Effects of Parents' Employment Status on Changes in Body Mass Index and Percent Body Fat in Adolescent Girls

Sunmin Lee, Sc.D.,¹ Deborah Rohm Young, Ph.D.,² Charlotte A. Pratt, Ph.D.,³ Jared B. Jobe, Ph.D.,³ Soo Eun Chae, Ph.D.,⁴ Robert G. McMurray, Ph.D.,⁵ Carolyn C. Johnson, Ph.D.,⁶ Scott B. Going, Ph.D.,⁷ John P. Elder, Ph.D.,⁸ and June Stevens, Ph.D.⁹

Abstract

Background: Parents' employment status is frequently cited as a possible predictor of child weight status. Despite the importance of the topic, only a few studies have been conducted. No longitudinal studies have been conducted in the United States.

Methods: A cohort of 1201 girls from the Trial of Activity for Adolescent Girls was used. Height, weight, and percent body fat (PBF) were measured at the 6th and 8th grades. Parents' employment status (measured at 6th grade) was categorized into working full time (reference), part time, unemployed, working or staying at home, and don't know. Mixed-model regression was used to reflect the hierarchical design of our study and adjusted for age, race, parents' education level, free or reduced-price school lunch status, and living arrangement.

Results: Girls whose mothers worked part time or stayed at home had a decreased risk of excess weight gain [relative risk (RR) = 0.94, 95% confidence interval (CI) 0.88, 1.00; RR = 0.89, 95% CI 0.79, 1.00, respectively] compared to girls whose mothers worked full time. Girls whose fathers were unemployed had a moderately increased risk of excess weight gain (RR = 1.13, 95% CI 1.00, 1.26) compared to girls whose fathers worked full time. Having an unemployed mother or part-time or stay-at-home father was not associated with excess weight gain. Parents' employment status was not associated with excess PBF gain.

Conclusions: Our findings suggest that the availability of the mother has a greater influence on the weight of the daughter than the availability of the father. There is a need for a better understanding of how parents' employment status influences excess weight gain in adolescent girls.

Introduction

Obesity rates in American adolescents have escalated rapidly in recent decades. National Health and Nutrition Examination Survey (NHANES) data indicate that the prevalence of obesity (at or above 95th BMI percentile) in 12- to 19-year-old Americans increased from 10.5% in 1988–1994 to 15.5% in 1999–2000.¹ According to current data, 16% of 6 to 19 year olds (more than 9 million) are overweight and an addi-

tional 15% are at risk for obesity (between the 85th and 95th BMI percentile), triple the proportion in 1980.²

Overweight and obesity is a critical problem, especially in adolescents, because overweight adolescents often become overweight or obese adults. Up to 80% of overweight adolescents will become obese adults,^{3–6} and early childhood obesity that persists into adulthood is associated with more severe obesity among adults.³ Childhood obesity has been linked to numerous disorders such as hyperinsulinemia,⁷ reduction in insulin-stimulated

¹Department of Epidemiology and Biostatistics, University of Maryland College Park School of Public Health, College Park, MD.

²Department of Research and Evaluation, Kaiser Permanente Southern California, Pasadena, CA.

³Division of Prevention and Population Sciences, National Heart, Lung, and Blood Institute, Bethesda, MD.

⁴Korean Educational Development Institute, Seoul, Republic of Korea.

⁵Department of Exercise and Sport Science, University of North Carolina at Chapel Hill, Chapel Hill, NC.

⁶Department of Community Health Sciences, Tulane University School of Public Health and Tropical Medicine, New Orleans, LA.

⁷Department of Physiology and Nutritional Sciences, University of Arizona, Tucson, AZ.

⁸Division of Health Promotion and Behavioral Sciences, San Diego State University, San Diego, CA.

⁹Departments of Nutrition and Epidemiology, School of Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC.

glucose metabolism,⁷ hyperlipidemia,⁸ elevated blood pressure,⁹ obstructive sleep apnea,¹⁰ nonalcoholic steatohepatitis,¹¹ poor self-esteem,¹² and lower health-related quality of life.¹² Therefore, identifying and understanding factors that underlie the development of obesity in adolescents is critical.

