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Home Food and Exercise Environments of Normal-weight and Overweight Adults

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Abstract

Objective—To examine the home environments of overweight and normal-weight adults and the relationships between the environment and weight-regulating behaviors.

Methods—Overweight (n=201) and normal-weight adults (n=213) assessed their homes via checklist and self-reported their eating and activity habits.

Results—OW adults had less exercise equipment, fewer low-fat snacks and fruits/vegetables, and more TVs, high-fat snacks, and spreads than did NW adults ($P < .01$). These variables were associated ($P < .05$) with weightregulating behaviors.

Conclusions—Increasing healthy foods and opportunities for physical activity within the home may improve weight-control efforts in adults.

Keywords

home environment; weight; weight-regulating behaviors

The influence of the home environment on the eating and exercise habits of children is well established,¹⁻¹⁰ yet relatively few studies have examined household factors that might influence weight, eating, and exercise in adults. Some notable exceptions include work by Jakicic and colleagues¹¹ that established a small but significant correlation between the presence of exercise equipment in the home and physical activity in overweight women. More recently, Gattshall and colleagues⁹ reported a similar association between accessibility of physical activity options within the home and adult physical activity levels. There is also some indication that home food availability is related to dietary intake in adults. Small to

moderate associations between availability of specific food groups in the home (ie, dairy, fruits, and vegetables) and relevant indicators of dietary consumption in adults have been reported.^{12,13} Likewise, in a prospective study, we found that a decrease in the number of high-fat foods in the home was associated with reductions in caloric intake in adults.¹⁴ Phelan and colleagues¹⁵ also reported that differences in the home eating and exercise environment distinguished weight-loss maintainers from treatment-seeking obese. Taken together, these initial findings are consistent with a behavioral model of obesity, in which food and exercise cues in the environment set the stage for behavioral choices in adults. These findings are also consistent with more contemporary environmental models such as the EnRG framework proposed by Kremers and colleagues,¹⁶ which recognizes the dynamic interplay between environmental factors, cognitive mediators, and energy-balance-related behaviors.

Gaining a better understanding of whether home environmental factors are associated with weight and related behaviors in adults may aid in the development of more effective weight-control interventions. Thus, the goals of this study were to first examine whether the homes of overweight adults differ from those of normal-weight adults in the amount of exercise equipment available, access to televisions, and types of foods present and then to explore whether these home environmental factors were associated with relevant weight-regulating behaviors and weight status in adults. We hypothesized that overweight and obese adults would have (1) fewer pieces of exercise equipment, (2) more high-fat foods, and (3) more TVs in the home than would normal-weight adults. We also hypothesized that the home environment would be related to eating and exercise behaviors within both the overweight and obese and normal-weight participant groups.

METHODS

Design

We conducted a cross-sectional comparison of the home environments and weight-regulating behaviors of over-weight/obese individuals and normal-weight individuals.

Participants

Two distinct groups of individuals were identified as part of separately funded studies in NIH's Health Maintenance Consortium (<http://hmcrs.srph.tamhsc.edu/default.aspx>). Both studies were approved by the Institutional Review Board at The Miriam Hospital in Providence, Rhode Island, and all participants provided written informed consent. Data were collected between 2005 and 2008 in both studies. Sample characteristics are displayed in Table 1.

Overweight and obese adults (OW; N=201; BMI=37.3+7.0 kg/m²)—The overweight and obese group comprised individuals entering an 18-month behavioral weight-loss study. Participants were recruited through advertisements in local newspapers and did not receive compensation for completing the study's baseline assessment.

Normal-weight adults (NW; N=213; BMI=21.2±1.6 kg/m²)—The normal-weight group comprised individuals with no history of overweight who were weight stable (\pm 5 lbs) for 2 years. Recruitment was conducted by placing advertisements in national and local publications and through articles published in media targeting a general audience. Participants were located predominantly in New England (>70%) and were paid \$50 for completing the study assessments.

Measures

All measures were administered prior to beginning weight-loss treatment in the OW group and at study enrollment in the NW group. Most variables were measured using common methodology, but there were some differences between the 2 studies as indicated below.

