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Shared meals among young adults are associated with better diet quality and predicted by family meal patterns during adolescence

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Abstract

Objective: To describe shared meal patterns and examine associations with dietary intake among young adults.
Design: Population-based, longitudinal cohort study (Project EAT: Eating and Activity in Teens and Young Adults).
Setting: Participants completed surveys and FFQ in high-school classrooms in Minneapolis/St. Paul, MN, USA in 1998–1999 (mean age = 15·0 years, 'adolescence') and follow-up measures online or by mail in 2008–2009 (mean age = 25·3 years, 'young adulthood').
Subjects: There were 2052 participants who responded to the 10-year follow-up survey and reported on frequency of having shared meals.
Results: Among young adults, the frequency of shared meals during the past week was as follows: never (9·9 %), one or two times (24·7 %), three to six times (39·1 %) and seven or more times (26·3 %). Having more frequent family meals during adolescence predicted a higher frequency of shared meals in young adulthood above and beyond other relevant sociodemographic factors such as household composition and parental status. Compared with young adults who never had family meals during adolescence, those young adults who reported seven or more family meals per week during adolescence had an average of one additional shared meal per week. Having more frequent shared meals in young adulthood was associated with greater intake of fruit among males and females, and with higher intakes of vegetables, milk products and some key nutrients among females.
Conclusions: Nutrition professionals should encourage families of adolescents to share meals often and establish the tradition of eating together, and work with young adults to ensure that healthy food and beverage choices are offered at mealtimes.

Keywords
Family meals
Longitudinal
Young adulthood
Adolescence

When families regularly eat together at mealtimes, children and adolescents are more likely to have diets of higher nutritional quality. Several studies have found that children and adolescents who have more family meals each week have higher intakes of fruit, vegetables and key nutrients (e.g. fibre, Ca, Fe and several vitamins) and lower intakes of soft drinks and saturated fat[1–8]. However, to the best of the authors' knowledge, no prior research has explored whether young people who participate in family meals during adolescence carry on the tradition of shared mealtimes by regularly eating with family or other household members as they transition to adulthood and enter parenthood. Further, little is known regarding the relationship between having shared mealtimes and dietary intake in young adult populations.

While dietary intake quality is important in young adulthood for optimal health and weight management[9], most young adults fail to meet recommendations for healthy eating such as the Dietary Guidelines for Americans[10]. National survey data indicate that intakes of fruit, vegetables, whole grains and several vitamins and minerals are lower than recommended and nearly all US young adults exceed the recommended maximum energy intake from solid fats, added sugars and alcoholic beverages[11–13]. There is also evidence, although limited, suggesting that young adult parents may have poorer dietary intake patterns than those without children[14]. A better understanding of shared meal patterns among young adults could help inform the design of programmes and services aimed to promote improved dietary intake in this population.

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Therefore, the current study was designed to provide more information on shared meal patterns among a diverse population of young adults, including those who are parents. The first aim of the study was to describe and examine sociodemographic differences in the frequency of having shared meals among young adults as well as longitudinal associations with frequency of eating family meals during adolescence. In addition, the study aimed to examine associations between shared meal frequency in young adulthood and measures of dietary quality in the overall sample and in a subset of young adult parents.

Methods

Study design and population

Data for the present analysis were drawn from Project EAT (Eating and Activity in Teens and Young Adults), a 10-year longitudinal study designed to examine dietary intake, physical activity, weight control behaviours, weight status and factors associated with these outcomes among young people. The overall analytic sample represents 2052 participants (45 % male, 55 % female, mean age = 25·3 (SD 1·7) years, range = 20–31 years), including 314 custodial parents, who responded to the 10-year follow-up survey and reported on the frequency of eating with family or other household members. At baseline (Project EAT-I), junior and senior high-school students at thirty-one public schools in the Minneapolis/St. Paul metropolitan area of Minnesota completed surveys and anthropometric measures during the 1998–1999 academic year[15,16]. The 10-year follow-up survey (Project EAT-III) was designed to follow up on the original participants in 2008–2009 as they progressed from adolescence to young adulthood and through their twenties.

