjects analyzed for nine nutrients.

3. No significant difference exists between obese and normal weight subjects in terms of self-recorded and observed actual food intakes analyzed for nine nutrients.

METHODS

Criteria

The three general criteria for subjects in this study were: (a) inpatients at the Memorial Hospital Sysytem's southwest unit, Houston, Texas; (b) normal diet prescription; (c) range in age from 35-55 years. This age group was selected for convenience in subject selection as it was anticipated that the majority of the hospitalized population would fall within that twenty year span.

Specific criteria for the sample selected in this study were: (a) meet the general criteria for subjects in this study, and (b) represent a random sampling of obese and normal weight subjects.

Facility Selection

This study involved the evaluation of 3-day food records kept by obese and normal weight patients in the Memorial Hospital System's, southwest unit, Houston, Texas. A three day recording period was selected because no validity studies have been conducted on recording periods of that length. Gersovitz et al. (1978) suggests that food record accuracy deteriorates after the third or fourth day.

The 3-day food records were evaluated for accuracy by comparing recorded data to that obtained by trained observers. Patients selected were admitted for routine testing, rehabilitation or orthopedic treatment. The menus were based on a restaurant type format, allowing the following choices:

<u>Breakfast</u>

8 Varieties of fruits or juices
9 Varieties of entrees
5 Varieties of cereals
6 Varieties of breads
9 Varieties if beverages
7 Varieties of condiments

<u>Lunch and Dinner</u>

2 Varieties of appetizers
14 Varieties of entrees
13 Varieties of vegetables
14 Varieties of desserts
6 Varieties of salads
8 Varieties of dressings
8 Varieties of breads
9 Varieties of beverages
7 Varieties of condiments

Food service production was one of a ready prepared system (West, Wood, Harger and Shugart, 1977). Food items were sent to decentralized floor kitchens where food was plated and rethermalized according to each patient's selections. Portion control was maintained through mechanical preportioning during preparation or with the use of standardized scoops and ladles in the floor kitchen units. Tray pick-up occurred after each meal. Dirty trays were brought to a holding area on each floor where they were loaded onto shipping carts and remained until they were sent to the centralized dishroom (holding time was thirty minutes to one hour). This study was conducted for thirteen series of three day recording periods covering the breakfast, noon and evening meals.

Procedure

A screening of the patients' charts and the dietetic department's kardex was made to determine patients who met the previously described criteria. These subjects were then interviewed by the investigator to verify age. At that time actual measurment of height and weight were taken by the investigator using the movable Health-O-Meter scales located at the nurses station on each floor. Patients were measured in the afternoon prior to the evening meal, dressed in light attire without shoes. If a patient was unable to get out of bed (e.g. was in traction), the chart record of admitting weight and height was used to determine obesity. During the interview, human research consent forms were administered (See Appendix A).

As it was logistically impossible to construct a precise population frame, a subject pool was formed (Drew, 1976). The size of the pool was 78 patients--34 obese and 34 normal weight, who recorded intake for the allotted three day period. From that pool, study samples were randomly selected which included 17 obese and 17 normal weight subjects. The minimum acceptable number of subjects established for the completion of this study was 15 subjects for each group.

Following selection, the investigator gave written instructions to the subjects on the method for keeping a

3-day food record (See Appendix B). Subjects were requested to state intake in terms of how much of the portion they consumed. A recording chart was furnished to each subject. The subjects then kept the record for the next three consecutive days.

At the onset of recording, i.e., the first day for which a subject was instructed to record his intake, observation of actual intake began. Prior to meal service, the investigator or a trained dietetic intern identified subjects' trays and tagged them by placing a small numbered sticker on the bottom of the tray. At that time, the subjects' menu selections were charted. Observation of tray service continued to ensure that food items placed on the subjects' tray matched their menu selections or that substitutions were noted on the charting form. Following the meal, visual appraisal of the subjects' intake, stated in terms of how much of the portion had been removed from the tray, was made. As direct knowledge of this examination may have biased the patients' recording, observation was conducted after the tray was removed from the room and brought to the shipment area on each floor. Actual intake was charted for each meal--morning,noon and evening, for three consecutive days. Prior to the implementation of this study, the investigator and one dietetic intern underwent four training sessions to standardize observations of intake measures and improve inter-rater reliablilty. Determination of food portion sizes were made using an ounce scale located in one of the floor kitchens. The regular server portioned the various food items, which were then weighed by the investigator. For prepackaged items (milk, condiments, etc.), the manufacturer's statement of weight was taken. Upon completion of the recording period, the food records were collected by the investigator. If at that time a patient stated or the record indicated that food items had been given to another person, the subject was deleted from the study. This type of event was not seen as a major problem for two reasons: (1) visiting hours did not occur during meal hours and (2) patients who indulged in this practice indicated such either verbally or on the food records.

Statistical Analysis

The independent variables (two factors) in this study consisted of:

(a) one random factor--two groups (obese and normal weight).

(b) one fixed factor--two trials (observed actual and self recorded).

Dietary data, as reported on the food records, was converted to actual weight in terms of grams and analyzed for nine different nutrients: calories, protein, Vitamin A, Vitamin C, thiamine, iron, calcium, fat, and carbohydrate. This analysis was conducted for each of nine meals using the Ohio State Nutrient Analysis computer program.

A two-factor mixed design, with repeated measures on one factor, model of analysis of variance (Bruning and Kintz, 1977) was used to determine significant differences and interaction in actual versus recorded intake for obese and normal weight subjects, $p < .05$. Statistical assumptions underlying analysis of variance include: (a) subject groups are randomly selected from a defined population; (b) subject groups are independent from one another; (c) there is a normal distribution of the variables in the population; and (d) homogeniety of variance (Bruning, et al., 1977). These criteria were met for this study.

Limitations

The research design for this study encompassed the following limitations:

(1) The population was limited to hospitalized patients, obese and normal weight, who agreed to keep a 3-day food record.

(2) Food intake and measurment by the observers was limited to visual appraisel of the amount of the portion consumed, as it was impossible to weigh tray remains.

RESULTS AND DISCUSSION

Nutrient intakes of 34 subjects (17 obese and 17 normal weight) were calculated from self-recorded and actual observed food records maintained for nine separate, consecutive breakfast, lunch and dinner meal periods. An average of four subjects per meal were eliminated from the study due to the misplacement of the subjects' trays after a given meal service. Thus, the 3-day food records of an average of 30 subjects (15 obese and 15 normal weight) were considered.

Nutrient intake differences between trials, i.e., between self-recorded and observed intake, were found to be significant (p .05) for the calorie and fat or carbohydrate intakes of: day one, breakfast and lunch; day two, breakfast and lunch; day three, breakfast (See appendix c; tables 1-3). There were no significant differences between recorded and actual intakes for the other nutrients analyzed in this study (See appendix c; tables 4-9). Mean intake values for the nutrients were summarized by meal period (See appendix c; tables 1-9). Between groups, i.e., between the intakes of obese and normal weight subjects, no significant differences were found (See appendix d). There were no significant differences found for nutrient intakes between groups by trials (see appendix d). Appendix e, figures 1-9 graphically show the lack of significant interaction between accurately reported intakes and weight classification.

Although significant F-ratios were not found in all of the analyses, several trends emerged from the data obtained in this study. On the average, nutrient intakes acquired from self-reported food records were lower than those observed to be consumed by the subjects (See table 10). This underestimation resulted in significant F-ratios for the calorie and fat or carbohydrate intakes of breakfast and lunch meals.

When classifying the nutrients in terms of the energy contributing potential, (i.e., comparing calorie, protein, fat and carbohydrate intakes to those of Vitamins A and C, thiamine, iron and calcium) subjects had a tendency to over-estimate consumption of foods with high vitamin and mineral contents (11 out of 45 analyses) more often than they over-estimated consuming foods with high calorie levels (0 out of 36 analyses) (See figure 10). There were no significant differences between actual and recorded intake however, in the over-reporting of these nutrients.

The number of significant between trial F-ratios was distributed according to days to determine if the accuracy of self-reported food records remained constant over the alloted recording periods (see figure 11). The number of

Table 10

Comparison of Recorded and Actual Intakes for Under-reporting of Nutrient Intake

Meal	Calories		Fat (gm)		CHO (gm)		Protein(gm)		Vit.A(IU)		Vit.C(mg)		Thiamine		Iron (mg)		Calcium(mg)	
	Act.	Rec.	Act.	Rec.	Act.	Rec.	Act.	Rec.	Act.	Rec.	Act.	Rec.	Act.	Rec.	Act.	Rec.	Act.	Rec.
Day One																		
Breakfast	492	494	24	22	53	42	17	16	1093	967	38	42*	.39	.38	3.1	3.2*	245	244
Lunch	759	651	33	24	98	88	25	24	3641	3749*	73	61	.48	.38	4.3	3.7	188	277*
Dinner	714	651	31	26	80	78	32	28	4916	4830	41	57*	.33	.35*	4.7	4.6	238	214
Day Two																		
Breakfast	600	513	31	24	74	59	21	21	1372	1151	66	63	.49	.48	3.7	3.2	278	253
Lunch	803	668	36	32	105	84	28	25	4756	5117*	66	59	.44	.48*	4.3	3.8	205	221*
Dinner	627	527	25	25	72	64	29	29	2316	1983	36	31	.31	.30	3.1	2.9	150	169*
Day Three																		
Breakfast	553	445	26	20	64	51	18	17	1278	1030	53	46	.53	.38	3.3	2.7	274	277*
Lunch	640	559	28	23	83	65	23	22	3031	3595*	43	33	.45	.41	3.8	3.5	142	135
Dinner	553	479	24	19	66	56	28	25	4777	3971	37	28	.28	.28	4.7	3.8	184	142

