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Away-from-home family dinner sources and associations with weight status, body composition and related biomarkers of chronic disease among adolescents and their parents

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Abstract

Information regarding associations between types of away-from-home family meal sources and obesity and other chronic diseases could help guide dietitians. The present study describes the purchase frequency of away-from-home food sources for family dinner (fast food, other restaurant purchases, home delivery, and take-out foods) and associations with weight status and percent body fat among adolescents (n=723) and parents (n=723) and related biomarkers of chronic disease among adolescents (n=367). A cross-sectional study design was used with baseline parent

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surveys and anthropometry/fasting blood samples from two community-based obesity studies (2006–2008) in Minnesota. Logistic regression and general linear modeling assessed associations between frequency of family dinner sources (weekly versus none in past week) and outcomes (parent and adolescent overweight/obesity and percent body fat; adolescent metabolic risk cluster z-score (MRC), cholesterol, HDL-C, LDL, triglycerides, fasting glucose, insulin and systolic blood pressure. Models accounted for clustering and adjusted for study allocation, baseline meal frequency and demographic characteristics. The odds of overweight/obesity were significantly greater when families reported at least one away-from-home dinner purchase in the past week (OR=1.2–2.6). Mean percent body fat, MRC z-scores and insulin levels were significantly greater with weekly purchases of family dinner from fast food restaurants (p 's < .05). Mean percent body fat, MRC z-scores and HDL levels were significantly higher for families who purchased weekly family dinner from take-out sources (p 's < .05). Although frequent family dinners may be beneficial for adolescents, the source of dinners is likely as important in maintaining a healthy weight. Interventions should focus on encouragement of healthful family meals.

Keywords

family dinner; overweight; obesity; away-from-home; adolescents

Introduction

Obesity prevalence among adolescents and adults has reached epidemic proportions (1). Moreover, obesity is associated with premature morbidity (2,3), social stigmatization (4,5) and medical expenditures (6).

Adult fast food consumption frequency is significantly and positively associated with body mass index (BMI) and weight status (7,8), increases in body weight (8–10), insulin resistance over time (10), and other metabolic outcomes (8). In addition, the frequency of commercially-prepared food consumption, including full-service restaurants, cafeterias, and take-out restaurants, is significantly and positively associated with BMI (11) and body fatness (12). However, few studies have examined these associations among youth. Among adolescents, limited research has shown associations between fast food purchase frequency and the likelihood of being overweight (13) and significant and positive associations between other commercially-prepared foods with percent body fat among youth (14).

To prevent obesity and its associated health problems, national recommendations include making more healthful food choices and eating at home (15–17). Among youth, the frequency of eating at home for family meals is associated with better dietary and nutrient intake (18–21). Yet, little is known about the types of foods available at family meals. Furthermore, while some studies have shown significant inverse associations between family meal frequency and overweight status (22–25), others have not (26). Discrepancies between studies may depend on the type, source, and frequency of foods served at meals.

Only a few studies have examined associations between foods purchased away-from-home for family meals and weight status of family members. Studies have shown that children's weight status is positively associated with their family's fast food patronage (27), the frequency of fast food purchases (28) and with frequent consumption of energy dense foods (29). Parents' weight status has been shown to be associated with patronizing buffet-type restaurants (27) and the frequency of fast food purchases specifically for dinner (30). In one study, parents who purchased restaurant foods at least once per week were significantly more likely to be overweight than those who did not (28).

One substantial gap in the literature is that few studies have investigated the sources of away-from-home foods purchased specifically for family meals and whether these purchases are associated with weight status among family members. Moreover, no studies in the published literature have investigated associations between food purchases and lipid and insulin profiles of youth. Pediatric research indicates that, although metabolic syndrome is difficult to assess in youth (31,32), low levels of related biomarkers are associated with lower measures of cardiovascular risk in adulthood (33) and elevated indicators such as insulin are related to clinically-relevant cardiovascular risk from childhood to young adulthood (34). To prevent future disease, more research is needed to identify correlates, particularly changeable behaviors, of elevated risk blood profiles among adolescents.

The present study aims to describe the associations between purchases of away-from-home food for family dinner and weight status and percent body fat among adolescents and their parents. An additional aim is to describe the associations between purchases of away-from-home foods for family dinner and blood biomarkers of cardiovascular disease (CVD) and diabetes among adolescents, including a metabolic syndrome risk score. Subgroup analyses will be conducted by away-from-home food source. It is hypothesized that purchase frequency from each source will be associated with higher weight status, body fat and CVD/diabetes indicators and metabolic syndrome risk score.

Methods

This research uses a cross-sectional design (baseline data only) and two samples of adolescents from the Minneapolis/St. Paul, Minnesota area. The adolescent samples are from the Etiology of Childhood Obesity (ECHO) study and the Identifying the Determinants of Eating and Activity (IDEA) study; two etiological, longitudinal studies examining factors that may be related to unhealthy weight gain in youth. Identical measurement protocols between studies allowed us to combine these two samples and increase analytic power.