At follow-up, participants were mailed survey invitation letters providing the web address and a unique password for completing the Project EAT-III survey and an FFQ online[17]. Data collection ran from November 2008 to October 2009 and was conducted by the Health Survey Research Center in the School of Public Health at the University of Minnesota, Minneapolis, MN, USA. Among those who could be contacted at the 10-year follow-up, the response rate was 66·4 % (48·2 % of the original school-based sample). The University of Minnesota's Institutional Review Board approved all protocols used in Project EAT at each time point.

Survey development

At both time points, survey development was guided by a theoretical framework, literature reviews, expert review by professionals from different disciplines and pilot testing. The theoretical framework used to guide development of the EAT-I survey was based on social cognitive theory[18]; this framework was integrated with an ecological perspective[19,20] at EAT-III given the growing body of research that indicates it is important to consider not only the characteristics of individuals and their families, but also to examine characteristics of broader environments[21–23]. Age-appropriate measures of shared mealtimes were included on the EAT-I and EAT-III surveys. Because formative focus groups with adolescents at baseline emphasized the importance of eating with family members, the EAT-I survey included questions on 'family meals'[24]. However, pilot testing of the EAT-III survey in young adult focus groups revealed the importance of more broadly assessing 'shared meals' with family or other household members in young adult populations due the greater diversity of living situations during this life stage[25]. Test–retest reliability was assessed in a diverse adolescent sample (*n* 161) at EAT-I[16,26] and examined in a sample of sixty-six young adults at EAT-III[25]. Details of the survey development process at both time points have been described elsewhere[24,25,27].

Shared/family meals

At baseline, family meal frequency during adolescence was assessed with the question: 'During the past seven days, how many times did all, or most, of your family living in your house eat a meal together?' (test–retest $r = 0{\cdot}70$). At follow-up, the frequency of having shared meals in adulthood was assessed with the slightly modified and more developmentally appropriate question: 'During the past seven days, how many times did all, or most, of the people living in your household eat a meal together?' (test–retest $r = 0{\cdot}83$). Response categories for both questions were 'never', 'one to two times', 'three to four times', 'five to six times', seven times' and 'more than seven times'. For some of the analyses, the categories were collapsed into 'never', 'one to two times', 'three to six times' and 'seven or more times' to avoid small numbers and ease interpretation. At follow-up, young adults were also given the option of skipping the question by indicating 'I live alone' and those who indicated living alone were excluded from the current analysis (*n* 221). To allow for comparison of mean meal frequencies, the number of meals was assigned a score of 0, 1·5, 3·5, 5·5, 7 or 10 to correspond to the six possible responses.

Diet quality

A semi-quantitative FFQ assessing intake of multivitamins, twenty-seven other dietary supplements (e.g. Ca, vitamin C, folic acid) and 151 foods was administered at the same time as the Project EAT-III survey[28]. This FFQ was used to measure usual past-year intake of fruit (excluding juice), vegetables (excluding potatoes), milk products, whole grains and sugar-sweetened beverages for the current study[28]. A daily serving was defined as the equivalent of one-half cup for fruit and vegetables, 16 g for whole grains and one cup for milk products. For sugar-sweetened beverages, a serving was defined as the equivalent of one glass, bottle or can. In addition, the FFQ