Parents' employment status may have an impact on children's body weight because parents may influence children's behavior related to body weight or body composition. For example, parents' availability at home (especially mother's availability) may impact food choices^{13,14} and time for physical activity versus engaging in sedentary behaviors.¹⁴⁻¹⁶ Parents' employment status is frequently cited as a possible predictor of child weight status.^{14,16-22} However, most prior studies were cross-sectional, with only a few longitudinal studies available in the literature. The Longitudinal Study of Australian Children found that, compared to the children of mothers who worked full-time, the children of mothers who worked part-time watched less television and were less likely to be overweight.²³ A British study using UK Millennium Cohort data reported that children were more likely to be overweight because mothers worked longer hours. Although the outcome was not weight status, the study reported that children whose mothers worked part-time or full-time were more likely to primarily drink sweetened beverages between meals, use the television/computer, or be driven to school than children whose mothers had never been employed. Children whose mothers worked full-time were less likely to primarily eat fruit/vegetables between meals or eat three or more portions of fruit daily.¹⁸ We were not able to locate any longitudinal studies of cohorts from the United States in the literature.

The purpose of this study was to examine associations between parents' employment status and both cross-sectional and cohort data of objectively measured BMI and percent body fat (PBF) in 1201 6th grade (at baseline) girls of diverse racial/ethnic backgrounds using the data from the Trial of Activity for Adolescent Girls (TAAG).

Materials And Methods

Study Sample

Data used for the current study were collected as part of the TAAG, a school-based, multicenter group-randomized controlled trial of 36 middle schools. The primary aim was to determine whether an intervention linking schools and community organizations could reduce the age-related decline in moderate-to-vigorous physical activity in middle school girls. Six universities established field centers in the vicinities of Washington, DC, and Baltimore (University of Maryland); Columbia (University of South Carolina); Minneapolis (University of Minnesota); New Orleans (Tulane University); Tucson (University of Arizona); and San Diego (San Diego State University). Study coordination was provided by the University of North Carolina at Chapel Hill and the National

Heart, Lung, and Blood Institute (NHLBI) Project Office. Each participant's parent or guardian provided written informed consent, and the girls provided assent. The study was approved by participating universities' institutional review boards. The main results for the study have been published.²⁴

Each field site recruited six middle schools to participate in the trial, half of which were randomized to intervention and half to control status. Random, cross-sectional samples of 45–60 girls (depending on school size) were drawn from each school, and approximately 80% of them consented to participate in measurement activities at baseline when the girls were in 6th grade (2003). Among 1721 girls who consented to participate at baseline, 1203 girls completed BMI measurement, and 1200 girls completed PBF measurements in both years. Among these, 2 additional girls were excluded from the BMI sample due to missing information for age. In addition, we excluded one outlier from the PBF data. Our final cohort dataset, therefore, had 1201 girls for BMI, and 1199 girls for PBF.

Measurements

Independent variable. Parents' employment status was self-reported. We asked girls about the employment status of their mother and father separately. Response categories were: Working full-time; working part-time; work at home or stay at home; unemployed; and don't know. Employment status was measured twice at 6th and 8th grades, but because the data were almost identical, and we wanted to examine a prospective association, we used the measure from 6th grade.

Dependent variables. Trained and certified data collectors administered anthropometric measures in private settings when girls were in 6th and 8th grades. Standing height was measured without shoes using a portable stadiometer (Shorr Productions, Olney, MD) to the nearest millimeter. Body weight was assessed to the nearest 0.1 kg by using a digital scale (Seca 880, Seca Corporation, Hanover, Maryland) after removing shoes and extraneous clothing (e.g., coats, sweaters, heavy belts). Triceps skinfold thickness was measured in triplicate to the nearest millimeter at the midpoint between the olecranon and acromion processes of the right arm using Lange skinfold calipers. BMI was derived from weight and height measurements. BMI was calculated as body weight (kg)/height (m)². PBF was estimated from anthropometric measures using an equation developed by the study group for use in girls in this age range: $PBF = -23.39 + 2.27 (BMI) + 1.94 (\text{triceps skinfold, mm}) - 2.95 (\text{race, 1 if African American, else 0}) - 0.52 (\text{age, years}) - 0.06 (BMI \times \text{triceps skinfold, mm})$.²⁵ The equation was shown to have an R^2 of 0.88 for predicting PBF against the same measure obtained from dual-energy X-ray absorptiometry (DEXA).²⁵

Covariates. Covariates used in this analysis were girl's age, race/ethnicity, father's and mother's education, free

or reduced lunch status at school, and living arrangement, which was defined as living with both parents, living only with mother, living only with father, living with neither parent, and don't know.