The IDEA study (baseline: 2006–2007) follows 349 youth, regardless of weight status, (ages 10–16 at baseline) and one significant adult in their life (usually a parent) over 24 months, using three data collection periods (35). Youth were recruited from: 1) an existing cohort of youth participating in the Minnesota Adolescent Community Cohort Tobacco Study (36), 2) a Minnesota Department of Motor Vehicle (DMV) list restricted to the seven-county metro area, and 3) a convenience sample drawn from local communities.

Participants in the ECHO study (n=375 adolescent/parent dyads) were recruited from the membership of Health Partners (HP) health plan between June 2007 and March 2008 (37). Recruitment targeted a range of overweight and healthy weight youth and parent members and oversampled minorities. Youth were in grades six through 11 in the fall of 2007 and resided in one of the randomly selected school districts included in the sample.

For both studies, the University of Minnesota Institutional Review Board approved the study protocol and active participant consent/assent were completed. Parent/child dyads attended a clinic visit for survey and anthropometry data collection and a subsample of adolescents consented to a second visit for a blood draw. Participants received financial incentives (up to \$150 in gift cards per year for three years) for completing the measurement protocol. Youth participating in the blood draw received an additional \$100 gift card.

Anthropometry

Trained and certified University of Minnesota staff measured parent and adolescent height and weight and body composition (% body fat) using bioelectrical impedance. Adolescent anthropometric values were used to calculate age- and gender-adjusted BMI percentiles

based on the Center for Disease Control (CDC) growth references.(38) Students with a BMI $\geq$ the 85th percentile were categorized as overweight/obese; those with a BMI between the 5th and < 85th percentile were categorized as normal weight. Parent overweight/obesity status was calculated as BMI > 25.

Blood draw

Twelve-hour fasting blood samples were obtained by venipuncture from adolescents (n=366; 50.6% of baseline sample). Plasma samples were measured for glucose, insulin, triglycerides, total cholesterol, low-density lipoproteins (LDL) and high-density lipoproteins (HDL). There were no statistically significant differences ($p < .05$) in pubertal status, gender, age or BMI between blood draw participants and non-participants. Additional measurement details are provided elsewhere (39). Because there is controversy regarding application of adult criteria for metabolic syndrome among youth (31,32) and research indicates that a continuous indicator of risk may overcome some of the limitations (40), the present study used a metabolic risk cluster score derived by calculating the sum of the sample-specific z-scores from percent body fat, fasting glucose, HDL-C (negative), triglycerides, and systolic blood pressure (39,41).

Demographic characteristics

Parents and adolescents each reported demographic characteristics (e.g., age, gender) on their own surveys. Parent-reported work status, educational attainment, and whether the family qualified for free/reduced priced school meals were assessed as indicators of socioeconomic status (SES).

Family meal frequency

Family meal frequency was assessed with one question: “During the past seven days, how many times did all or most of your family living in your home eat dinner or supper (i.e., the evening meal) together?”

Away-from-home family dinner sources

Parents were asked, “During the past seven days, how many times was a family evening meal: 1) purchased from a fast food restaurant and eaten either at the fast food restaurant or at home?, 2) purchased and eaten in other types of restaurants (i.e., full-service, sit down type)?, 3) delivered to your home (e.g., pizza, sandwiches)?, and 4) picked up as take-out food? Response options for all four items were “never,” “one-two times,” “three-four times,” “five-six times,” and “seven times”. Based on the distributions, response options for each away-from-home food source type were dichotomized into “never” (0) and “at least once in the past week” (1). A variable representing the number of away-from-home food sources used in the past week was created as a measure of reliance upon away-from-home dinner sources, and was created by summing the away-from-home food sources used at least once in the past week (range=zero to four).

Logistic regression models examined associations between each away-from-home family dinner source (never versus at least once in past week) and dichotomous dependent variables (e.g., normal vs. overweight/obese status). General linear models (GLM) assessed mean differences in continuous dependent variables (e.g., percent body fat, insulin levels) by each away-from-home family dinner source individually as well as mean differences by the number of weekly away-from-home food sources. All models used general estimating equations with school as repeated measure to account for correlated data (42) and adjusted for study allocation (IDEA, ECHO). Models with parent outcomes were adjusted for baseline family dinner frequency, parent education and work status, free/reduced lunch

eligibility, parent gender, age and race/ethnicity. Models with adolescent outcomes adjusted for the same covariates but used adolescent-level data (gender, grade in school and race/ethnicity). Associations were considered significant at $p < 0.05$. All analyses were conducted using Statistical Analysis Software (SAS) (version 9.2, 2009, SAS Institute Inc, Cary, NC).

