Naval Health Research Center

# *SOCIAL ECOLOGICAL PREDICTION OF OBESITY IN U.S. NAVY PERSONNEL*

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# SOCIAL ECOLOGICAL PREDICTION OF OBESITY IN U.S. NAVY PERSONNEL

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## Summary

### Problem

Obesity has been associated with increased morbidity and mortality. While obesity in the Navy is less a problem than for the U.S. population as a whole, the physical health and combat readiness of active duty personnel, is a vital concern for the Navy.

### Purpose

The purpose of the study was to assess personal, environmental, and psychosocial factors related to obesity in a Navy sample. The goals of the research were: 1) to evaluate demographic characteristics related to obesity, 2) to examine psychosocial mechanisms involved with obesity, and 3) to construct a heuristic model of obesity that includes the environmental, personal and psychosocial components of obesity. Two hypotheses are investigated. Hypothesis 1: obesity will be higher among enlisted personnel and those with less education. Hypothesis 2: obese individuals will exhibit more dysfunctional eating behaviors in response to stress than the nonobese.

### Approach

The sample consisted of 153 subjects. Those whose percent body fat fell within acceptable standards constituted 41% of the sample, while 59% were classified as overfat. Attempts were made to match lean and overfat subjects according to sex, age, ethnicity, and rank.

### Results

The socioeconomic hypothesis, which stated that lower ranking and less education would be associated with higher percent fat, received support. The psychosocial hypothesis explored eating behaviors and coping in response to stress and was not supported.

## Conclusions

The results suggest that adiposity in the Navy has a strong relationship to obesity-prone food behaviors, family obesity, and lower socioeconomic level. The Navy's weight reduction programs could enhance their behavioral interventions by addressing food obsessions associated with obesity. Treatment for food obsessions should assist the individual toward implementing alternative behaviors to eating, selecting low-calorie foods for in-between meal snacks, and mobilizing social resources as positive reinforcement strategies for long term behavior change. By enhancing the subject's behavioral repertoire, the Navy should benefit from more successful behavioral intervention for weight control.

## INTRODUCTION

The rate of obesity in the U.S. population shows marked increases in the last 20 years. A recent estimate of the prevalence of obesity is approximately 25% of the adult population (Greenwood & Pittman-Waller, 1988). The National Health and Nutrition Examination Surveys, conducted between 1971 to 1974 (NHANES I) and 1976 to 1980 (NHANES II), showed increases in the numbers of obese adults in the U.S.[2] (Braitman, Adlin, & Stanton, 1985; Najjar & Rowland, 1987; Van Itallie, 1979, 1985). NHANES I results indicated that approximately 29 million adults were classified as 20% or more above ideal weight (Braitman et al., 1985). Of this group, 8.4% were classified as morbidly obese. Findings from NHANES II indicated that 34 million adults were 20% or more above ideal weight and approximately 35% were severely obese (Van Itallie, 1985). Thus, in the 1970's alone, the condition of obesity increased by approximately 5 million people while the prevalence of morbid obesity increased by 26.6%.

Obesity has been associated with increased morbidity and mortality from coronary heart disease, diabetes, cancer and conditions related to obesity (Greenwood & Pittman-Waller, 1988; Bray, 1987; Mann, 1974; Simopoulos, 1986; U.S. Public Health Service, 1988). Obesity poses a significant risk for the development of hypertension, impaired pulmonary function in the morbidly obese, increased risk of digestive diseases in those 15-35% overweight, and increased risk for gallbladder disease (Bray, 1987).

The prevalence of overweight in the Navy, determined from percent body fat standards[3], was 24% in 1987 and 19% in 1988 (Conway, Trent & Conway, 1989). The prevalence of morbid obesity, defined as having 26% or more body fat in males and 36% or more body fat in females, was 9.7% in 1987 and 6.1% in 1988. Females exceeded males in all percent fat categories. In terms of absolute numbers, obesity in the Navy is less a problem than for the U.S. population as

a whole. In mandating physical health and readiness requirements for all active duty personnel, a recent Department of the Navy instruction established guidelines for acceptable percent body fat in Navy men and women (OPNAV 6110.1C [1 Aug 86]). Failure to meet percent body fat requirements will result in detachment from the Navy.

The purpose of the present study was to assess the personal, environmental, and psychosocial factors related to obesity in a Navy sample. The goals of the research were: 1) to evaluate the demographic characteristics related to obesity, 2) to examine the psychosocial mechanisms involved with obesity by assessing the interaction between stress and coping styles, and 3) to construct a heuristic model of obesity that includes the environmental, personal and psychosocial components of obesity. Two hypotheses are investigated. Hypothesis 1 states that obesity will be higher among enlisted personnel and those with less education (socioeconomic hypothesis). Hypothesis 2 states that obese individuals will exhibit more dysfunctional eating behaviors in response to stress than the nonobese (psychosocial hypothesis).