Statistical Analysis

BMI and PBF were analyzed in continuous and binary forms. For the binary analyses of BMI, we used the customary cutoff for overweight (the age- and gender-specific 85th percentile cut point from the U.S. CDC^{20,26,27}). For PBF, we designated girls as below or at 32% versus above 32% based on the work of Williams et al.²⁸ Changes in BMI and PBF were calculated by subtracting the 6th grade value from the 8th grade value. We created a variable to indicate excessive gains in BMI and PBF using methods similar to those proposed by Stevens et al.²⁹ We defined excessive weight gain as: (1) >10% increase in BMI in girls who were normal weight at baseline and overweight at 8th grade or (2) >3% gain of BMI in girls who were overweight at both 6th and 8th grades. Different criteria were used for normal-weight and overweight girls because we reasoned that even a small increase in already overweight girls could be considered unhealthy. For PBF, excessive fat gain was defined as being above 32% at 8th grade, provided that their body fat level was less than 32% at 6th grade.

For cross-sectional and cohort analyses, we used mixed-model linear regression (for continuous outcomes) and mixed-model logistic regression (for binary outcomes) to examine effects of independent variables on our dependent variables. We used mixed models to reflect the hierarchical design of our study, and modeled sites and schools as random effects. We also checked for collinearity among our independent variables and covariates using the variance inflation factor (VIF) function in SAS 9.1. None of the independent variables and covariates displayed significant collinearity. No significant interactions were noted in initial analyses, so they were not included in our final models. All data analyses were conducted with SAS 9.1.

Results

Table 1 shows the baseline characteristics of our participants. Mean age was 11.9 years, and a little less than half of participants were white (48.8%), followed by similar percentages of Hispanics (20.3%) and blacks (19.7%), with much lower percentages of others (6.8%) and Asians (4.4%). Mean BMI and PBF values at baseline were 20.8 and 28.0, respectively, with 33% at risk of overweight (BMI >85th percentile) and 34% with body fat greater

Table 1. Baseline Characteristics of Participants at 6th Grade and Their Parents (n = 1201)

Characteristics	Number (%)	Characteristics	Number (%)
Mean age (years)	11.9 (0.4) ^a	Father's education	
Mean BMI	20.8 (4.9) ^a	High school graduate	320 (26.6)
Mean percent body fat	28.0 (9.2) ^a	Less than college	159 (13.2)
Father's working status		College graduate	333 (27.8)
Full-time	826 (68.8)	More than college	165 (13.7)
Part-time	113 (9.4)	Don't know	224 (18.7)
Work at home	16 (1.3)	Mother's education	
Unemployed	50 (4.2)	High school graduate	339 (28.2)
Don't know	196 (16.3)	Less than college	194 (16.2)
Mother's working status		College graduate	346 (28.8)
Full-time	594 (49.5)	More than college	197 (16.4)
Part-time	289 (24.0)	Don't know	125 (10.4)
Work or stay at home	81 (6.7)	Living arrangement	
Unemployed	127 (10.6)	Both parents	857 (71.4)
Don't know	110 (9.2)	Only with mother	242 (20.2)
Race/ethnicity (%)		Only with father	18 (1.5)
White	586 (48.8)	Do not live with parent(s)	17 (1.4)
African American	237 (19.7)	Don't know	67 (5.5)
Hispanic	244 (20.3)	Free/reduced lunch at school	
Asian	52 (4.4)	Yes	428 (35.6)
Other	82 (6.8)	No	594 (49.5)
		No idea	179 (14.9)

^aNumbers in parentheses, standard deviation.

than 32%. About half the mothers worked full-time and about 69% of the fathers worked full-time. Only a small percentage of the parents worked at home. Most of the children (~71%) were exposed to two-parent environments and less than 2% of the children did not live with their parents.