* indicates under-reporting of nutrient intake

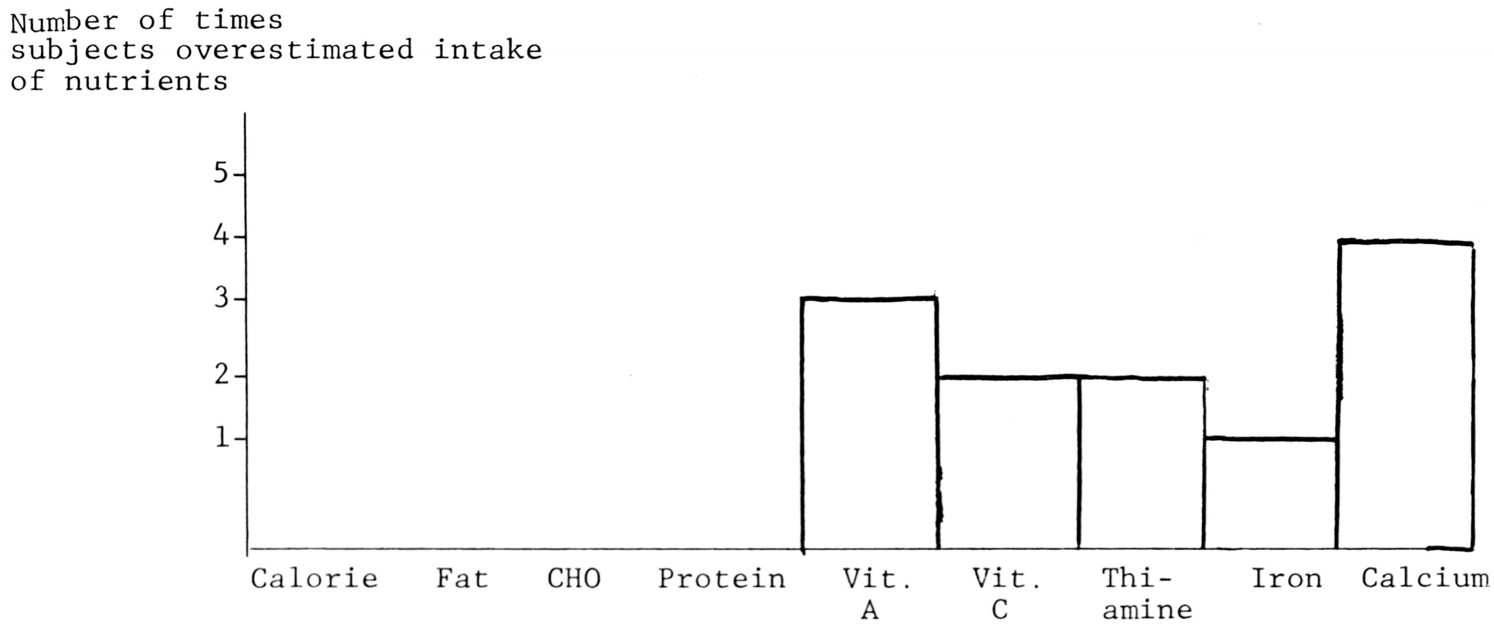

Figure 10. Comparison of mean nutrient intakes for overestimation of consumption by subjects.

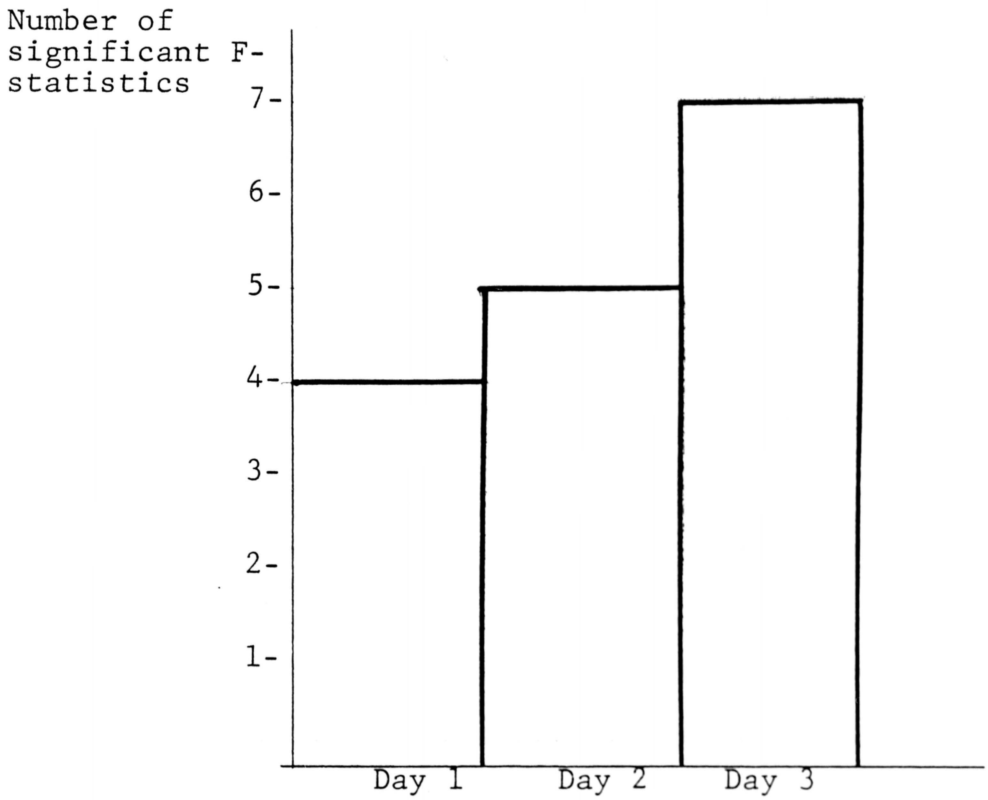

Figure 11. Comparison of Days 1,2 and 3 in terms of the number of significant between trial F-ratios which occurred that day.

significant between trial F-ratios found for day one as compared to days two and three does not suggest differences in how accurately this sample population estimated intake over the three day period. All subjects generally estimated food consumption with the same degree of accuracy on day one as on days two and three.

The number of significant between trial F-ratios was also grouped according to meals to determine if the accuracy of self-reported food records remained constant throughout a given day (see figure 12). When tabulated in this manner, the number of significant between trial F-ratios decreased throughout the course of the day. This sample population generally estimated food consumption more accurately as the day progressed.

The results of this study indicate that for hospitalized obese and normal weight subjects agreeing to keep 3-day food records, there were significant differences between self-reported and actual intakes for some of the nutrients analyzed in this study (see appendix c, tables 1-9). The F-statistic between trials answers the question: Is there a significant main effect between trials factor (Huck, Cormier and Bounds, 1974)? In this study, it would be interpreted as : Is there a significant difference between self-reported and actual nutrient intakes obtained from the

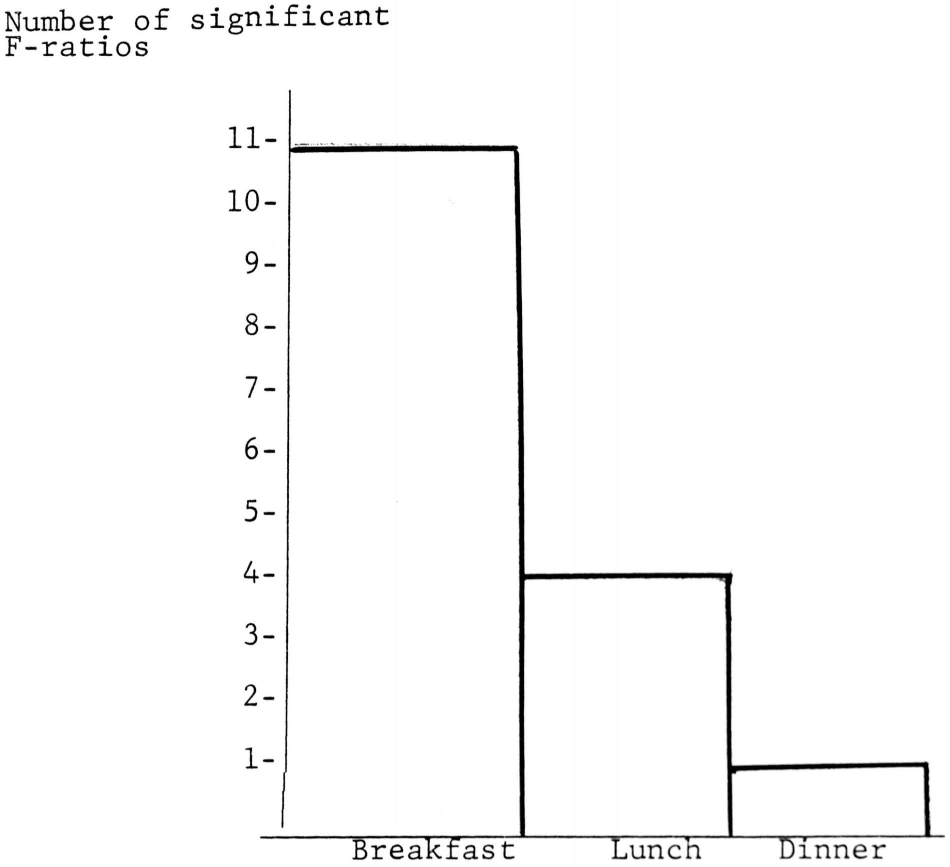

Figure 12. Comparison of breakfast, lunch and dinner in terms of the number of significant F-ratios which occurred at each meal.

subjects over a three day period? There was a trend for self-reported food records to generally understate nutrient intakes but significantly so only for the previously mentioned calorie, fat and carbohydrate intakes. These findings coincide with those of Gersovitz et al. (1978) for the nutrient intakes of groups reported by the 7-day food records.

In this sample population, there were no significant differences noted between groups. The F-ratio statistic between groups answers the question: Is there a significant main effect between groups factor (Huck et al., 1974)? In this study, it would be interpreted as: Is there a significant difference between the nutrient intake of obese and normal weight individuals? If there were such a significance, it would mean that the weight of an individual differentially affects nutrient intake when actual and recorded intakes are averaged. For the sample population, there was no data to indicate that obese subjects consumed significantly more or less nutrients than do normal weight subjects.