## The Social Ecology of Obesity

The social ecology model is an integrated approach to evaluating the contributions of personal and environmental factors to health status (Moos, 1979). The approach provides a basis for examining transactions between people and their environments and how these transactions impact human and social functioning. The environmental system of the subject may include the physical setting, organizational factors, social climate, and human aggregate. The personal system includes demographic characteristics (i.e. sex, age, education, income, etc.) and may include such factors as past medical history, cognitive ability, and emotional states. Mediating factors between personal/

environmental variables and health outcomes are the mechanisms of cognitive appraisal, activation, and adaptation. How the environment is perceived, acted upon, and adjusted to invokes a psychosocial response that results in variable levels of adaptation. Such adaptation, interacting with personal/environmental factors, may result in differential health outcomes. As a conceptual framework, the social ecology approach has broad applications for the social and behavioral sciences and human service fields. It facilitates explanation of the effects of human and social functioning by placing health status in an appropriate social, cultural, and behavioral context. Such an approach helps to explain the ecology of human behavior and the specific factors associated with disease onset.

The social ecology model provides a framework for evaluating factors associated with obesity. Data from NHANES I and II showed that obesity was highly related to differences in sex, age, education, ethnic identity, and socioeconomic level (Braitman et al., 1985; Van Itallie, 1985). The problem of overweight is higher among females than males, blacks than whites, and the poor than the non-poor (Ross & Mirowsky, 1983). Garn et al. (1977) explored level of education and income in relation to adult fatness. Males were more likely to be fatter with higher education and income, while females having higher education and income were more likely to be lean. Females having limited education and income were the most likely to be obese. Males, in general, increase their weight after age 35 and show a gradual reduction in weight after age 55 (Greenwood & Pittman-Waller, 1988; Van Itallie, 1979). Females continue to add more weight as they age with the largest incremental increase occurring around the age of 45 (Van Itallie, 1979). Contrasting black and white males, increases in amount overweight occur for both groups after age 25, while a gradual decrease in overweight occurs after age 55. Black males, however, have

a higher rate of overweight between the ages of 35 to 55 than white males (40.9% versus 28.2%). Black females exceed white females in all age categories, but especially after the age of 45 when black females have nearly twice the level of overweight as white females (61.2% versus 29.9%).

The difficulty with separating genetic from environmental factors (i.e. learning food habits in the family) makes the genetic determination of obesity difficult to assess (Bouchard & Perusse, 1988; Greenwood & Pittman-Waller, 1988). Studies of twins reared apart have shown strong support for the genetic basis of obesity by showing a high concordance between the adoptee's body weight and that of the biological parents, but not with the adoptive parents (Stunkard, Sorenson, Hanis, et al., 1986). Although there is strong evidence that genetics and familial aggregation play important roles in fat mass, fat distribution, and adipose tissue metabolism (Bouchard & Perusse, 1988; Van Itallie, 1988), genetic sensitivities are susceptible to environmental influences, such that the interaction between a genetic predisposition to fatness in a calorie-laden, low exercise environment will commonly result in greater adiposity (Raymond, 1986; Van Itallie, 1988). The amount of fat which can be attributed to heritability versus environmental factors remains unknown however.

Obesity has been associated with certain personality characteristics and behavioral styles. In studies of emotional arousal and eating, there is substantial evidence that the obese are less able to distinguish between internal hunger stimuli and external factors (i.e. interpersonal problems, emotional reactivity) and are thus more externally oriented in terms of their eating behaviors than the nonobese (Leon & Roth, 1977; Herman, Olmsted, & Polivy, 1983). The frequency of emotionally-induced snacking episodes has been reported to increase with higher weight elevations (Lowe & Fisher, 1982).

Thus, eating behaviors may be situationally/environmentally determined. Studies of obesity-related eating disorders (i.e. bingeing, purging, bulimia) have been associated with behavioral characteristics of borderline personality disorder (Johnson, Tobin, & Enright, 1989), anxiety or depression (Hoiberg, Berard, & Watten, 1978; Keck & Fiebert, 1986), the perception of little self-control (Loro & Orleans, 1981; Wilson, 1976), impulsiveness, obsessive behavior, or guilt (Williamson, Kelley, Davis, Ruggiero, & Blouin, 1985), difficulty coping with stress (Loro & Orleans, 1981), and interpersonal difficulties in general (Kolotkin, Revis, Kirkley & Janick, 1987). That diverse behavioral and psychological variables are related to obesity suggests that psychosocial factors related to stress and coping may well be linked with personal and environmental factors associated with obesity.