Table 2 summarizes cross-sectional associations between parents' employment status and BMI and PBF at 6th grade. Compared to girls with full-time working mothers, girls with part-time working mothers or working/stay-at-home mothers were less likely to be overweight after adjusting for age, race/ethnicity, mother's education, father's education, living arrangement, and receipt of free/reduced lunch at school. Modeling the data as continuous outcomes showed a similar trend. Furthermore, girls with part-time working or working/stay-at-home mothers were less likely to have excess PBF, compared to girls with full-time working mothers. Continuous PBF

measures demonstrated consistent results with binary results, with additional significant findings for girls with unemployed mothers in age-adjusted univariate analysis. Father's employment status was not significantly associated with PBF. When we excluded girls whose parents did not live with them ($n = 17$), findings were generally similar, except that in cross-sectional analysis of continuous outcomes, we found still significant but lower BMI and PBF values in girls whose mothers worked at home or stayed at home compared to the girls in the same category in the original dataset.

Table 3 summarizes associations between parents' employment status and changes in BMI and PBF over 2 years. Girls with part-time working mothers or working/stay-at-home mothers were less likely to have excessive BMI gain, compared to girls with full-time working mothers, after adjusting for all covariates. Contrary to the cross-sectional data, girls with unemployed fathers

Table 2. Cross-Sectional Age-Adjusted Univariate and Multivariate-Adjusted BMI and PBF in 6th-Grade Girls

	Age-adjusted univariate				Multivariate-adjusted			
	Continuous BMI/PBF		Binary BMI/PBF		Continuous BMI/PBF		Binary BMI/PBF	
	β	95% CI	OR	95% CI	β	95% CI	OR	95% CI
BMI								
Father's employment status								
Full time	0		1.00		0		1.00	
Part time	-0.01	-0.10, 0.08	0.99	0.90, 1.08	-0.01	-0.11, 0.08	0.99	0.89, 1.08
Unemployed	0.06	-0.07, 0.19	1.06	0.93, 1.19	0.04	-0.09, 0.18	1.04	0.91, 1.18
Work/stay at home	-0.18	-0.41, 0.05	0.84	0.61, 1.07	-0.14	-0.37, 0.09	0.87	0.64, 1.10
Don't know	0.07	0.00, 0.14	1.07	1.00, 1.15	0.02	-0.07, 0.12	1.02	0.93, 1.12
Mother's employment status								
Full time	0		1.00		0		1.00	
Part time	-0.07	-0.14, -0.01	0.93	0.86, 0.99	-0.07	-0.14, -0.01	0.93	0.86, 1.00
Unemployed	-0.06	-0.15, 0.03	0.94	0.85, 1.03	-0.06	-0.15, 0.03	0.94	0.85, 1.03
Work/stay at home	-0.11	-0.22, 0.00	0.90	0.79, 1.01	-0.10	-0.21, 0.01	0.90	0.79, 1.01
Don't know	-0.01	-0.10, 0.09	0.99	0.90, 1.09	-0.03	-0.14, 0.08	0.97	0.86, 1.08
PBF								
Father's employment status								
Full time	0		1.00		0		1.00	
Part time	0.01	-0.08, 0.10	1.01	0.92, 1.10	0.01	-0.08, 0.11	1.01	0.92, 1.11
Unemployed	0.04	-0.09, 0.17	1.04	0.91, 1.18	0.03	-0.10, 0.17	1.03	0.90, 1.17
Work/stay at home	-0.18	-0.41, 0.05	0.83	0.60, 1.06	0.03	-0.37, 0.09	0.87	0.64, 1.10
Don't know	0.07	0.00, 0.15	1.07	1.00, 1.15	-0.14	-0.06, 0.13	1.03	0.94, 1.13
Mother's employment status								
Full time	0		1.00		0		1.00	
Part time	-0.07	-0.13, 0.00	0.93	0.87, 1.00	-0.07	-0.13, 0.00	0.94	0.87, 1.00
Unemployed	-0.10	-0.19, -0.01	0.91	0.82, 1.00	-0.08	-0.17, 0.01	0.92	0.83, 1.01
Work/stay at home	-0.15	-0.25, -0.04	0.86	0.76, 0.97	-0.14	-0.25, -0.03	0.87	0.76, 0.98
Don't know	0.02	-0.08, 0.11	1.02	0.92, 1.11	0.00	-0.11, 0.11	1.00	0.89, 1.11

PBF, Percent body fat; CI, confidence interval; OR, odds ratio.

were more likely to have excessive BMI gain compared to those with full-time working fathers. The continuous outcome did not show a significant association. We did not observe any difference in excessive gain in PBF by mother's or father's employment status in continuous and binary outcomes.