Whether this is indicative of regular food habits cannot be ascertained from the data, however, the caloric intakes reported here most certainly are not in accordance with the physiologic considerations of obesity. Thus, it appears that the obese subjects kept food records with some accuracy but may simply not have been consuming the kinds and amounts of foods customarily eaten. If this is indeed the case, then it may be attributed to either the act of recording dietary information or to the hospital setting. In this facility, patients are allowed freedom to choose from a wide variety of foods and are not particularly limited on the number of portions that they receive. Theoretically, they could consume simular types and amounts of food as eaten at home. Thus, the act of recording may have been a check on food intake for these obese subjects and could, therefore, be of therapeutic value in the treatment of obesity.

There were no significant differences for groups by trials within the sample population. The F-ratio statistic for groups by trials answers the question as to whether there is interaction between the two factors (Huck et al., 1974). In terms of this study, it would be interpreted as: Is there a significant difference between obese and normal weight subjects in terms of self-reported nutrient intake as compared to actual intake taken over a three day period? Said statistic, thus, represents a estimator of the accuracy of 3-day food records obtained from two different weight groups. For this sample population, there is no indication that an individual's weight influences how accurately dietary information is recorded.

For these subjects, some inaccuracies in self-reported food consumption acquired from 3-day food records exist regardless of an individual's weight. Although the results of data analysis were not always significant, there was a tendency for obese and normal weight subjects to underestimate food consumption when maintaining 3-day food records. The trend occurred more often in reporting intake of foods associated with a high calorie content than those with high vitamin and/or mineral contents.

The degree of accuracy in reporting food consumption remained constant throughout the three day recording period. However, variation in accuracy between meals indicates that the sample population estimated food consumption more accurately as the day progressed. This implies that the recording of dietary data by the subjects may have been done at the end of the day rather than after each meal period and resulted in a memory loss of the earliest meal.

The significant differences between self-reported and actual nutrient intake may have resulted from numerous causes (Turner, 1940; McHenry, et al., 1945; Beal, 1967; Fidanza, 1974; Nicol, 1974). In accordance with reports by Beal (1967) and Emmons, et al. (1973), condiments (sugar, margarine, honey, jelly, mayonnaise and salad dressings) were often omitted from obese and normal weight subjects' food records, and may have contributed to the under-reporting of fat, carbohydrate and calorie intakes. Negative media connotations are frequently associated with those nutrients and the foods that contain them. In keeping with Fidanza's view (1974), this supports the idea that the social acceptability of an item has an effect on one's ability to remember use of that item. A compounding memory loss would also contribute to the inaccuracies if subjects do indeed wait until the evening to record foods consumed (Fidanza, 1974).

CONCLUSIONS

Results of this study show that in the 3-day food records kept by hospitalized obese and normal weight subjects errors in the estimation of calorie, fat and carbohydrate intake occured. However, there were no indications that the weight of an individual influenced the degree of accuracy with which the records were kept. The data also demonstrated that the nutrient intakes of obese subjects were not significantly different from those of normal weight subjects during this recording period. Thus, for some of the analyzed nutrients, one of the null hypotheses of this study was rejected. This hypothesis was: no significant difference exists between the recorded and actual food intakes of subjects, analyzed for nine nutrients. Two of the null hypotheses for the study failed to be rejected. These hypotheses were: (a) no significant difference exists between the intakes of obese and normal weight subjects analyzed for nine nutrients, and (b) no significant difference exists between obese and normal weight subjects in terms of self-recorded and observed actual food intakes analyzed for nine nutrients.

There was a tendency for subjects to underestimate intake of all nutrients but more so for high calorie contributing foods than for those which have a high vitamin and mineral content. The degree of accuracy in the records remained consistent over the three day period. There was also a tendency for the records to increase in accuracy as the day progressed, suggesting that subjects may be waiting until the evening to complete their records.

That these 3-day food records showed some degree of inaccuracy is indicative of the problems associated with dietary survey methods. Poor estimations of intake may have occurred for a number of reasons (memory loss, inability to determine amounts consumed, social connotations connected with food items, etc.) but they most certainly existed in this study. Recognizing this, investigators implementing 3-day food records are faced with certain dilemmas in the use of that method. Recommendations for improving accuracy are not available at this time, but studies using the records should note that certain "errors" will exist in the reported data.

The study also indicated that during recording periods, nutrient intakes of obese subjects were approximately the same as those of normal weight subjects. This suggests that obesity <u>per se</u> is either connected with something other than caloric intake or that the cat of recording food intake may change dietary habits. Investigators working with obese subjects should recognize that the data received from those records may not be representative of regular food habits, i.e., these subjects recorded intake as accurately as normal weight individuals, but may have changed their eating pattern during the recording period. Thus, it may be beneficial to weigh obese subjects prior to and after the recording period to determine if caloric intake is consistant with weight maintainence.

IMPLICATIONS FOR FURTHER STUDY

The survey tool used in this study was one of many methods used to collect dietary data. This study could be conducted using other tools (24-hour recalls, 7-day food records, 1-day food records, etc.) to determine their level of accuracy.

While it was not the main thrust of this study to determine if recording intake alters food consumption, the same type of investigation could be undertaken focusing on that aspect. In that instance, subjects should be weighed prior to and after the recording periods.

Subjects in this study did not have a free choice of food vendors or of food items. Thus, the dietary selections of the subjects occured because of a preference for the available items. If an investigation of this type could be established in a natural setting, then a more comprehensive picture of dietary habits could be obtained. In such a study, greater variances in nutrient intake between obese and normal weight subjects might occur.

If this study was performed again, the investigator would suggest one revision be made in the procedure. Tray remains should be weighed rather than visually appraised to determine actual intake. This was not possible in the food service system used, but would have provided a more accurate estimation of the subjects' food intake.

With that revision, the investigation conducted on different dietary survey methods would prove worthwhile. Information extracted from such studies might lead to more accurate methods of collecting dietary information.

APPENDIXES

APPENDIX A

Informed Consent Form

My name is Sydney Morrow. I am a graduate student studying human nutrition at Texas Woman's University. For the next few weeks, I am asking approximately 100 patients to participate in a study on dietary recording.

This study involves keeping a record of everything you eat and drink for the next three days. Prior to the onset of the study, I will take a measurment of your height and weight. You will be given written instructions on the method for completing the 3-day food record and the forms on which to record your dietary intake. The actual recording will take approximately 15 minutes per day. At the end of the three days, I will collect your recording forms.

Obtaining dietary information is basic to our understanding of an individual's nutritional status. It is the purpose of this study to determine the usefulness of 3-day food records in collecting information about a person's diet. This data will help dietitians and physicians select the best method for learning about their patients' diets.

This study poses no risk or discomforts to your health. All subjects will be identified by numbers. No names will be used when collecting or analyzing data. This assures you that all information about age, weight, height or dietary intake will remain confidential. By signing this consent form, you are giving me permission to study your dietary intake in relation to others like you in this project. I will be happy to answer any questions you might have about this study.

Your participation is appreciated,

Sydney R. Morrow

I agree to participate in this research project and allow Sydney Morrow to study my dietary intake. I understand that all information will be kept confidential and will be used for this study only. My name will not be associated with any data. I understand that I may withdraw my consent at any time.

____

APPENDIX B

Instructions for Keeping the 3-day Food Record

Keeping a daily record of what you eat is really not too time consuming. It may even prove to be a pleasant and interesting diversion for you during your hospital stay. This record involves writing down everything you eat or drink during the day.

Attached to this instruction sheet is the form on which you will record your dietary intake. As you can see, it is divided into three columns. The first column is headed "Food/Drink Item". Here, write down the food you ate. For example, if you ate beets for lunch, the word "beets" would go in this column. The second column is headed "Amount". Here, write down how much of the portion you ate. "None, ¼, ½, and all" are good words to use when reporting how much of the portion you consumed. The last column is headed "Meal/Snack". Simply place a "M" or "S" in this column to indicate if the food was eaten as part of a meal or as a snack.

If you can work this into your routine, it would be best for my study if you record your intake as soon after eating as possible. Begin recording your intake tomorrow. Write down everything you eat or drink for the following two consecutive days. At the end of the third day I will return to collect your records. Thank you for agreeing to participate in this study.

Food/Drink Item	Amount	Meal/Snack

APPENDIX C

Summary Table of Mean Intakes and Analysis of Variance F-ratios for Obese and Normal Weight Subjects

Nutrient	Mean Normal Actual	Mean Normal Record	Mean Obese Actual	Mean Obese Record	Group F-ratio	Trial F-ratio	Interaction F-ratio
Day 1 Breakfast							
Calorie	494	399	489	567	.04	6.77*	1.66
Protein(gm)	16	17	18	16	.01	.57	.03
Vit. A (IU)	1062	835	1133	1138	.23	.75	.82
Vit. C (mg)	29	36	50	50	1.31	.37	.33
Thia. (mg)	.32	.33	.48	.42	.82	.36	.41
Iron (mg)	2.81	2.99	3.43	3.36	.24	.01	.05
Calcium(mg)	252	234	236	257	.00	.00	1.10
Fat (gm)	24	21	23	22	.01	1.23	.64
CHO (gm)	54	38	51	47	.06	9.94*	3.59
Day 1 Lunch							
Calorie	735	681	786	617	.00	4.05*	1.09
Protein	23	24	26	24	.33	.12	.47
Vitamin A	3223	2730	4123	4925	1.18	.08	1.33
Vitamin C	89	81	55	39	6.62*	3.74	.36
Thiamine	.46	.39	.54	.34	.00	3.53	.71
Iron	4.1	3.7	4.5	3.7	.05	2.47	.26
Calcium	191	226	183	229	.00	2.48	.03
Fat	30	25	35	22	.03	5.35*	1.16
CHO	99	92	96	82	.18	1.17	.12
Day 1 Dinner							
Calorie	697	675	734	622	.00	1.14	.51
Protein	32	31	31	25	.32	2.29	.88
Vitamin A	3988	4831	6059	4767	.19	.76	4.68*
Vitamin C	35	103	30	28	1.60	.83	1.96
Thiamine	.33	.39	.33	.29	.37	.09	1.77
Iron	4.5	5.4	5.0	3.7	.24	.22	7.09*
Calcium	208	204	238	215	.42	1.18	.88
Fat	17	20	18	19	.13	2.79	.69
Cho	79	81	83	76	.00	.06	.20