## METHODS

### Subjects

The sample consisted of 153 subjects. Those whose percent body fat fell within acceptable standards (i.e. under 23% for men and 33% for women) constituted 41% of the sample (n=63), while 59% were classified as overfat (N=90). The lean sample was selected from incoming personnel visiting the Navy Dental Clinic's annual dental exam. Members of the overfat group were enrolled in one of two Navy weight reduction programs: an outpatient program sponsored by Navy Medical Clinic, San Diego, and an inpatient treatment program at Naval Alcohol Rehabilitation Center[4]. Attempts were made to match lean and overfat subjects according to sex, age, ethnicity, and rank. Of total respondents, 120 were male (78%) and 33 were female (22%).

## Measures

**Demographic and Environmental Variables.** Variables of age, sex, education, marital status, ethnicity, ranking (enlisted versus officer status), paygrade, and duty station were included in the study. Male/female, and marital status (married/not married) were dichotomous variables (0/1). Ethnic identity was indicated by 4 primary group affiliations: Black, Caucasian, Hispanic, or other. The 'other' designation included Asian, Pacific Islander, or Indian. Years of education was an interval level variable. Occupation-related variables of Navy rank (enlisted versus officer status) and ship versus shore-based duty station were designated by dichotomous categories (0/1).

**Medical History and Physical Health Assessment.** A medical history of past overweight problems and hypertension diagnosis was self-reported by the participants. Asked if they ever had a weight problem in the past and if a hypertension diagnosis had ever been made, participants answered yes or no (1 or 0). Family obesity was the ratio of the number of overweight or obese individuals to total family members.

A physical examination was conducted which assessed the subject's weight, height, radial pulse, blood pressure (systolic and diastolic measures), and percent fat. Percent body fat was calculated using circumference measures (women: neck, waist, and hips; men: neck and abdomen in men), which were calibrated to body density measures and included in a percent fat algorithm (Hodgdon & Beckett, 1984a, 1984b).

**Food Behaviors.** Behavioral assessment was conducted in the area of food obsessions and emotional eating. A food obsession scale was used following the procedures developed by Hoiberg et al. (1978) for assessing obesity-related behaviors in the Navy. The food obsession scale included 10 statements which required participants to indicate the frequency with which they practiced

specific food behaviors, from 1 (not at all) to 6 (a lot of the time or daily). Submitted for reliability testing, the resulting Cronbach's Alpha was .87 (see Appendix, Table A-1). The emotional eating scale, also developed by Hoiberg et al. (1978), required respondents to indicate affective states and frequency of occurrence from 1 (not at all) to 6 (a lot of the time). Reliability testing resulted in an alpha of .93 (see Appendix, Table A-1).

Psychosocial Factors. The Daily Hassle scale was used to assess the frequency and impact of irritants from minor annoyances to major difficulties (Kanner, Coyne, Schaefer, & Lazarus, 1981). Respondents indicated if the hassle had occurred in the last month and its approximate level of severity from 1 (somewhat severe), 2 (moderately severe), to 3 (extremely severe). Reliability testing resulted in an alpha of .99.

An abridged coping scale was used to assess coping in response to a major problem in the preceding year (Moos, Cronkite, Billings, & Finney, 1987). Respondents indicated if they invoked a particular coping response and the frequency with which they used the response in mediating the problem, from 1 (once or twice), 2 (sometimes), to 3 (fairly often). An overall coping effectiveness scale was developed that showed an alpha of .81.

## RESULTS

Table 1 shows mean percent body fat distributions by demographic characteristics and sex. Higher percent body fat in males showed significant associations with older age (age=30 or higher), less education (high school/some college), being married, enlisted personnel status, overweight problems in the past, and a previous diagnosis of hypertension. Higher percent body fat in females was significantly related to shipboard duty assignment, an

overweight problem in the past, and a previous hypertension diagnosis. There were no significant ethnicity-related factors associated with higher fatness level for either men or women, although black males, and black and Hispanic females had higher mean percent fat than other population segments.

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Table 1 about here

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Table 2 shows the correlation matrix of the variables. Regression analysis was used to examine the effects of demographic characteristics (age, sex, marital status, education, ethnicity, paygrade, rank, and duty station), psychosocial factors (hassles, coping), food behaviors (emotional eating, food obsessions), and medical history information (past overweight problem, previous diagnosis of hypertension, and family obesity) with percent fat. Because we were interested in the relationships between stress, coping, and eating behaviors, interactions were created to test the effects of hassles by coping, hassles by emotional eating, and hassles by food obsessions on body fatness to determine if higher fat elevations were related to different psychosocial mechanisms. An additional interaction was used to test the effects of family obesity and age on percent fat in order to determine if the influence of family obesity continued to be a factor with older age.