When we combined father's and mother's employment status and observed its association with BMI and PBF, we found a consistent trend. For girls where only the father worked, their BMI and PBF values were 8%–10% less than that for girls where both parents worked.

Discussion

Our multivariate-adjusted cross-sectional analysis showed moderate associations between mother's employ-

ment status and BMI and PBF. Compared to girls whose mothers worked full-time, girls whose mothers worked part-time or worked/stayed at home were less likely to be overweight or have high PBF. The underlying supposition may be that mothers working full-time have less time to prepare food at home.¹³ Thus, children may spend more time in out-of-home settings with potentially greater availability of less nutritious high-fat foods than if they were exclusively in their mother's care.¹³ Also, children of working mothers may be more likely to have irregular mealtimes.¹⁴ Working mothers may require their children to be at home in the afterschool hours (latch-key children), which may not only reduce their children's ability to participate in physical activities but also may foster the potential for increased time watching TV.¹⁴ Also, working mothers may not have sufficient time to take their children to sports programs or other recreational activities

Table 3. Cohort Age-Adjusted Univariate and Multivariate-Adjusted Changes of BMI and PBF from 6th to 8th Grade

	Age-adjusted univariate				Multivariate-adjusted			
	Continuous change in BMI/PBF		Excessive gain in BMI/PBF		Continuous change in BMI/PBF		Excessive gain in BMI/PBF	
	β	95% CI	RR	95% CI	β	95% CI	RR	95% CI
Change in BMI								
Father's employment status								
Full time	0		1.00		0		1.00	
Part time	0.06	−0.32, 0.44	1.02	0.93, 1.11	0.04	−0.35, 0.44	1.03	0.94, 1.12
Unemployed	0.37	−0.18, 0.92	1.16	1.03, 1.28	0.31	−0.26, 0.87	1.13	1.00, 1.26
Work/stay at home	0.06	−0.90, 1.02	0.90	0.68, 1.12	−0.12	−1.10, 0.86	0.91	0.69, 1.13
Don't know	0.19	−0.11, 0.49	1.07	1.00, 1.14	0.05	−0.35, 0.45	1.02	0.93, 1.10
Mother's employment status								
Full time	0		1.00		0		1.00	
Part time	−0.11	−0.38, 0.16	0.95	0.88, 1.01	−0.13	−0.42, 0.15	0.94	0.88, 1.00
Unemployed	0.24	−0.14, 0.61	0.97	0.88, 1.05	0.12	−0.26, 0.51	0.96	0.88, 1.04
Work/stay at home	−0.02	−0.47, 0.44	0.89	0.78, 0.99	−0.03	−0.49, 0.44	0.89	0.79, 1.00
Don't know	0.26	−0.13, 0.66	1.03	0.94, 1.12	0.13	−0.33, 0.59	1.00	0.89, 1.10
Change in PBF								
Father's employment status								
Full time	0		1.00		0		1.00	
Part time	0.18	−0.74, 1.09	0.96	0.89, 1.03	0.24	−0.71, 1.18	0.97	0.90, 1.04
Unemployed	0.32	−1.00, 1.64	1.04	0.93, 1.14	0.39	−0.95, 1.73	1.05	0.94, 1.15
Work/stay at home	0.96	−1.33, 3.25	1.10	0.92, 1.28	0.26	−2.06, 2.58	1.07	0.89, 1.25
Don't know	−0.03	−0.76, 0.71	0.95	0.90, 1.01	0.25	−0.70, 1.20	0.96	0.89, 1.04
Mother's employment status								
Full time	0		1.00		0		1.00	
Part time	−0.10	−0.75, 0.56	0.99	0.94, 1.04	−0.23	−0.91, 0.44	0.99	0.94, 1.04
Unemployed	0.66	−0.24, 1.56	0.99	0.92, 1.06	0.37	−0.55, 1.29	0.97	0.90, 1.04
Work/stay at home	0.67	−0.41, 1.76	1.00	0.92, 1.09	0.48	−0.63, 1.58	1.00	0.91, 1.08
Don't know	−0.06	−1.01, 0.90	0.95	0.87, 1.02	−0.44	−1.53, 0.65	0.96	0.87, 1.04

PBF, Percent body fat; CI, confidence interval; RR, relative risk.

compared to mothers who stay at home.^{15,16} Excess weight gain may result in children whose mothers have less time to supervise and monitor their children's behaviors.