* $p < .05$

Summary Table of Mean Intakes and Analysis of Variance
F-ratios for Obese and Normal Weight Subjects

Nutrient	Mean Normal Actual	Mean Normal Record	Mean Obese Actual	Mean Obese Record	Group F-ratio	Trial F-ratio	Interaction F-ratio
Day 2 Breakfast							
Calorie	619	484	577	550	.03	6.71*	2.96
Protein	21	18	20	25	.39	.50	2.32
Vitamin A	1382	1219	1259	1068	.33	2.36	.02
Vitamin C	72	73	59	50	1.53	.14	.29
Thiamine	.57	.55	.39	.41	2.28	.00	.11
Iron	4.0	2.8	3.3	3.6	.00	1.28	4.59*
Calcium	288	259	266	273	.02	.05	.29
Fat	31	22	33	26	.26	5.05*	.05
CHO	72	57	77	62	.31	10.04*	.01
Day 2 Lunch							
Calorie	777	688	831	646	.00	7.71*	.97
Protein	25	24	30	26	.52	.96	.25
Vitamin A	4825	4244	4681	6052	.28	.16	.97
Vitamin C	71	68	60	48	1.26	.97	.33
Thiamine	.37	.37	.51	.39	.86	.52	.67
Iron	3.7	5.1	3.7	3.9	.86	.52	.67
Calcium	186	198	226	246	.06	.62	.03
Fat	33	27	39	37	1.65	1.27	.46
CHO	99	92	110	77	.03	8.49*	3.29
Day 2 Dinner							
Calorie	682	604	565	540	.33	1.53	.40
Protein	34	34	23	23	3.30	.03	.00
Vitamin A	2263	1665	2375	2343	.16	.56	.45
Vitamin C	39	33	31	28	.28	1.07	.19
Thiamine	.28	.31	.34	.29	.06	.05	.43
Iron	2.8	3.1	3.4	2.9	.06	.05	.43
Calcium	154	158	145	181	.02	.88	.59
Fat	29	24	22	26	.11	.00	2.67
CHO	76	66	67	62	.13	2.35	.19

$^*p < .05$

Summary Table of Mean Intakes and Analysis of Variance
F-ratios for Obese and Normal Weight Subjects

Nutrient	Mean Normal Actual	Mean Normal Record	Mean Obese Actual	Mean Obese Record	Group F-ratio	Trial F-ratio	Interaction F-ratio
Day 3 Breakfast							
Calorie	564	476	540	412	.20	10.99*	.37
Protein	19	18	17	16	.31	.81	.03
Vitamin A	1249	1007	1368	1053	.02	4.53*	.00
Vitamin C	56	59	49	33	.93	.64	1.13
Thiamine	.58	.43	.49	.33	.44	7.07*	.02
Iron	3.2	2.5	3.5	2.9	.28	6.69*	.00
Calcium	289	259	322	229	.59	.00	2.71
Fat	28	25	21	18	.36	6.25*	.00
CHO	67	54	66	47	.01	14.49*	2.10
Day 3 Lunch							
Calorie	592	554	691	564	.09	1.20	.36
Protein	20	20	27	25	.71	.27	.27
Vitamin A	2116	3335	4016	3875	.58	.85	1.36
Vitamin C	37	34	49	32	.17	2.68	1.19
Thiamine	.40	.36	.50	.48	.36	.24	.03
Iron	3.4	2.9	4.3	4.1	.92	.37	.13
Calcium	93	115	194	157	2.06	.12	1.91
Fat	28	23	27	23	.00	1.79	.00
CHO	73	66	93	64	.17	3.04	.97
Day 3 Dinner							
Calorie	661	576	420	539	2.65	2.62	.07
Protein	31	28	24	21	1.11	1.85	.02
Vitamin A	3192	3165	6728	4963	1.60	2.30	2.16
Vitamin C	43	28	31	29	.24	2.90	1.92
Thiamine	.32	.30	.25	.27	.28	.00	.33
Iron	5.2	3.7	4.2	4.1	.08	1.95	1.34
Calcium	220	166	145	113	1.25	6.84*	.65
Fat	29	21	17	17	1.29	1.29	1.33
CHO	78	50	70	36	2.97	2.74	.16

$^{*}p < .05$

APPENDIX D

Tables of Means, F-ratios and P Values for Actual and Recorded Intakes of all Nutrients

Table 1

Means, F-ratio and P values for Actual and Recorded Intakes for Calories

Calories	Mean Intake Actual	Mean Intake Recorded	F-ratio	P
Day 1				
Break.[a]	492	424	6.77*	.017
Lunch [b]	759	651	4.05*	.055
Dinner[c]	714	651	1.14	.296
Day 2				
Break.[d]	600	513	6.71*	.015
Lunch [c]	803	668	7.71**	.010
Dinner[e]	627	574	1.53	.226
Day 3				
Break.[d]	553	445	10.99**	.002
Lunch [f]	640	559	1.20	.284
Dinner[c]	553	479	2.62	.117

[a] $n = 23$

[b] $n = 28$

[c] $n = 29$

[d] $n = 31$

[e] $n = 32$

[f] $n = 27$

*p .05

**$\underline{p}$ .01

Table 2

Means, F-ratio and P values for Actual and Recorded Intakes for Fat

Fat	Mean Intake Actual (gm)	Mean Intake Recorded (gm)	F-ratio	P
Day 1				
Break.[a]	24	22	1.23	.279
Lunch [b]	33	24	5.35*	.029
Dinner[c]	31	26	2.79	.106
Day 2				
Break [d]	31	24	5.05*	.032
Lunch [c]	36	32	1.27	.270
Dinner[e]	25	25	.00	.970
Day 3				
Break.[d]	26	20	6.25*	.018
Lunch [f]	28	23	1.79	.193
Dinner[c]	24	19	1.29	.266

[a] $n = 23$

[b] $n = 28$

[c] $n = 29$

[d] $n = 31$

[e] $n = 32$

[f] $n = 27$

* $\underline{p}$ .05

Table 3

Means, F-ratios and P values for Actual and Recorded Intakes for Carbohydrate

Carbohydrate	Mean Intake Actual (gm)	Mean Intake Recorded (gm)	F-ratio	P
Day 1				
Break.[a]	53	42	9.94**	.005
Lunch[b]	98	88	1.17	.289
Dinner[c]	80	78	0.06	.814
Day 2				
Break.[d]	74	59	10.04**	.003
Lunch[c]	105	84	8.49**	.007
Dinner[e]	72	64	2.35	.136
Day 3				
Break.[d]	64	51	14.49**	.001
Lunch[f]	83	65	3.04	.094
Dinner[c]	66	56	2.74	.111

[a]n = 23

[b]n = 28

[c]n = 29

[d]n = 31

[e]n = 32

[f]n = 27

**p .01

Table 4

Means, F-ratios and P Values for Actual and Recorded Intakes for Protein

Protein	Mean Intake Actual (gm)	Mean Intake Recorded (gm)	F-ratio	P
Day 1				
Break.[a]	17	16	0.57	.459
Lunch [b]	25	24	.12	.732
Dinner[c]	32	28	2.29	.142
Day 2				
Break [d]	21	21	.50	.833
Lunch[c]	28	25	.96	.336
Dinner[e]	29	29	.03	.872
Day 3				
Break[d]	18	17	.81	.377
Lunch[f]	23	22	.27	.611
Dinner[c]	28	25	1.85	.185

n = 23

[b]n = 28

[c]n = 29

[d]n = 31

[e]n = 32

[f]n = 27

Table 5

Means, F-ratio and P values for Actual and Recorded Intake for Vitamin A

Vitamin A	Mean Intake Actual (I.U.)	Mean Intake Recorded (I.U.)	F-ratio	P
Day 1				
Break.[a]	1093	967	.75	.396
Lunch[b]	3641	3749	.08	.785
Dinner[c]	4916	4830	.76	.697
Day 2				
Break.[d]	1372	1151	2.36	.135
Lunch[c]	4756	5117	.16	.693
Dinner[e]	2316	1983	.56	.459
Day 3				
Break.[d]	1278	1030	4.53*	.042
Lunch[f]	3031	3595	.85	.365
Dinner[c]	4777	3971	1.85	.141

[a] $n = 23$

[b] $n = 28$

[c] $n = 29$

[d] $n = 31$

[e] $n = 32$

[f] $n = 27$

* p .05

Table 6

Means, F-ratio and P values for Actual and Recorded Intakes for Vitamin C

Vitamin C	Mean Intake Actual (mg)	Mean Intake Recorded (mg)	F-ratio	P
Day 1				
Break.[a]	38	42	.37	.549
Lunch[b]	73	61	3.74	.064
Dinner[c]	41	57	.83	.371
Day 2				
Break.[d]	66	63	.14	.714
Lunch[c]	66	59	.97	.333
Dinner[e]	36	31	1.07	.309
Day 3				
Break.[d]	53	46	.64	.430
Lunch[f]	43	33	2.62	.118
Dinner[c]	37	28	2.90	.100

n

[a] n = 23

[b] n = 28

[c] n = 29

[d] n = 31

[e] n = 32

[f] n = 27

Table 7

Means, F-ratio and P values for Actual and Recorded Intakes for Thiamine

Thiamine	Mean Intake Actual (mg)	Mean Intake Recorded (mg)	F-ratio	P
Day 1				
Break.[a]	.390	.367	.36	.552
Lunch[b]	.483	.367	3.53	.072
Dinner[c]	.329	.345	.09	.768
Day 2				
Break.[d]	.488	.484	.00	.978
Lunch[c]	.437	.484	.52	.479
Dinner[e]	.309	.297	.05	.817
Day 3				
Break.[d]	.530	.378	7.04*	.013
Lunch[f]	.446	.414	.24	.630
Dinner[c]	.284	.283	.00	.974