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Table 2 about here

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All of the independent variables were used in a regression analysis to estimate percent body fat (see Table 3). The regression procedure used stepwise selection to include or exclude independent variables (demographic

varibles, food behaviors, psychosocial factors, and interaction variables) from inclusion in the model. The resulting model showed that Sex, Age, Navy Ranking, Food Obsessions, Family Obesity and the interaction of Age and Family Obesity accounted for 56% of the explained variance in percent body fat. Other factors constant, females generally had about 7% more body fat than males. Given the same age and other characteristics, enlisted personnel had an increase in percent body fat of 8%. This finding suggests that differences in adiposity may be attributable to lifestyle differences between officers and enlisted personnel. Percent body fat was positively influenced by one's degree of obsessions with food. A 1 point increase in food obsessions (measured on a 6 point scale) was associated with a 2.8% increase in percent body fat. Among those with no history of obesity in their families, each advancing year of age was generally accompanied by .5% increase in percent body fat. However, among those with a history of obesity in the family, an increase of 1 year in age was met with a decline in percent body fat of .07%. This is not to say that persons from obese families are generally leaner than those from nonobese families. On the contrary, family obesity has a tremendous positive effect on an individual's percent body fat. Given identical characteristics, persons from families with a history of obesity were most likey to be obese themselves. However, the effect of family obesity is somewhat tempered with age -- the older the subject, the less the influence of obesity in his or her family. With the same characteristics, at 20 years of age, a person from an obese family background will generally have an added 15% body fat than someone from a nonobese family. At 30 years of age the differential is 9.6%; at 40 the differential is reduced to 4.2%. This age with family obesity interaction argues for a behavioral, rather than a genetic, basis for obesity. It suggests a strong family environmental (learned food behaviors) more than a genetic

factor in adult fatness. The interaction between age and family obesity indicated that the longer the period of time away from the parental home (as indicated by older age), the less likely family obesity was related to higher percent fat. It also may be indicative of new behaviors acquired since the subject left the parental home.

The change in explained variance ($R^2$) in the model when a variable is entered in the model last (unique variance) indicates the variable's unique contribution to total $R^2$. The largest portion of explained variance was from Food Obsessions which had a unique variance of .12, independently accounting for more than 20% of the total variance explained in the model. Sex had a unique variance of .10 while ranking (officer versus enlisted) independently contributed .07 to $R^2$. Age independently contributed .04 to total explained variance and Family Obesity contributed .02 while the interaction of these variables independently accounted for .01 of the total $R^2$.

It was hypothesized that the obese would participate in higher rates of food obsessive behaviors and emotional eating patterns, and especially so in the presence of greater psychosocial stress. In fact, those having greater percent fat showed higher rates of food obsessions. Emotional eating behaviors, although significantly correlated with food obsessions, did not emerge as a significant independent predictor of percent fat when food obsessions was included in the model. An indicator of psychosocial stress, Hassles was not a significant predictor of adiposity, increasing explained variance only marginally. As a psychosocial measure, the degree of activation due to hassles is best understood in combination with various coping responses. The variable of coping, however, was not significantly related to either percent body fat or daily hassles, and thus, did not enter into the regression equation.

Table 3 about here

## DISCUSSION

Two hypotheses were presented in the study. The socioeconomic hypothesis, which stated that lower ranking and less education would be associated with higher percent fat, received support. The psychosocial hypothesis explored eating behaviors and coping in response to stress and was not supported.

### Socio-demographic factors and obesity:

Bivariate results indicated a strong age/obesity relationship in males only. Increased adiposity accompanies aging generally; however, females tend to have a higher percent fat at all age levels (Van Itallie, 1979, 1985). Although age differences were not demonstrated between younger (19-29) and older women (40+), a trend for increased body fat was evident with age. This was supported by regression results that showed highest percent fat occurs among older females. That obesity is associated with lower socioeconomic level was supported in the present research, but for males only. Education and income are two primary components used for establishing socioeconomic status. Bivariate results indicated that lower educational achievement and lower paygrade were both significantly related to higher percent fat among males while no such pattern was evident among females. Regression modeling showed that adiposity was related to lower occupational ranking (enlisted personnel). Enlisted males had highest percent fat (26%), while males in the officer ranks had lowest percent fat (14%).