Results and Discussion

Seven-hundred-twenty three adolescent/parent dyads participated. The adolescent sample (mean age = 14.7 years ($SD=0.1$)) was equally split between males and females while most parents (79%) were female. Parents' average age was 45.8 years ($SD=0.2$) and 64% were college graduates. Most parents (92.5%) and adolescents (82.3%) were white. Overweight/obese prevalence was 25.6% for adolescents and 56.3% for parents (mean BMI = 22.1 ($SD=0.2$) and 27.3 (0.2), respectively). About two-thirds of families reported eating three to six family meals per week (never = 2.8%, one to two times = 18.2%, three to four times = 31.1%, five to six times = 33.9%, seven times = 14.0%). About half of families reported purchasing fast food, foods from full-service restaurants and take-out at least once per week each for a family meal in the past week (50.4%, 44.5%, 40.7%, respectively); food delivery was less common with 18.2% purchasing at least weekly. The frequency of away-from home food purchases for family meals appear to be more frequent than previous research (28) for families with children, but similar to the fast food purchases for family meals of adolescents (30).

Adolescents were four times more likely to be overweight/obese if their families purchased their dinner meal from all four food sources at least weekly compared to other adolescents (Table 1, $n=723$). Among adolescents, the odds of being overweight/obese were one and a half to two times more likely if their families purchased family dinner at a fast food restaurant, other types of restaurants, had food delivered to their home, or picked up food as take-out at least weekly compared to adolescents whose families did not make such purchases. The findings are in contrast to previous research (30). The present study's higher SES sample may have contributed to differences in findings.

Parents reporting weekly purchases from all four sources were almost four times more likely to be overweight/obese compared to parents who did not make such purchases (Table 1, $n=723$). The odds of being overweight/obese were up to two and a half times greater if they purchased weekly family dinner at any one of the food sources compared to parents who did not make these purchases. These findings corroborate previous research showing significant positive associations between fast food restaurant usage and overweight status among youth (13,27) and adults (7,9,10) and demonstrate that these findings hold for adolescents even when the food is purchased specifically for dinner with family. It is unclear whether foods from away-from-home sources are associated with overweight status because of the portion size offered, because of preparations that increase caloric content, or both.

Purchasing dinner from three or more away-from-home food sources within one week was significantly associated with a higher percent body fat among adolescents (Table 2). Mean percent body fat among both adolescents ($n=723$) and parents ($n=723$) was significantly higher in families who purchased weekly dinner from fast food restaurants, home food delivery, and take-out foods compared to their counterparts who did not make these purchases. These findings corroborate previous research with adults (12); but also demonstrate these findings in adolescents.

Significantly higher adolescent ($n=367$) mean MRC z-scores ($p < .05$) and insulin levels ($p < .05$) were seen when their parents reported weekly fast food family dinner purchases (MRC z-score = 0.33 (0.18), insulin = 9.6 (0.5)) compared to adolescents whose families did

not make weekly purchases (MRC z-score = -0.21 (0.17), insulin = 7.9 (0.3)). These findings are similar to studies with adult samples (8). Mean insulin levels for adolescents were also significantly higher when family dinner was purchased at other restaurants (9.3 (0.5) vs. 8.1 (0.3), $p < .05$). Significantly higher mean adolescent MRC z-scores ($p < .05$) and higher mean HDL-C levels ($p < .05$) were also observed when family dinner was purchased at take-out sources at least weekly (MRC z-score = 0.34 (0.20), HDL-C = 48.2 (0.9)) compared to none in the past week (MRC z-score = -0.16 (0.17), HDL-C = 50.5 (0.7)). The present study findings indicate that perhaps family health promotion efforts should discourage even weekly purchases of fast food and take-out and such purchases could serve as a warning sign for health care providers who are concerned about the development of CVD and diabetes.

Findings of this investigation illuminate how even weekly family dinner purchases of foods from unhealthful sources are associated with adolescent and adult weight status and other adiposity-related indicators. Dietitians and other health professionals working with families to reduce childhood obesity may promote frequent preparation of healthful meals at home and limit reliance on dinner meals from fast food, take out and home delivery. Discussions of the ramifications of away-from-home food purchases may be helpful; there is not much evidence that the public is aware of the potential downsides to ordering take-out foods. In particular, dietitians could describe how the current food environment is proliferated with restaurants that allow quick curbside pickup, and that although these foods may be convenient, they may not be healthful. Eating family dinner is important regardless of location; however, eating home cooked meals may be inversely associated with overweight/obesity, body fat, and biomarkers of chronic disease. Of note, present study findings did not differ when adolescent moderate-to-high physical activity was included in the statistical models; however, the sample size was reduced so the original models are presented.