[a] n = 23

[b] n = 28

[c] n = 29

[d] n = 31

[e] n = 32

[f] n = 27

*p .05

Table 8

Means, F-ratio and P value for Actual and Recorded Intakes for Iron

Iron	Mean Intake Actual (mg)	Mean Intake Recorded (mg)	F-ratio	P
Day 1				
Break.[a]	3.1	3.2	.01	.
Lunch [b]	4.3	3.7	2.47	.128
Dinner[c]	4.7	4.6	.22	.645
Day 2				
Break.[d]	3.7	3.2	1.28	.268
Lunch [c]	4.3	3.8	.52	.479
Dinner[e]	3.1	2.9	.05	.819
Day 3				
Break.[d]	3.3	2.7	6.69*	.015
Lunch [f]	3.8	3.5	.37	.551
Dinner[c]	4.7	3.8	1.95	.174

[a]n = 23

[b]n = 28

[c]n = 29

[d]n = 31

[e]n = 32

[f]n = 27

*p .05

Table 9

Means, F-ratio and P values for Actual and Recorded Intakes for Calcium

Calcium	Mean Intake Actual (mg)	Mean Intake Recorded (mg)	F-ratio	P
Day 1				
Break.[a]	245	244	.00	.924
Lunch [b]	188	227	2.48	.128
Dinner[c]	238	214	1.18	.286
Day 2				
Break [d]	278	253		
Lunch [c]	205	221	.62	.440
Dinner[e]	150	169	.88	.357
Day 3				
Break [d]	274	277	.00	.954
Lunch [f]	142	135	.12	.729
Dinner[c]	184	142	6.84*	.014

[a] n = 23

[b] n = 28

[c] n = 29

[d] n = 31

[e] n = 32

[f] n = 27

*$\underline{p}$ .05

APPENDIX E

<u>Figures of Mean Nutrient Intakes for the Lunch of Day Two, Actual and Recorded Values by Obese and Normal Weight Subjects</u>

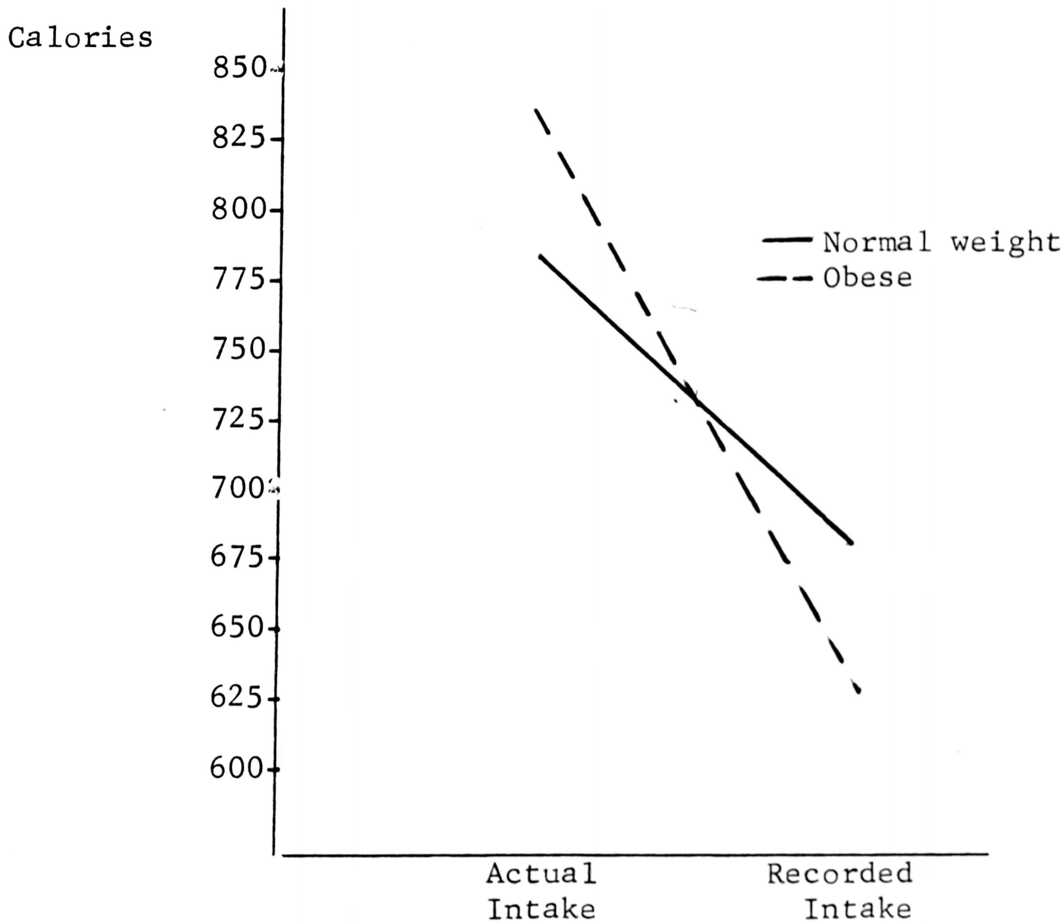

Figure 1. Mean caloric intake for lunch of Day 2, actual and recorded values by obese and normal weight subjects

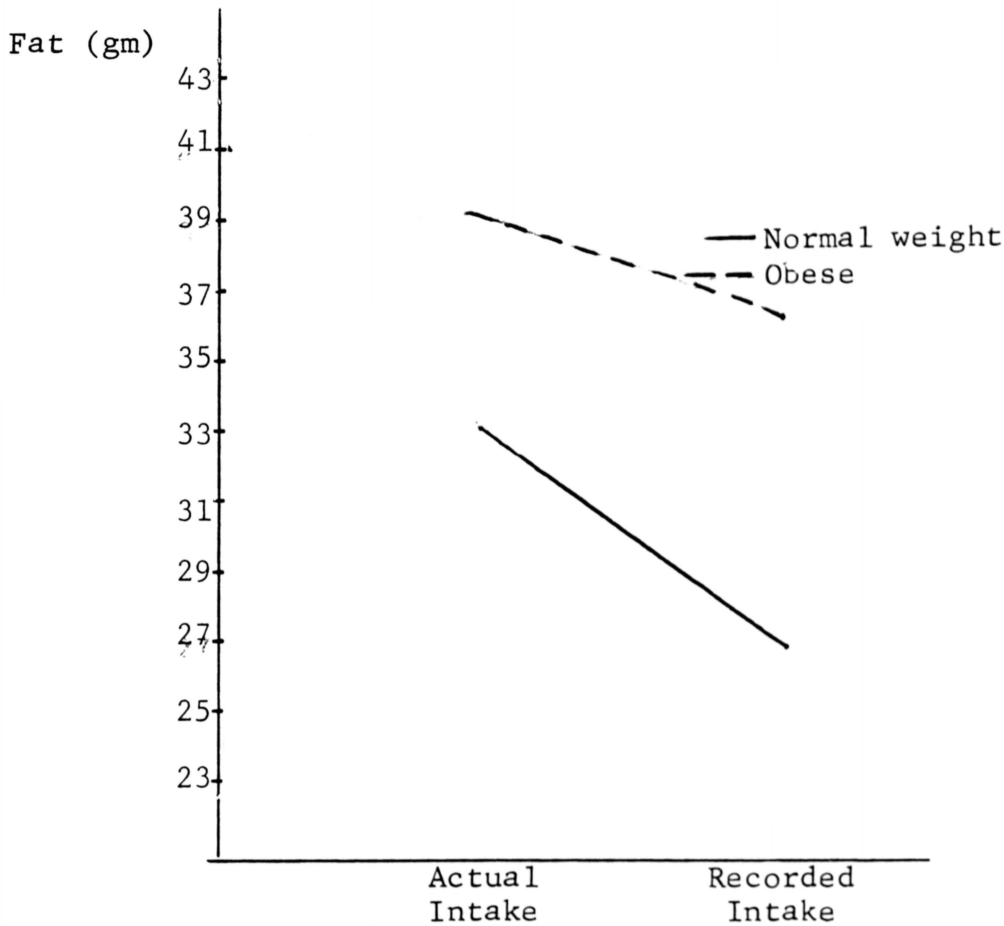

Figure 2. Mean fat intake for lunch of Day 2, actual and recorded values by obese and normal weight subjects.