**Familial aggregation of obesity:**

Studies that have examined the genetics of obesity have shown support for the heritability of body fat placement, body composition, and lipid metabolism, but equivocal results in terms of the amount of body fat. Present results indicated that family obesity was a significant predictor for percent fat in both males and females. An interaction between age and family obesity indicated that the influence of family obesity on the respondent's percent fat diminished with age. Obesity acquires a strong behavioral component which may supersede the genetic basis of obesity the longer a person is overweight.

**Psychosocial Factors:**

Neither stress nor coping ability were shown to be significant predictors in the regression model of percent fat. The inclusion of these variables and interactions involving these variables would have increased the total explained variance by about 1%. Thus, the hypothesis that obesity is associated with stress (external stimuli) and poor coping skills, was not supported in the research.

Having higher number of food obsessions was directly related to higher percent fat. Emotional eating was linked with higher percent fat in correlational analysis; however, food obsessions was a better behavioral predictor of adiposity. This finding suggests the importance of personality characteristics associated with obesity that are operant in the maintenance of body fat.

The social-ecological approach used in the present analysis proved useful for defining the conceptual structures commonly associated with obesity. Although the psychosocial processes involved with stress, coping, and

adaptation were not related to percent fat, the results suggest that adiposity in the Navy has a strong relationship to obesity-prone food behaviors, family obesity, and lower socioeconomic level. Based upon present results, the Navy's weight reduction programs could enhance their behavioral interventions by addressing food obsessions associated with obesity. Treatment for food obsessions should assist the individual toward implementing alternative behaviors to eating, selecting low-calorie foods for in-between meal snacks, and mobilizing social resources as positive reinforcement strategies for long term behavior change. By enhancing the subject's behavioral repertoire, the Navy should benefit from more successful behavioral intervention for weight control.

**Table 1. Means, Standard Deviations, and Significance of One-Way ANOVAS: Percent Body Fat by Demographic Characteristics by Sex**

| | MALES X (SD) | N | FEMALES X (SD) | N | TOTAL X (SD) | N |
|---|---|---|---|---|---|---|
| **AGE: (Yrs.)** | | | | | | |
| 19-29 | 20.1 (9.9) | 40 | 30.3 (7.8) | 12 | 22.4 (10.4) | 52 |
| 30-39 | 27.0 (7.2) | 58 | 33.4 (7.4) | 18 | 28.6 (7.7) | 76 |
| 40+ | 25.9 (9.1) | 13 | 40.5 (5.0) | 2 | 27.8 (10.0) | 15 |
| | p<.001 | | NS | | p<.01 | |
| **EDUCATION: (Yrs.)** | | | | | | |
| -12 High Sch. | 25.7 (8.6) | 63 | 33.7 (3.7) | 12 | 27.0 (8.6) | 75 |
| 13-15 Some Coll. | 25.0 (8.1) | 31 | 30.5 (9.5) | 13 | 26.6 (8.8) | 44 |
| 16+ Graduate | 17.6 (9.8) | 16 | 34.9 (9.2) | 7 | 22.9 (12.5) | 23 |
| | p<.01 | | NS | | NS | |
| **MARITAL STATUS:** | | | | | | |
| Yes | 26.2 (8.0) | 79 | 33.8 (7.5) | 17 | 23.4 (10.8) | 46 |
| No | 19.6 (9.9) | 31 | 31.4 (8.0) | 15 | 27.5 (8.4) | 96 |
| | p<.01 | | NS | | p=.01 | |
| **ETHNICITY:** | | | | | | |
| Black | 26.1 (6.2) | 9 | 35.8 (5.8) | 4 | 29.1 (7.4) | 13 |
| Caucasian | 24.7 (9.3) | 85 | 31.8 (7.8) | 25 | 26.3 (9.4) | 110 |
| Hispanic | 22.1 (9.6) | 6 | 35.8 (5.8) | 3 | 26.7 (11.3) | 9 |
| Other | 18.2 (8.2) | 8 | - - | - | 18.2 (8.2) | 8 |
| | NS | | NS | | NS | |
| **PAYGRADE:** | | | | | | |
| E1-E3 | 17.3 (6.7) | 6 | 33.8 (12.3) | 3 | 22.8 (11.6) | 9 |
| E4-E6 | 26.0 (8.8) | 70 | 32.9 (7.7) | 23 | 27.7 (9.0) | 93 |
| E7-E9 | 25.9 (7.3) | 25 | 25.7 (8.2) | 2 | 25.9 (7.2) | 27 |
| W1-W4 | - - | 0 | - - | 0 | - - | 0 |
| 01-03 | 11.3 (6.1) | 7 | 33.4 (3.4) | 3 | 17.9 (11.9) | 10 |
| 04-09 | 18.7 (6.6) | 3 | 37.1 (0) | 1 | 23.3 (10.7) | 4 |
| | p<.01 | | NS | | p<.05 | |
| **RANK/DUTY STATION** | | | | | | |
| Enlisted | 25.5 (8.5) | 101 | 32.5 (8.1) | 28 | 26.3 (9.4) | 129 |
| Officer | 13.5 (6.9) | 10 | 34.4 (3.3) | 4 | 19.5 (11.4) | 14 |
| | p<.01 | | NS | | p<.01 | |
| Ship | 24.4 (9.3) | 65 | 35.3 (5.7) | 17 | 26.7 (9.7) | 82 |
| Shore | 24.4 (8.8) | 46 | 29.8 (8.7) | 15 | 25.7 (9.0) | 61 |
| | NS | | p<.05 | | NS | |
| **MEDICAL HISTORY:** | | | | | | |
| Overweight in Past | | | | | | |
| Yes | 29.8 (5.4) | 69 | 35.8 (5.6) | 24 | 31.4 (6.0) | 93 |
| No | 15.1 (5.8) | 41 | 23.2 (4.7) | 8 | 16.4 (6.3) | 49 |
| | p<.01 | | p<.01 | | p<.01 | |
| Hypertension Diagnosis | | | | | | |
| Yes | 29.9 (6.5) | 25 | 42.0 (4.5) | 5 | 31.9 (7.7) | 30 |
| No | 22.7 (9.1) | 85 | 31.0 (7.1) | 26 | 24.6 (9.3) | 111 |
| | p<.01 | | p<.01 | | p<.01 | |