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was used to assess usual daily intakes of total energy (kJ or kcal), total fat (percentage of total energy), saturated fat (percentage of total energy), alcohol (percentage of total energy), Na (mg), fibre (g), Ca (mg), Fe (mg), K (mg) and folate (μg). Dietary intake outcomes were selected for consideration with an emphasis on foods and nutrients identified to be of public health concern in the *Dietary Guidelines for Americans, 2010* or of particular relevance to reproductive health in young adulthood (e.g. folate, Fe)[10,29]. Although other food (e.g. meats, snack foods) and nutrient intake measures (e.g. Zn, vitamin C) were available for consideration, a limited number of specific dietary outcomes were selected to allow for the development of specific and tailored messages based on the results. Nutrient intakes were determined in 2009 by the Nutrition Questionnaire Service Center at the Harvard School of Public Health using a specially designed database, primarily based on the US Department of Agriculture's Nutrient Database for Standard Reference (release 19)[30]. Intakes of foods and nutrients respectively were compared with intakes recommended in the *Dietary Guidelines for Americans, 2010*[10] and the Institute of Medicine's Dietary Reference Intakes[31–35]. Previous studies have examined and reported on the reliability and validity of intake estimates[36,37]. Responses to the FFQ were excluded for 127 participants who reported a biologically implausible level of total energy intake (<2093 kJ/d or >20 934 kJ/d) and for thirty-seven participants who left more than twenty items blank[38].

Sociodemographic characteristics

Sociodemographic characteristics were self-reported and included gender, age, race/ethnicity, educational attainment, current employment, living situation and parental status. Educational attainment was assessed at follow-up with the question: 'What is the highest level of education that you have completed?' (test–retest agreement = 97 %). Responses were categorized according to whether young adults had completed some high school, a high-school degree or a General Equivalency Diploma, a 2-year post-secondary degree or a 4-year post-secondary degree. Current employment was assessed with the question: 'How many hours a week do you currently work for pay?' (test–retest $r = 0{\cdot}94$). Young adults who reported working ≥40 h/week were categorized as employed full-time. Living situation was assessed with the question: 'During the past year, with whom did you live the majority of the time?' (test–retest agreement = 100 %).

Parental status was assessed by asking young adults, 'How many children do you have (including step-children and adopted children)?' (test–retest agreement = 100 %). Response options ranged from 'none' to 'three or more'. Those who reported having one or more child were asked to write their ages in years. Only those who reported living with their child(ren) for the majority of the time during the past year were defined as parents for the analyses reported here. Among custodial parents, the mean age of the oldest child was 5 years. To best capture family meals involving children, analyses examining the relationship between shared meal frequency and diet quality focused on custodial parents with at least one child aged 6 months or older (97·6 %). Parents who reported only having children less than 6 months old were not included in analyses because it is recommended that parents wait to start feeding children solid foods until they reach 4 to 6 months of age[39].

Statistical analyses

Descriptive statistics were calculated to examine associations between sociodemographic characteristics and shared meal patterns during young adulthood. The χ^2 test was used to test for independence of sociodemographic categorization and frequency of shared meals in the past week. Linear regression models were used to further examine adjusted differences in the frequency of shared meals according to sociodemographic characteristics and longitudinal associations with family meal frequency during adolescence. An initial model included all sociodemographic factors found to be related to shared meal patterns in the unadjusted analysis described above along with race/ethnicity; race/ethnicity was included in the model as a strong association with family meal frequency was found in a previously published analysis using only the baseline Project EAT-I data[8]. Then a second model was examined, including all of the sociodemographic factors in the initial model and family meal frequency at baseline.

Finally, gender-stratified linear regression analysis was conducted to examine associations between shared meal frequency in young adulthood and dietary intake outcomes. Based on prior longitudinal research using the Project EAT data that indicated more frequent family meals during adolescence predicts higher priority for eating with family and friends and better diet quality during the transition to adulthood[40], associations between shared meal frequency and dietary patterns of young adults were examined with and without adjustment for family meal frequency in adolescence. As the results were similar with and without adjustment, only the associations from models which accounted for family meal frequency in adolescence are described in detail here. One model of associations with dietary intake outcomes accounted for sociodemographic factors and baseline family meal frequency, and a second model additionally accounted for total energy intake using the nutrient density approach[41]. Only means from the first model were included here as these values representing total daily intake were more readily interpretable than the outcome of daily intake per 4184 kJ from the second model. Probability testing of trends in the dietary intake outcome variables across shared meal frequency categories used linear contrasts.