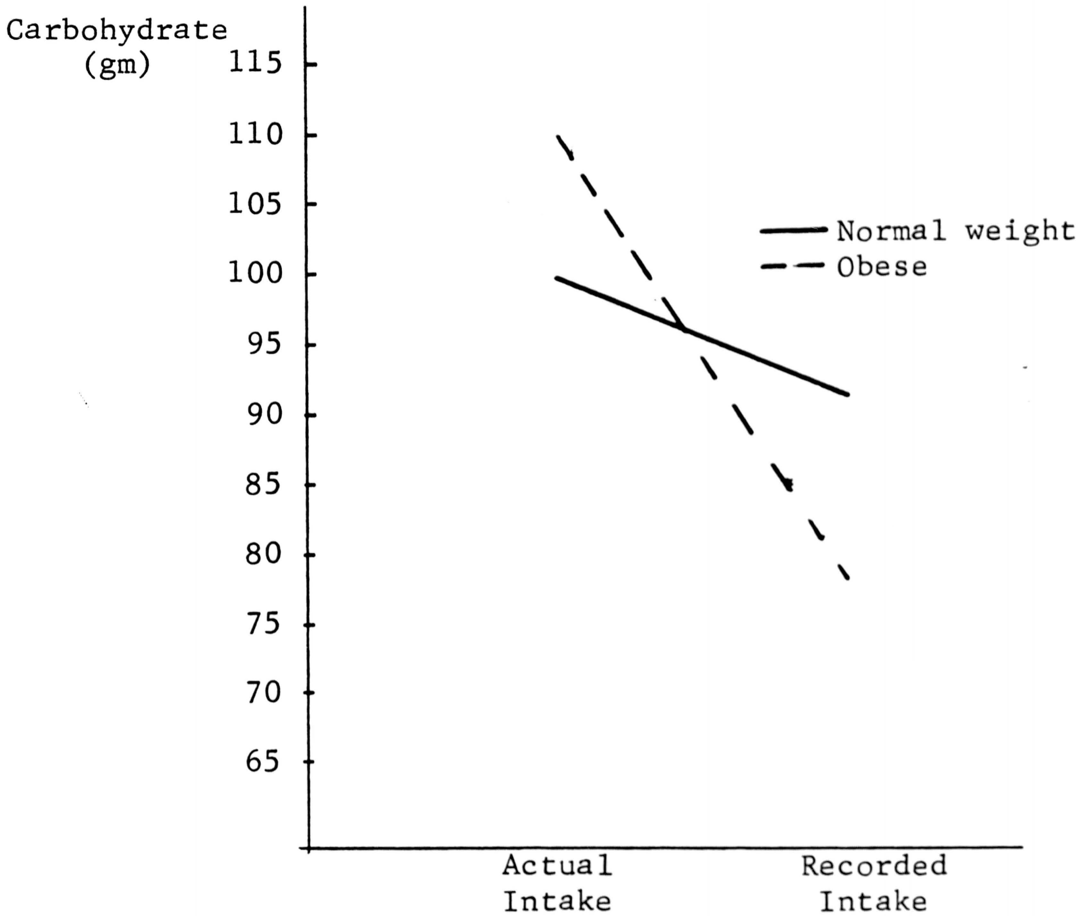

Figure 3. Mean carbohydrate intake for lunch Day 2, actual and recorded values by obese and normal weight subjects.

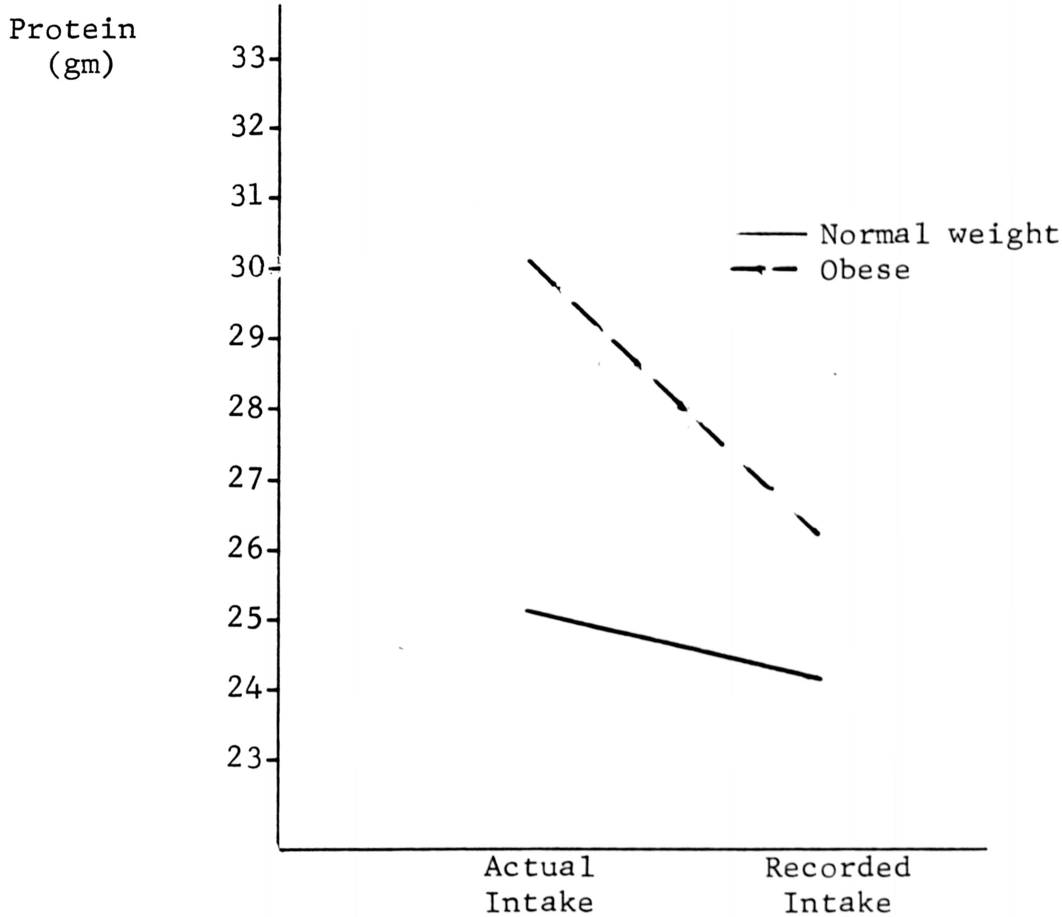

Figure 4. Mean protein intake for lunch of Day 2, actual and recorded values by obese and normal weight subjects

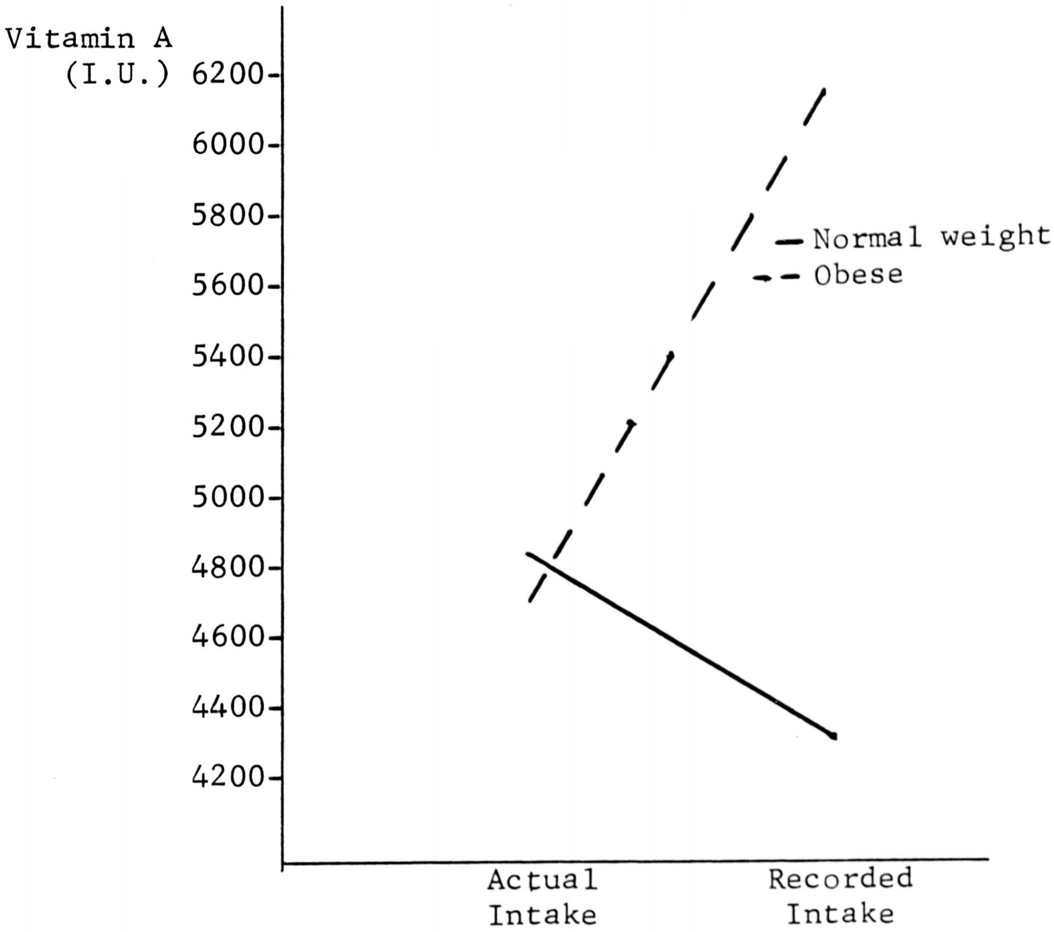

Figure 5. Mean Vitamin A intake for lunch of Day 2, actual and recorded values by obese and normal weight subjects.

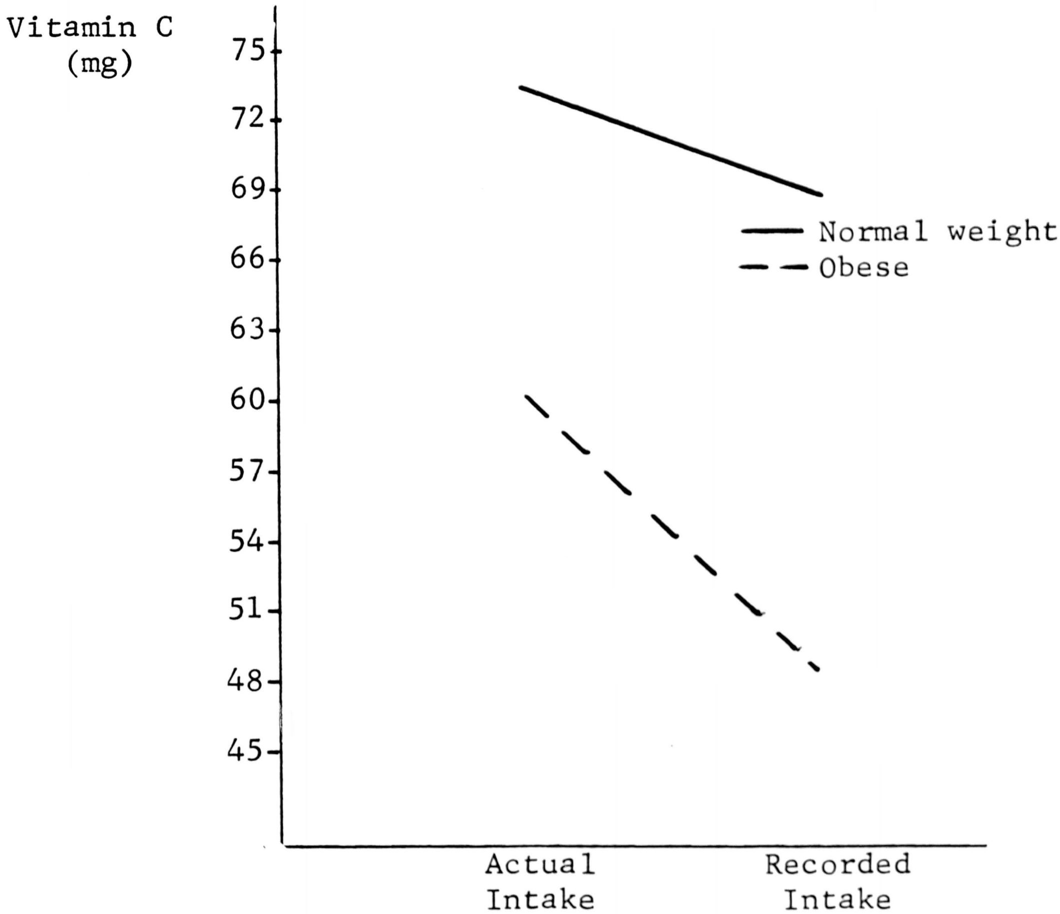

Figure 6. Mean Vitamin C intake for lunch of Day 2, actual and recorded values by obese and normal weight subjects.