Household Measures

Exercise equipment—The Exercise Environment Questionnaire¹¹ was used to assess the presence of exercise equipment available in the home. The 14-item questionnaire lists various types of equipment and asks participants to indicate whether each item is present in the home. Subscales include number of pieces of aerobic exercise equipment (eg, stationary bike, treadmill; 4 items), individual recreation equipment (eg, bicycle, roller skates; 4 items), individual sports equipment (eg, golf clubs; 2 items), and team sports equipment (eg, baseball glove, volleyball; 3 items). The measure has been found to have high levels of test-retest reliability as well as high interrater reliability between family members.¹¹ In the OW group, the checklist was completed by research assistants during a scheduled home visit whereas NW individuals completed the checklist themselves.

TV access—The number of TVs in the home and the presence of a TV in the bedroom were assessed via self-report in both groups.

Home food inventory—The household food inventory, a checklist with acceptable test-retest and interrater reliability,^{13,14} was used to assess foods currently available in the home. The checklist includes foods listed on the Block Food Frequency Questionnaire¹⁷ and additional low-fat food choices (eg, reduced fat cakes and pies). Responses were categorized into total number of foods available in the house as well as number of high-fat snacks (eg, regular potato chips; 6 items), high-fat spreads (eg, regular mayonnaise; 2 items), high-fat dairy (eg, regular milk; 2 items), and number of low-fat fruits and vegetables (eg, apples, oranges, broccoli; 12 items), low-fat spreads (eg, reduced-fat mayonnaise; 2 items), low-fat dairy (eg, reduced-fat cheese; 2 items), low-fat cereals (eg, cold cereals such as Corn Flakes, Rice Krispies; 3 items) and low-fat snacks (eg, low- or reduced-fat potato chips; 2 items). In the OW group, the checklist was completed by research assistants during a scheduled home visit whereas NW individuals completed the checklist themselves.

Weight and Behavioral Measures

Weight was objectively measured in OW individuals and measured via self-report in NW individuals.

Physical activity was assessed using the Paffenbarger Physical Activity Questionnaire (PAQ),¹⁸ providing estimates of the total energy expended in physical activity per week. Participants reported their involvement in activities of light (5 kcal/min), medium (7.5 kcal/min), and high (10 kcal/min) intensity over the past week, which were then summed to produce an estimate of overall leisure-time activity. The PAQ has high test-retest reliability¹⁹ and is significantly correlated with measures of cardiovascular fitness.²⁰

TV viewing was assessed with a single item asking participants how many hours per week they typically watch TV in both groups.

Dietary intake was assessed with the Block Food Frequency Questionnaire¹⁷ in the OW group and three 24-hour recalls²¹ in the NW group. Both measures yield estimates of total daily caloric intake and percentage of calories from fat. Results from the Block Food Frequency correlate significantly with 24-hour recall measures.²² The 24-hour recalls were completed using the Nutrition Data System software (NDS) developed by the Nutrition Coordinating Center, University of Minnesota, Minneapolis, Minnesota, and the Block Food Frequency questionnaires were scored by NutritionQuest, Berkeley, California.

Analyses—Data were analyzed using Statistical Package for the Social Sciences (SPSS for Windows, version 17.0, SPSS Inc., Chicago, IL, USA). Demographic differences were examined using chisquare or independent t-tests. Demographic variables that differed between OW and NW groups (ie, age, gender, marital status, race, education) were used as covariates in general linear model analyses of home environmental variables. Analyses of the home environment's influence on weight-regulating behaviors were conducted within groups using partial correlations controlling for demographic variables and weight. Logistic regression analyses, adjusting first for demographic differences and then for demographic differences and weight-regulating behaviors, were conducted to identify significant independent discriminators of OW vs NW group status.

RESULTS

The NW group comprised a greater percentage of females, college graduates, single individuals, and whites than the OW group (all P 's $\leq .01$) and as a whole was slightly younger than the OW group ($P=.06$; Table 1). Differences between OW and NW adults were also found in self-reported levels of physical and sedentary activities. OW individuals watched more TV ($P<.0001$), reported more sedentary activity ($P=.02$), and reported less physical activity ($P<.0001$) than did NW individuals. OW individuals also reported consuming a greater percentage of their calories from fat than did NW individuals ($P<.0001$), but the groups did not differ in reported caloric intake ($P=.43$).