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In all analyses, the data were weighted using the response propensity method because attrition from the baseline sample (1998–1999) did not occur at random. Compared with the baseline sample, EAT-III participants were more likely to be female, white and of higher socioeconomic status based on level of parental education reported at EAT-I. The response propensity method applies a weight equal to the inverse of the estimated probability that an individual responded in 2008–2009 and produces estimates representative of the demographic makeup of the baseline Project EAT-I sample, thereby allowing results to be more fully generalizable to the population of young people in the Minneapolis/St. Paul metropolitan area[42]. Weights were additionally calibrated so that the weighted total sample sizes used in analyses accurately reflect the actual observed sample sizes for men and women. The weighted sample was 46·9% white, 18·9% African American, 20·5% Asian and 13·7% mixed or other race/ethnicity. A 95% confidence level was used to interpret the statistical significance of probability tests, corresponding to $P < 0{\cdot}05$. Whenever the dependent variable exhibited positive skewness, such testing was carried out under the square root transformation. Analyses were conducted using the SAS statistical software package version 9·2 (2008; SAS Institute).

Results

Shared meals among young adults by sociodemographic characteristics

In the overall sample of young adults, the unadjusted frequency of shared meals during the past week at follow-up was as follows: never (9·9%), one or two times (24·7%), three to six times (39·1%) and seven or more times (26·3%). However, frequency of shared meals differed according to gender, age, employment status, parental status and living situations of young adults (all $P \leq 0{\cdot}001$; Table 1). The groups most likely to have shared meals seven or more times per week were females, young adults aged 26–31 years, those who were not employed, those who were parents and those living with a spouse or partner.

Similar patterns were observed in a multivariate model including gender, age, race, parental status and other sociodemographic characteristics related to shared meal frequency in the univariate analysis (Table 2, Model 1). Although differences by age observed in the univariate analysis did not remain statistically significant, mean shared meal frequencies were likewise highest among females ($P = 0{\cdot}02$), those who were not employed ($P = 0{\cdot}009$), those who were parents ($P < 0{\cdot}001$) and those living with a spouse or partner ($P < 0{\cdot}001$). Racial/ethnic differences

Table 1 Young adults' frequency of shared meals in the past week by sociodemographic characteristics: 10-year follow-up, Project EAT (Eating and Activity in Teens and Young Adults), Minneapolis/St. Paul, MN, USA, 2008–2009

		Frequency of shared meals/week*				
	n	Never (%)	1–2 times (%)	3–6 times (%)	7+ times (%)	*P* value†
Gender						<0·001
Males	932	11·9	28·7	36·4	22·9	
Females	1120	8·2	21·4	41·3	29·1	
Age						0·001
20–25 years	636	12·1	27·3	39·3	21·3	
26–31 years	1416	8·9	23·6	39·0	28·5	
Race/ethnicity						0·32
White	1281	10·2	24·1	39·4	26·3	
Black or African American	192	11·0	27·6	37·2	24·2	
Asian American	353	8·2	23·1	38·5	30·1	
Mixed/other	205	8·1	26·2	42·7	23·0	
Educational attainment						0·61
Some high school	63	4·8	28·4	40·3	26·4	
High-school degree	778	9·8	23·8	39·8	26·6	
2-year post-secondary degree	490	11·5	22·5	40·3	25·7	
4+-year post-secondary degree	714	9·2	26·8	37·6	26·3	
Employment status						<0·001
Not employed	210	6·7	22·2	38·3	32·8	
Part-time	687	10·5	27·5	41·8	20·2	
Full-time	1056	10·0	23·5	38·0	28·4	
Parental status						<0·001
No children	1738	11·4	26·7	38·5	23·4	
≥1 child	314	3·0	15·8	42·0	39·2	
Live with spouse/partner						<0·001
No	978	17·3	34·2	33·3	15·2	
Yes	1074	3·0	15·8	44·5	36·7	
Live with parents						<0·001
No	1247	9·6	21·5	37·9	31·0	
Yes	603	12·1	32·5	39·5	15·9	

*All percentages are weighted to reflect the probability of responding to the EAT-III survey.
†*P* values represent testing for independence of sociodemographic categorization and frequency of shared meals in the past week by the χ^2 test.