**Table 2. Inter-Correlations between Variables**

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | Age | 1.00 | | | | | | | | | | | | | | | | | | |
| (2) | Sex | .04 | 1.00 | | | | | | | | | | | | | | | | | |
| (3) | Marital Sta. | .15 | .17 | 1.00 | | | | | | | | | | | | | | | | |
| (4) | Education | .33 | -.14 | -.13 | 1.00 | | | | | | | | | | | | | | | |
| (5) | Ethnicity | .22 | -.01 | .10 | .11 | 1.00 | | | | | | | | | | | | | | |
| (6) | Paygrade | .34 | .02 | -.03 | .55 | .10 | 1.00 | | | | | | | | | | | | | |
| (7) | Ranking | .11 | -.04 | -.17 | .55 | .02 | .91 | 1.00 | | | | | | | | | | | | |
| (8) | Duty Sta. | .00 | .04 | -.02 | -.05 | -.02 | -.07 | -.01 | 1.00 | | | | | | | | | | | |
| (9) | Overweight | .38 | -.08 | .22 | -.13 | .12 | .00 | -.13 | -.01 | 1.00 | | | | | | | | | | |
| (10) | Hi BP | .27 | .07 | .11 | .10 | -.03 | .01 | -.07 | .09 | .25 | 1.00 | | | | | | | | | |
| (11) | Fam. Obes. | .33 | -.08 | .17 | .09 | .15 | -.02 | -.09 | .06 | .53 | .22 | 1.00 | | | | | | | | |
| (12) | Hassles | -.05 | -.17 | -.04 | -.10 | .05 | -.14 | -.12 | .20 | .19 | -.12 | .10 | 1.00 | | | | | | | |
| (13) | Coping | -.09 | -.10 | -.02 | .06 | -.06 | .16 | .14 | .14 | -.19 | -.12 | -.23 | .01 | 1.00 | | | | | | |
| (14) | Food Obs. | .14 | -.14 | .17 | -.04 | .02 | .08 | .02 | .14 | .58 | .15 | .34 | .33 | -.12 | 1.00 | | | | | |
| (15) | Emo. Eat. | .16 | -.20 | .05 | -.04 | .13 | -.01 | -.06 | .14 | .51 | .09 | .32 | .50 | -.05 | .72 | 1.00 | | | | |
| (16) | Hassles X Emo. Eat. | .01 | -.17 | .08 | -.08 | .12 | -.08 | -.10 | .17 | .38 | -.04 | .20 | .82 | -.08 | .58 | .83 | 1.00 | | | |
| (17) | Hassles X Food Obs. | .03 | -.19 | .09 | -.04 | .04 | -.05 | -.08 | .13 | .37 | .00 | .30 | .87 | .00 | .73 | .64 | .92 | 1.00 | | |
| (18) | Age X Fam. Obesity | .53 | -.07 | .17 | .17 | .19 | .03 | -.07 | .07 | .53 | .27 | .97 | .08 | -.23 | .38 | .33 | .18 | .28 | 1.00 | |
| (19) | % Fat | .27 | -.37 | .21 | -.14 | .04 | -.17 | -.24 | .05 | .76 | .32 | .51 | .20 | -.13 | .52 | .56 | .43 | .38 | .51 | 1.00 |