Multivariate-adjusted cohort analysis results were similar for excessive gain in BMI, but not for excessive gain in PBF. We found moderately reduced likelihood of excessive gain in BMI among girls whose mothers worked part-time or worked/stayed at home compared to girls whose mothers worked full-time. Our findings were consistent with several published articles. A cross-sectional study of young children in Japan found that children with full-time working mothers had significantly higher BMI, were 33% more likely to have irregular snack intake, and were 20% more likely to be physically inactive.¹⁴ A cohort study of young children in the United Kingdom found that children were 12% more likely to be overweight for every 10 hours the mother worked per week.¹⁸

Interestingly, father's employment status was not associated with overweight or high PBF or excessive gain in BMI or PBF in our study, except that those girls with unemployed fathers had excessive gain in BMI over 2 years. This is consistent with results from the NHLBI Growth and Health Study, which found that girls whose parents were unemployed compared to those with an employed parent had three times the odds of obesity, on the basis of their cross-sectional data from 2379 girls 9–10 years old.²² We speculate that father's unemployment may be a proxy for low socioeconomic status (SES). Although we adjusted for mother's and father's educational levels and receipt of free/reduced lunch at school, we did not have information on household income. Father's unemployment may be representative of the SES of the household. In addition, relationships beyond unemployment and excessive gain in BMI over 2 years may not have emerged due to the fact that 20% of the children were not living in the same house as their father (Table 1). Therefore, the influence of the father would be reduced for a significant portion of the sample. We examined this and found no significant effects. Thus, the lack of a relationship is difficult to interpret.

Information on parents' employment status was reported by the child, and it is possible that some girls did not know this information or reported it inaccurately. We have some girls who responded as "don't know" to father's employment status (16.3%) and mother's employment status (9.2%). It is possible that girls who responded as "don't know" were more likely to have parents who have irregular employment patterns. This may be supported by some of the significant findings we observed. It is also possible that we might have overadjusted for our covariates. Mother's and father's education or the girls' receipt of free/reduced lunch at school may be a part of the family's socioeconomic background, and family's SES may be on the causal pathway between parents' employment status and girls' BMI or PBF. An example for this may be an observation of an association of father's unemployment and increased likelihood of

excessive gain in BMI. However, in other cases (especially mother's employment status), there may be additional components that may influence BMI and PBF in addition to SES operationalized by parental employment status. Thus, we decided to adjust for them to reduce residual confounding by SES. As a consequence, this adjustment might have resulted in the underestimated associations we observed. Information on diet and sedentary behavior has not been collected, and thus it might have limited opportunities to examine mediating effects between parents' employment status and changes in BMI or PBF.

Nevertheless, our study has several strengths. We objectively measured BMI and PBF data over two time points, which may enhance the accuracy of our findings. Because only one cohort study has been conducted that examined longitudinal associations, our findings are an important contribution to the literature. Our current study also has participants from diverse racial/ethnic groups represented from six study sites across the United States. This makes our findings more generalizable.

Conclusion

Although we did not find associations of large magnitude, we believe that our study demonstrates the importance of parent's employment status on weight and body composition of adolescent girls. Our findings may inform future interventions, such as targeting working mothers and their children. A continuing stream of research is needed to better understand whether this phenomenon exists in other populations, and how this process unfolds by collecting data on diet and sedentary behavior to measure potential mediating effects. Additionally, more research is needed to figure out how to identify high-risk youth and prevent excess weight gain.

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Address correspondence to:

Sunmin Lee, Sc.D.

Associate Professor

Department of Epidemiology and Biostatistics

University of Maryland School of Public Health

2234C SPH Building

College Park, MD 20742

E-mail: sunmin@umd.edu