Group Differences in the Home Environment

OW homes had less total exercise equipment ($P=.004$) and fewer individual recreational items ($P<.0001$) than did NW homes but did not differ on the other exercise equipment subscales (Table 2). OW homes had more TVs ($P<.0001$) than NW homes, and OW individuals were more likely to report having a TV in their bedroom ($P<.0001$) than were NW individuals.

The total number of foods present in the home did not differ between the OW and NW groups (Table 3). However, when the types of foods available in the home were looked at, OW homes had more high-fat snacks ($P=.005$) and high-fat spreads ($P<.0001$) than NW homes had. OW homes also had fewer low-fat snacks ($P=.01$) and fewer fruits and vegetables ($P<.0001$) than NW homes. No group differences were found in the amount of cereal, high-fat or low-fat dairy items, or low-fat spreads.

Relationships Between the Home Environment and Weight-regulating Behaviors

Significant relationships emerged between physical activity and the exercise home environment within both the OW and NW groups (Table 4). In the OW group, positive associations were found between energy expenditure and total amount of exercise equipment in the home ($P=.002$) and number of individual sport items ($P=.001$). In the NW group, physical activity was most strongly associated with the amount of aerobic equipment available ($P=.02$). Associations between TV access and TV viewing also emerged. A positive correlation was observed between number of TVs in the home and TV viewing hours in the NW group ($r=.25$, $P<.001$). Moreover, normal-weight individuals who had a TV in the bedroom watched significantly more hours of TV than did NW individuals who did not have a TV in the bedroom (13.2 ± 9.0 vs 8.8 ± 7.0 hours/week, $P<.001$), but this difference was not significant in the OW group.

Weaker relationships were found among the home food environment and dietary intake (Table 5). Among OW individuals, caloric consumption was positively correlated with total food items in the home ($P=.01$) and with the number of fruits and vegetables ($P=.05$). Percent of calories from fat in the OW group was positively correlated with fruit and vegetable availability ($P=.006$). In NW individuals, we found a positive correlation between percent of calories from fat and number of high-fat snacks in the home ($P=.02$).

Multivariable Analyses

Logistic regression analyses showed that several environmental variables were significant independent predictors of weight status. After adjusting for demographic variables, significant predictors of the OW group were fewer pieces of exercise equipment ($P=.019$, $OR=.94[.89-.99]$), more TVs ($P=.001$, $OR=1.56[1.19-2.04]$), more high-fat spreads ($P<.0001$, $OR=5.88[3.47-9.97]$), more high-fat snacks ($P=.01$, $OR=1.31[1.07-1.62]$), and fewer fruits and vegetables ($P<.0001$, $OR=.67[.57-.78]$) in the home. Adding behavioral variables to the equation (ie, caloric intake, percent of calories from fat, and physical activity) removed most of these environmental differences, with the exception of high-fat spreads and fruits and vegetables.

DISCUSSION

The environmental context is recognized as a key determinant of behavior in ecological and behavioral models of weight control. In children and adolescents, several studies support a link between eating and activity cues within the home environment and diet, exercise, and sedentary behaviors;^{2-5,23-25} however, limited information is available regarding the impact of the home environment on weight and weight-regulating behaviors in adults. This study is

one of the first to explore whether the home food and exercise environment differs between overweight and normal-weight adults and whether home environmental variables are associated with dietary intake, physical activity, and television viewing in adults.