Strengths of the present study include evaluation of away-from-home food purchases specifically for family dinner rather than general food purchases for the home/family, collection of anthropometric data by trained staff from both parents and adolescents, and inclusion of several lipid indicators and insulin among adolescents. Study limitations that may affect the interpretation of findings, include the limited external validity of the study, the cross-sectional design that prohibits tests of overweight/obesity incidence, the lack of demonstrated validity of the meal source items, and the lack of information regarding foods eaten outside of the family meal, the types of foods purchased, household income and parental physical activity which could influence weight and disease risk.

Conclusions

Present study findings indicate that the odds of overweight/obesity are significantly greater when families report at least one weekly away-from-home dinner purchase. Mean percent body fat and CVD biomarkers are also significantly greater with weekly purchases of family dinner from fast food restaurants and take-out sources. Future research should investigate these associations with an ethnically- and demographically-diverse sample of families using validated measures and a prospective, longitudinal study design.

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Table 1

Odds ratios (OR) and 95% confidence intervals (CI) of adolescent and parent overweight status by number of different types of away-from-home family dinner sources and type of away-from-home family dinner source

Number of different types of away-from-home family dinner sources in past week (0–4, ordinal)	Adolescent overweight/obese status ¹ (n=723) OR (95% CI)	Parent overweight/obese status ² (n=723) OR (95% CI)
1 type ³	1.0 (0.6–1.7)	1.2 (0.8–1.9)
2 types ³	1.9 (1.1–3.3)	1.9 (1.2–2.8)
3 types ³	2.4 (1.3–4.3)	2.4 (1.5–3.9)
4 types ³	4.1(1.8–9.3)	3.7 (1.6–8.3)
Specific away-from-home family dinner sources		
Fast food restaurant ⁴	1.8 (1.3–2.7)	2.2 (1.6–3.1)
Other types of restaurants ⁴	1.5 (1.1–2.1)	1.2 (0.9–1.6)
Delivered to home ⁴	2.0 (1.3–3.0)	2.3 (1.5–3.4)
Picked up as take-out food ⁴	1.8 (1.2–2.6)	2.6 (1.2–5.5)

¹ Adolescent overweight/obese status = BMI > 85th percentile; analysis with school as repeated measure and baseline adjustments for parent education level, parent work status, free/reduced lunch eligibility, adolescent gender, grade in school, adolescent ethnicity, family dinner frequency, study (IDEA, ECHO).

² Parent overweight/obese status = BMI > 25; analysis with school as repeated measure and baseline adjustments for parent education level, parent work status, free/reduced lunch eligibility, parent gender, parent ethnicity, family dinner frequency, study (IDEA, ECHO).

³ Number of different family dinner source purchases per week versus none in past week (referent group).

⁴ Purchased for family dinner one or more times per week versus none in past week (referent group).

Table 2

Adjusted Mean and standard error (SE) of adolescent and parent percent body fat by number of different types of away-from-home family dinner sources and type of away-from-home family dinner source

Number of different types of away-from-home dinner sources in past week (0–4, ordinal)	Adolescent % body fat ¹ (n=723)	Parent % body fat ² (n=723)
0 types	20.3 (0.6) [*]	31.1 (0.6)
1 type	19.8 (0.5) [*]	32.5 (0.6)
2 types	22.0 (0.8) [*]	33.4 (0.6)
3 types	23.1 (0.9) [*]	34.3 (0.6)
4 types	26.8 (2.4) [*]	34.4 (1.6)
Specific away-from-home family dinner sources		
Fast food restaurant		
None in past week	20.5 (0.4) ^{**}	31.7 (0.4) ^{**}
One or more times in past week	22.4 (0.6) ^{**}	34.0 (0.4) ^{**}
Other types of restaurants		
None in past week	21.0 (0.5)	32.5 (0.4)
One or more times in past week	22.0 (0.6)	33.2 (0.4)
Delivered to home		
None in past week	21.0 (0.4) ^{**}	32.5 (0.3) ^{**}
One or more times in past week	23.7 (1.1) ^{**}	34.4 (0.7) ^{**}
Picked up as take-out food		
None in past week	20.3 (0.4) ^{**}	32.3 (0.4) ^{**}
One or more times in past week	23.1 (0.6) ^{**}	33.6 (0.5) ^{**}

¹ Analysis with school as repeated measure and baseline adjustments for parent education level, parent work status, free/reduced lunch eligibility, adolescent gender, grade in school, adolescent ethnicity, family dinner frequency, study (IDEA, ECHO).

² Analysis with school as repeated measure and baseline adjustments for parent education level, parent work status, free/reduced lunch eligibility, parent gender, parent ethnicity, parent age, family dinner frequency, study (IDEA, ECHO).

^{*} Significantly higher mean adolescent percent body fat between zero, one or two types of different dinner sources versus three or four types of different dinner sources ($p < .05$).

^{**} Statistically significant mean group differences between none in past week and one or more times in past week ($p < .05$).