Table 3. Multiple Regression of Factors Predictive of Percent Fat (N=140)

| Predictor | b | Std. Error of b | Beta | $R^2$ Change When Entered Last | |
|---|---|---|---|---|---|
| Sex (male=1; (female=0) | -7.167 | 1.324 | -.315 | .096 | *** |
| Age | .463 | .141 | .304 | .035 | *** |
| Ranking (officer=1; enlisted=0) | -8.343 | 1.840 | -.265 | .067 | *** |
| Food Obsessions | 2.801 | .482 | .366 | .117 | *** |
| Family Obesity | 25.606 | 9.523 | .870 | .024 | ** |
| Family Obesity X Age | -.534 | .282 | -.667 | .012 | |
| (Constant) | 6.759 | 4.643 | | | |
| R | .75 | | | | |
| $R^2$ | .56 | | | | |

* = p<.05
** = p<.01
*** = p<.001

Table A-1. Items Comprising the Scales

| Scale | Item |
|---|---|
| **FOOD OBSESSION** (alpha = .87) | **How often do you do the following things?** 1 . . . . 2 . . . . 3 . . . . 4 . . . . 5 . . . . 6 <br> Not at all — A lot of time/daily |
| | 1. Feel helpless about food |
| | 2. Tend to overeat though full |
| | 3. Eat more when alone |
| | 4. Snack between meals when not hungry |
| | 5. Difficulty resisting rich food |
| | 6. You reward yourself with food for good behavior. |
| | 7. Parents used food as a reward. |
| | 8. Are you a fast eater? |
| | 9. Have you hidden food to eat later. |
| **EMOTIONAL EATING** (alpha = .93) | **When you have to eat between meals, how do you describe your feelings?** 1 . . . . 2 . . . . 3 . . . . 4 . . . . 5 . . . . 6 <br> Not at all — A lot of time/daily |
| | 1. depressed |
| | 2. bored |
| | 3. angry |
| | 4. anxious |
| | 5. frustrated |
| | 6. lonely |
| **COPING SCALE** (alpha =.811) | **Indicate what you did in connection with a major problem in the last year and approximately how often you did it.** 0 . . . . 1 . . . . 2 . . . . 3 <br> None — Once or twice — Sometimes — Fairly often |
| | 1. Tried to find out more about the situation |
| | 2. Talked with spouse or relative about the problem |
| | 3. Talked with friend about the problem |
| | 4. Talked with professional person (doctor, lawyer, clergy, etc.) |
| | 5. Prayed for guidance and strength |
| | 6. Didn't worry about it; figured everything would prob'ly work out |
| | 7. Tried to see the positive side of the situation |
| | 8. Got busy with other things to keep my mind off the problem |
| | 9. Made a plan of action and followed it |
| | 10. Considered several alternatives for handling the problem |
| | 11. Drew on my past experience; I was in a similar situation before |
| | 12. Tried to step back from the situation and be more objective |
| | 13. Went over the situation in my mind to try to understand it |
| | 14. Tried not to act too hastily or follow my first hunch |
| | 15. Told myself things that helped me feel better |
| | 16. Got away from things for awhile |
| | 17. I knew what had to be done and tried harder to make things work |
| | 18. Made a promise to myself that things would be different next time |
| | 19. Let my feelings out somehow |
| | 20. Sought help from persons or groups with similar experiences |
| | 21. Bargained or compromised to get something positive from situation |
| | 22. Reduced tension by exercising more |
| | 23. Took things a day at a time, one step at a time |

**HASSLE SCALE**
**(alpha =.985)**

**Did a hassle happen to you in the last month?**
**If so, rate its level of severity?**
**0 . . . . 1 . . . . . 2 . . . . . 3**
**None Somewhat Severe Mod'ly Severe Ext'ly Severe**