We found that the homes of overweight adults were characterized by fewer cues for physical activity, more prompts for sedentary behaviors, and greater availability of unhealthy foods compared to the homes of normal-weight adults. Specifically, the homes of overweight adults had less exercise equipment, more TVs, more high-fat snacks and spreads, and fewer low-fat snacks and fruits and vegetables than did homes of normal-weight adults although the absolute differences between groups were small. We found some evidence that these home environmental stimuli were associated with poor exercise and eating habits. For example, in overweight adults, physical activity was positively correlated with access to exercise equipment items whereas energy intake was associated with the number of food items in the home. Interestingly, increased fruit and vegetable availability was also associated with greater caloric intake and a higher percentage of calories from fat in overweight adults. This unexpected finding suggests that for some individuals, exposure to more food options, even healthy options, may promote greater food intake. In normal-weight adults, having greater access to aerobic exercise equipment was correlated with physical activity, number of TVs was associated with increased viewing, and having more high-fat snacks in the home was associated with increase in percent of calories from fat. Moreover, in logistic regression analyses, most of the environmental differences between the groups were removed after adjusting for behavioral variables, underscoring a potential link between the home environment and weight-control behavior. Overall, these findings are consistent with the behavioral concept of stimulus control and suggest that for both overweight and normal-weight adults, cues within the home environment may prompt obesogenic behaviors on both sides of the energy balance equation.

Our results mirror the child and adolescent literature suggesting that access to exercise equipment in the home is related to increased physical activity⁷ whereas greater access to TVs is associated with more TV viewing.⁸ Our results also replicate the studies of Jakicic and colleagues¹¹ and Phelan and colleagues¹⁵ showing an association between the amount of exercise equipment in the home and physical activity levels in over-weight adults. Our study extends this finding into normal-weight adults. In general, our findings are largely consistent with the reported associations between the availability of fruits and vegetables, high-fat snacks, and other foods and dietary intake in children²⁻⁶ and support some of the recent home environment-dietary associations among adults reported in Fulkerson and colleagues' study.¹² As in these prior studies, the strength of the associations we observed between the home environment variables and eating and exercise behaviors is quite modest, raising concerns about the practical significance of the findings. Many other factors contribute to physical activity and diet choices in addition to one's immediate surroundings. Drawing on the EnRG framework,¹⁶ a next step is to explore potential cognitive mediators such as intentions and behavioral moderators such as habit strength that may provide a fuller understanding of the environment-behavior link.

Our study adds to the small but growing literature on the potential role of the home environment in the weight and behaviors of adults. To allow for a comparison of an

overweight and obese group and a normal-weight control group, we used samples from 2 separate NIH studies. This cross-study comparison allowed for a more complete examination of environmental influences on diet and exercise and was consistent with the Health Maintenance Consortium's goal to foster cross-study collaborations extending beyond the primary aims of the originally funded individual studies. Combining data from 2 different studies also presented some limitations such as the methodological differences in dietary assessments, self-report versus objective assessments of some key measures, and the demographic differences between the overweight and normal-weight groups. Our statistical approach was sensitive to these issues. Associations between the home environment and behaviors were examined primarily within groups, eliminating error due to these potential confounds; however, the between-group comparisons should be interpreted with caution. It is also important to consider that the overweight and obese participants in this study were presenting for a weight-loss intervention and may not be representative of overweight and obese adults in general. More research with non-treatment-seeking samples is needed. Another limitation of this study is that due to cross-sectional nature of the data, we are unable to ascertain whether the observed differences between overweight and normal-weight homes were causal factors in adult weight gain or whether behavior patterns were influencing participants' environmental surroundings.

In conclusion, findings from this study suggest that normal-weight and obese individuals may differ in the way they arrange their home eating and exercise environments. Prospective studies of the impact of the home environment on eating and activity behaviors in adults across the weight spectrum are needed as are randomized controlled trials testing whether creating a healthier home environment with increased availability of physical activity equipment and greater variety of healthy foods will enhance weight-management outcomes.