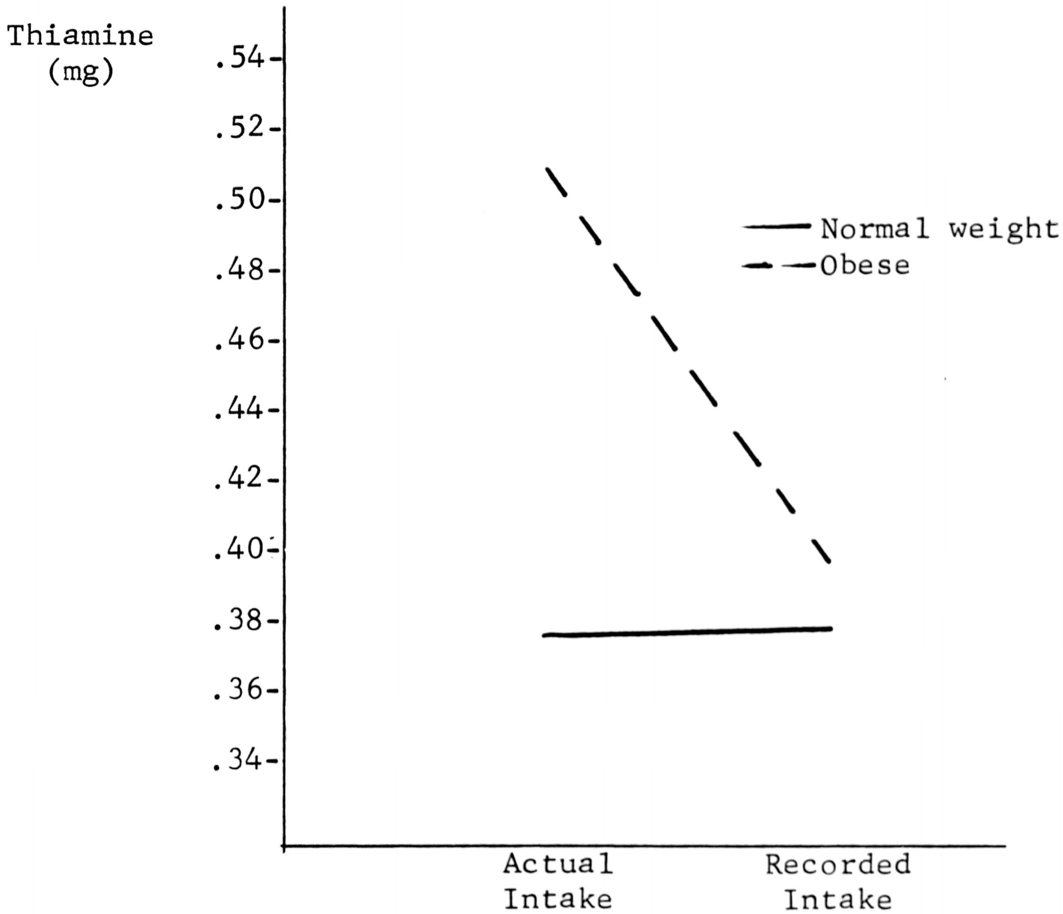

Figure 7. Mean thiamine intakes for lunch of Day 2, actual and recorded values by obese and normal weight subjects.

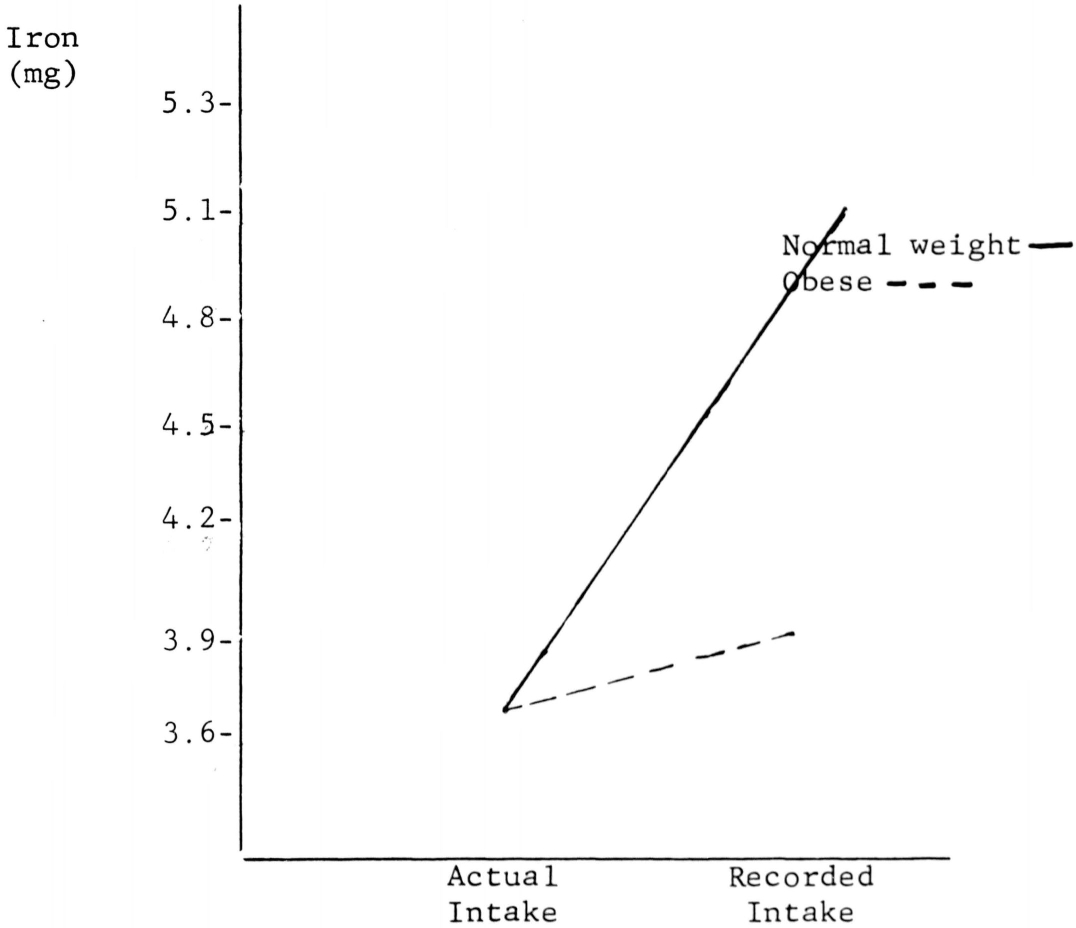

Figure 8. Mean iron intakes for lunch of Day 2, actual and recorded values by obese and normal weight subjects.

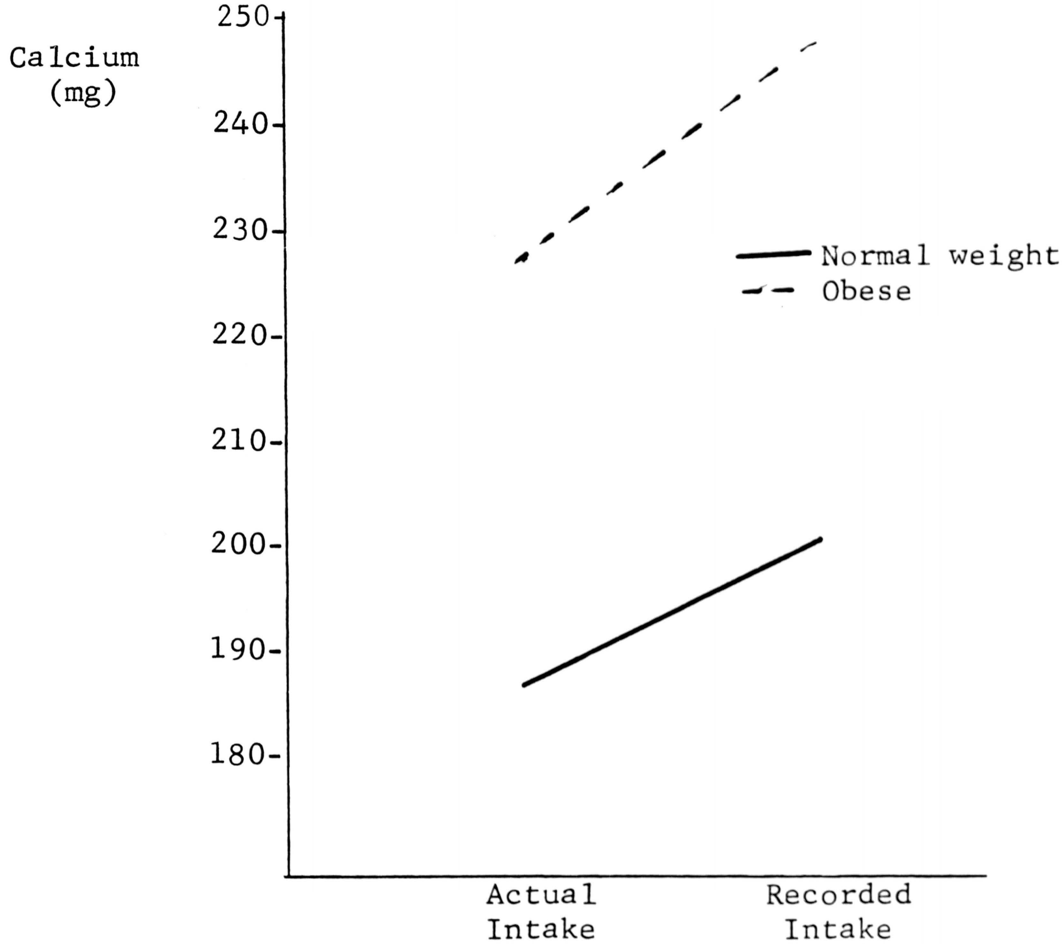

Figure 9. Mean calcium intake for lunch of Day 2, actual and recorded values by obese and normal weight subjects.