1. Misplacing things
2. Social obligations
3. Inconsiderate smokers
4. Troubling thoughts about future
5. Thoughts about death
6. Health of family member
7. Not enough money for clothing
8. Not enough money for housing
9. Concerns about owing money
10. Concerns about money for emergencies
11. Someone owes you money
12. Financial responsibility for person who doesn't live with you
13. Cutting down on electricity & water
14. Smoking too much
15. Too many responsibilities
16. Decisions about having children
17. Planning meals
18. Trouble relaxing
19. Trouble making decisions
20. Problems getting along with fellow workers
21. Home maintenance
22. Concerns about job security
23. Concerns about retirement
24. Don't like current work duties
25. Don't like fellow workers
26. Not enough money for basic necessities
27. Too many interruptions
28. Having to wait
29. Being lonely
30. Fear of confrontation
31. Financial security
32. Silly practical mistakes
33. Inability to express yourself
34. Physical illness
35. Physical appearance
36. Fear of rejection
37. Concerns about health in general
38. Not seeing enough people
39. Friends or relatives too far away
40. Preparing meals
41. Wasting time
42. Filling out forms
43. Financing children's education
44. Declining physical abilities
45. Concerns about body functions
46. Not getting enough sleep
47. Problems with aging parents
48. Problems with your children
49. Problems with younger persons
50. Problems with your partner/lover
51. Difficulties seeing or hearing
52. Overloaded with family responsibilities
53. Too many things to do
54. Unchallenging work
55. Concerns about meeting high standards
56. Job dissatisfactions
57. Worries about decisions to change job
58. Too many meetings
59. Gossip
60. Concerns about weight
61. Not enough time to do things you need to do
62. Not enough personal energy
63. Concerns about inner conflicts
64. Feel conflicted about what to do
65. Regrets over past decisions
66. Concerns about getting ahead
67. Hassles from boss or supervisor
68. Difficulties with friends
69. Not enough time for family
70. Not enough money for entertainment or recreation
71. Shopping
72. Prejudice and discrimination
73. Property, investments or taxes
74. Not enough time for entertainment or recreation
75. Noise
76. Traffic
77. Pollution

## Footnotes

1. Dr. Barbara Du Bois is a Research Associate and Medical Anthropologist with the National Research Council, National Academy of Sciences, 2101 Constitution Ave., Washington, D.C. and the Health Services Research Dept., Naval Health Research Center, P.O. Box 85122, San Diego, Calif. 92138-9174. Dr. Jerry Goodman is a Statistical Consultant and Sociologist with Naval Health Research Center.

2. Obesity assessment in the NHANES survey was based on height and weight measurements for the calculation of body mass index (BMI = Weight [kg]/ height$[m]^2$).

3. Obesity assessment methods used in the Navy rely on percent body fat determination rather than the body mass index, which does not separate lean body mass from fat body mass. Following recommendations put forth by the National Institutes of health, the Navy's percent body fat assessment method relies on circumference measures of the neck and abdomen for males and neck, waist, and hips for females. Circumference measures are calibrated with weight, height, and age, and evaluated with separate body density scores by sex (Hogdgon & Beckett, 1984a, 1984b). This method of assessing percent body fat was developed for rapid screening of obesity and was shown to be highly correlated with underwater weighing. Using the Navy's standards, acceptable percent fat in males is 22% or less and 30% or less in females. Moderate overfat in males is 23% to 25% body fat; in females, 31% to 35% body fat. Morbid obesity in males is 26% or more body fat and 36% or more in females.

4. The Naval Medical Clinic's behavioral weight control clinic is an out-patient weight reduction program that utilizes the food exchange system, health education, and guided group discussion. The weight reduction program is sponsored by the Education and Training Department, Naval Medical Clinic, San Diego Naval Station, P.O. Box 153, San Diego, Calif. 92136. An in-patient weight reduction program, operated under the auspices of the Naval Alcohol Rehabilitation Center, Miramar Naval Air Station, San Diego, utilizes the food exchange system, guided group discussion, health education, and behavior modification. The weight loss approach is a 12 step program, patterned after Overeater's Anonymous treatment program. Control group selection was conducted at the Navy Dental Clinic, San Diego Naval Station due to the non-selective nature and large number of personnel entering the clinic on a daily basis.

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This study assesses personal, environmental, and psychosocial factors related to obesity in a Navy sample (N=153). The research evaluated demographic characteristics related to obesity and examined psychosocial mechanisms involved with obesity. Two hypotheses are investigated. Hypothesis 1, obesity will be higher among enlisted personnel and those with less education, recieved support. Hypothesis 2, obese individuals will exhibit more dysfunctional eating behaviors in response to stress than the nonobese, was not supported. Adiposity in the Navy has a strong relationship to obesity-prone food behaviors, family obesity, and lower socioeconomic level. The Navy's weight reduction programs could enhance their behavioral interventions by addressing food obsessions associated with obesity. Treatment for food obsessions should assist the individual toward implementing alternative behaviors to eating, selecting low-calorie foods for in-between meal snacks, and mobilizing social resources as positive reinforcement strategies for long term behavior change. By enhancing the subject's behavioral repertoire, the Navy should benefit from more successful behavioral intervention for weight control.

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