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Table 1

Demographic and Behavioral Characteristics of Overweight and Normal-Weight Groups

	Overweight (n=201)	Normal weight (n=213)	P value
Age (years)	48.9±10.5 (23-68)	46.7±13.0 (25-100)	.06
Gender (% female)	78.1%	87.3%	.01
Marital status (% married)	81.1%	85.9%	<.0001
Race (% white)	82.4%	93.0%	<.0001
Education (% college graduate)	47.2%	85.9%	<.0001
Weight (lbs)	223.2±47.2 (134.2-408.1)	128.8±17.9 (97.0-185.0)	<.0001
Body mass index (kg/m²)	37.3±7.0 (25.4-67.9)	21.2±1.6 (17.6-24.9)	<.0001
Physical activity (kcal/week)	813.1±1166.1 (0-6924)	2646.6±2026.5 (56-13106)	<.0001
TV viewing (hrs/week)	19.6±13.2 (0-80)	11.0±8.4 (0-42)	<.0001
Sedentary activity (other than TV; hrs/week)	29.4±21.1 (0-99)	28.1±18.5 (1-80)	.02
Caloric intake (kcal/day)	1938.4±885.3 (552.5-5398.1)	1838.1±540.0 (384.1-5613.3)	.43
Calories from fat (%)	38.6±7.7 (16.8-66.9)	31.8±6.7 (15.1-56.3)	<.0001

Notes.

Means ± standard deviations and ranges are presented for continuous variables; percentages are presented for categorical variables.

Table 2

Means and Standard Deviations of Home Exercise Environment by Weight Group

	Overweight	Normal Weight	P value
Total exercise items	11.1±5.5	13.0±6.0	.004
Team sport	.9±1.0	.8±.9	.84
Individual sport	.8±.8	.9±.8	.46
Individual recreational	1.3±1.1	1.8±1.2	<.0001
Home exercise equipment	.6±.7	.6±.8	.68
Number of TVs in home	3.3±1.4	2.4±1.2	<.0001
TV in bedroom (% yes)	72.6%	51.6%	<.0001

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Table 3

Means and Standard Deviations of Home Food Environment Variables by Weight Group

	Overweight	Normal Weight	P value
Total Food Items	18.0±3.6	17.9±3.9	.35
High Fat-items			
Dairy	1.2±.5	1.2±.6	.29
Spreads	1.3±.7	.6±.5	<.0001
Snacks	3.7±1.5	3.0±1.5	.005
Low-Fat Items			
Dairy	1.2±.7	1.2±.7	.65
Spreads	.9±.7	.8±.8	.30
Snacks	.4±.6	.6±.7	.01
Fruits and vegetables	7.2±2.1	8.6±2.0	<.0001
Cereal	2.1±.9	2.0±.8	.42

Table 4

Correlations Between Physical Activity (Total Calories Expended) and Home Activity Environment by Weight Group

	Over-weight	Normal Weight
Total Exercise Items	.23 (.002)	.13 (.09)
Team sport	.10 (.16)	-.10 (.20)
Individual sport	.24 (.001)	.07 (.35)
Individual recreational	.14 (.06)	.11 (.17)
Home exercise equipment	.05 (.49)	.18 (.02)
Number TVs in Home	-.11 (.13)	.03 (.70)

Notes.

Partial correlation coefficients (r), controlling for demographic variables and weight, are presented with P values in parentheses.

Table 5

Correlations Between Home Food Environment and Caloric Intake and Percent Calories From Fat by Weight Group

	Overweight		Normal Weight	
	Calories	% Fat	Calories	% Fat
Total Food Items	.19 (.01)	.09 (.23)	.00 (1.0)	.09 (.21)
High-Fat Items				
Dairy	-.05 (.51)	-.05 (.47)	.08 (.26)	.11 (.13)
Spreads	.13 (.08)	-.03 (.72)	.05 (.49)	.04 (.58)
Snacks	.09 (.23)	.01 (.89)	-.07 (.36)	.17 (.02)
Low-Fat items				
Dairy	.04 (.63)	-.02 (.74)	-.03 (.70)	-.03 (.65)
Spreads	.08 (.26)	.07 (.35)	.03 (.72)	.02 (.80)
Snacks	.01 (.94)	-.12 (.10)	.03 (.64)	.01 (.87)
Fruits and vegetables	.15 (.05)	.20 (.006)	.00 (.99)	.00 (1.0)
Cereal	.07 (.36)	-.05 (.54)	-.004 (.95)	-.01 (.93)

Notes.

Partial correlation coefficients (r), controlling for demographic variables and weight, are presented with P values in parentheses.