LIST OF REFERENCES

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Adelson, S.F. Some problems in collecting dietary data from individuals. Journal of the American Dietetic Association, 1960, 36, 453-461.

Ball, M.F.,Wunderlich, R.A. and Swyter, J. Problems in treating obesity. American Family Practitioner, 1972, 6, 86-92.

Balough, M., Kahn, H.A. and Medalie, J.H. Random repeat 24-hour recalls. The American Journal of Clinical Nutrition, 1971, 24, 304-432.

Beal, V.A. The nutritional history in longitudinal research. Journal of the American Dietetic Association, 1971, 51, 426-432.

Beaudoin, R. and Mayer, J. Food intakes of obese and non-obese women. Journal of the American Dietetic Association, 1953, 29, 29-33.

Bransby, G.A., Daubney, C.G. and King, J. Comparison of results obtained from different methods of individual dietary survey. British Journal of Nutrition, 1948, 2, 89-109.

Bray, G.A., Zachary, B., Dahms, W.T., Atkinson, R.L. and Oddie, T.H. Eating Patterns of massively obese individuals. Journal of the American Dietetic Association, 1978, 72, 24-27.

Burke, B.S. The dietary history as a tool in research. Journal of the American Dietetic Association, 1947, 23, 1041-1046.

Chalmers, F.W., Clayton, M.M., Gates, L.O., Tucker, R.E., Wertz, A.W., Young, C.M. and Foster, W.D. The dietary record--how many and wich days? Journal of the American Dietetic Association, 1952, 48, 711-717.

Darby, W.J. The influence of some recent studies on the interpretation of the findings of nutrition surveys, Journal of the American Dietetic Association, 1947, 23, 204-209.

Dodd, D.K., Birky, H.J. and Stalling, R.B. Eating behavior of obese and normal weight females in a natural setting. Addictive Behaviors, 1976, 1, 321-325.

Drew, C.J. Introduction to designing research and evaluation. St Louis: C.V. Mosby Co., 1976.

Duncan, C.H. The writing need not be on the wall. New Zealand Journal of Medicine, 1976, 84, 20-30.

Emmons, L. and Hayes M. Accuracy of 24-hour recalls of young children. Journal of the American Dietetic Association, 1973, 62, 409-415.

Falkner, D.W. and Kay, R.S. Self concepts, sports interests, sports participation and body type of seventh and eigth grade boys. Journal of Psychology, 1971, 78, 223-228.

Ferguson, J.M. Learning to eat, Palo Alto: Bull Publishing Co., 1975.

Fidanza, F. Sources of error in dietary surveys. Bibliotheca Nutrio et Dieta, 1974, 20, 105-113.

Gates, J.C., Huenemann, R.L. and Brand J.C. Food choices of obese and non-obese persons. Journal of the American Dietetic Association, 1975, 67, 339-343.

Gersovitz, M., Madden, J.P. and Wright, H.S. Validity of the 24-hour dietary recall and seven-day record for group comparisons. Journal of the American Dietetic Association, 1978, 73, 48-55.

Groover, M.E., Boone,L., Houk, P.C. and Wolfe, S. Problems in the quantitation of dietary survey. Journal of the American Medical Association, 1967, 201, 86-88.

Hampton, M.C., Huenemann, R.L., Shapiro, L. and Mitchell, B.W. Caloric and nutrient intakes of teen-agers. Journal of the American Dietetic Association, 1967, 50, 385-395.

Hankin, J.H. and Huenemann, R.L. A short dietary method for epidemiologic studies. Journal of the American Dietetic Association, 1967, 50, 487- 492.

Hankin, J.H., Reynolds, W.E. and Margen, S. A short dietary method for epidemiologic studies. American Journal of Clinical Nutrition, 1976, 29, 935-945.

Hashim, S.A. and VanItallie, T.B. Studies in normal and obese subjects with a monitored food dispensing device. Annals of the New York Academy of Science, 1965, 137, 651.

Huck, S.W., Cormier, W.H. and Bounds, W.G., Jr. Reading Statistics and Research, New York: Harper and Row, 1974.

Huenemann, R.L. Food habits of obese and non-obese adults. Postgraduate Medicine, 1972, 99-105.

Huenemann, R.L., Hampton, M.C., Shapiro, L.R. and Behnke, A,R. Adolescent food prectices associated with obesity. Federation Proceedings, 1966, 25, 4-10.

Huenemann, R.L., Shapiro, L.R., Hampton, M.C. and Mitchell, B.W. Food and eating practices of teen-agers. Journal of the American Dietetic Association, 1968, 53, 17-24.

Johnson, M.L., Burke, B.S., and Mayer, J. Relative importance of inactivity and overeating in energy balance of obese high school girls. American Journal of Clinical Nutrition, 1956, 4, 37-43.

Karpowitz, D.H. and Zies, F.R. Personality and behavior differences of obese and non-obese adults. Journal of Consulting and Clinical Psychology, 1975, 25, 886-891.

Lincoln, J.E. Calorie intake, obesity and physical activity. American Journal of Clinical Nutrition, 1972, 25, 390-394.

Madden, J.P., Goodman, S.J. and Guthrie, H.A. Validity of the 24-hour recall. Journal of the American Dietetic Association, 1976, 68, 143-147.

Linusson, E.I., Sanjur, D., and Erickson, E.G. Validating the 24-hour recall method as a dietary survey tool. Archives of Latin America Nutrio, 1974, 24, 277-286.

Marston, A.R., Londen, P. and Cohen, N. In vivo observation of the eating behavior of obese and non-obese subjects. Journal of Consulting and Clinical Psychology, 1975, 25, 335-336.

Maxfield, E.W. and Konishi, F. Patterns of food intake and physical activity in obesity. Journal of the American Dietetic Association, 1966, 49, 406-408.

Mayer, J. and Thomas, D.W. Regulation of food intake and obesity. Science, 1967, 21, 328-337.

McHenry, E.W., Ferguson, H.P. and Gurland, J. Sources of error in dietary surveys. Canadian Journal of Public Health, 1945, 36, 355-361.

Meyer, J.E. and Pudel, V. Experimental studies on food intake in obese and normal weight subjects. Journal of Psychosomatic Research, 1972, 16, 305-308.

Nicol, B.M. Reasons for and methods in dietary and food consumption surveys. Bibliotheca Nutrio et Dieta, 1974, 20, 69-76.

Nisbett, R.E. Determinants of food intake in man. Science, 1968, 159, 1245-1255.

Ries, W. Feeding behavior in obesity. Proceedings of the Nutrition Society, 1973, 32, 187-192.

Schachter, S. Obesity and eating. Science, 1968, 159, 751-755.

Stefanik, P.A., Heald, R.K. and Mayer, J. Caloric intake in relation to energy output of obese and non-obese adolescent boys. American Journal of Clinical Nutrition, 1959, 7, 55-59.

Stunkard A.J. Environment and obesity: Recent advances in our understanding of regulation of food intake in man. Federation Proceedings, 1968, 27, 1367-1373.

Stunkard, A.J. and Kaplan, D. Eating in public places: A review of reports of the direct observation of eating behavior. Journal of Consulting and Clinical Psychology, 1968, 45, 789-795.

Stunkard, A.J. and Mendelson, M. Obesity and the body image: I. Characteristics of disturbance in the body image of some obese persons. Journal of Psychology, 1967, 123, 1296-1300.

Trulson, M.F. Assessment of dietary study methods. Journal of the American Dietetic Association, 1954, 30, 991-995.

Trulson, M.F. Assessment of dietary study methods, variability of eating practices and determination of sample size and duration of dietary surveys. Journal of the American Dietetic Association, 1955, 31, 797, 802.

Trulson, M.F. and McCann, M.B. Comparison of dietary survey methods. Journal of the American Dietetic Association, 1959, 35, 672-676.

Trulson, M.F., Walsh, E.D. and Caso, E.K. Study of obese patients in a nutrition clinic. Journal of the American Dietetic Association, 1947, 23, 941-946.

Turner, D. The estimation of the patient's home intake. Journal of the American Dietetic Association, 1940, 16, 875-881.

Van den Berg, A.S. and Mayer, J. Comparison of one-day food records and research dietary histories on a group of obese pregnant women. Journal of the American Dietetic Association, 1954, 30, 1239-1243.

West, B.B., Wood, L., Harger, V. and Sughart, G. Food Service in Institutions. New York: John Wiley, 1977.

Young, C.M., Hagan, G.C., Tucker, R.E. and Foster, W.D. A comparison of dietary survey methods. II. Dietary history vs. seven-day record vs. 24-hour recall. Journal of the American Dietetic Association, 1952, 28, 218-221.