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Table 2 Young adults' adjusted mean frequency of shared meals in the past week by sociodemographic characteristics and frequency of family meals during adolescence: 10-year follow-up, Project EAT (Eating and Activity in Teens and Young Adults), Minneapolis/St. Paul, MN, USA, 2008–2009

	Model 1*			Model 2†		
	Adjusted mean frequency	SE	*P* value	Adjusted mean frequency	SE	*P* value
Gender			0·02			0·02
Males	4·1	0·1		4·1	0·1	
Females	4·5	0·1		4·4	0·1	
Age			0·14			0·01
20–25 years	4·1	0·1		4·0	0·1	
26–31 years	4·4	0·1		4·4	0·1	
Race			0·01			0·34
White	4·3	0·1		4·3	0·1	
Black or African American	4·1	0·2		4·2	0·2	
Asian American	4·8	0·2		4·5	0·2	
Mixed/other	4·0	0·2		4·1	0·2	
Employment status			0·009			0·02
Not employed	4·9	0·2		4·9	0·2	
Part-time	4·2	0·1		4·2	0·1	
Full-time	4·3	0·1		4·3	0·1	
Parental status			<0·001			<0·001
No children	4·2	0·1		4·2	0·1	
≥1 child	4·9	0·2		4·9	0·2	
Live with spouse/partner			<0·001			<0·001
No	3·2	0·1		3·2	0·1	
Yes	5·4	0·1		5·5	0·1	
Live with parents			0·67			0·99
No	4·3	0·1		4·3	0·1	
Yes	4·3	0·1		4·3	0·1	
Family meals during adolescence (past 7 d)						<0·001
Never	–	–		3·8	0·2	
1–2 times	–	–		3·9	0·2	
3–6 times	–	–		4·3	0·1	
7+ times	–	–		4·9	0·1	

*Model 1 includes gender, age, race, employment status, parental status and living situation; $R^2 = 0·16$.
†Model 2 includes the covariates in Model 1 and family meal frequency at baseline (Time 1); $R^2 = 0·18$.

were also observed ($P = 0·01$), with the highest mean frequency reported by Asian-American young adults (4·8 meals/week) and the lowest frequency reported by those in the mixed/other category (4·0 meals/week).

Shared meals among young adults by family meal frequency during adolescence

Frequency of shared meals in young adulthood was further examined according to frequency of family meals during adolescence (Table 2, Model 2). The longitudinal multivariate model similarly accounted for all of the same sociodemographic characteristics included in Model 1 and showed that family meal frequency during adolescence was positively associated with the frequency of shared meals in young adulthood ($P < 0·001$). Compared with young adults who never had family meals during adolescence, those young adults who reported seven or more family meals per week during adolescence had an average of one additional shared meal per week (3·8 *v.* 4·9 meals/week).

Young adults' dietary intake by frequency of shared meals

Associations between frequency of shared meals and dietary intake were examined in models accounting for sociodemographic characteristics and baseline family meal frequency among young adult females (Table 3, Model 1) and males (Table 4, Model 1). Frequency of shared meals was positively associated with intake of fruit among females ($P = 0·03$) and males ($P = 0·004$). Among females, frequency of shared meals was also positively associated with intakes of vegetables ($P = 0·006$), milk products ($P = 0·008$), energy ($P = 0·01$), fibre ($P = 0·009$), Ca ($P = 0·002$), Fe ($P = 0·02$) and K ($P < 0·001$). Among males, frequency of shared meals was also positively associated with intake of whole grains ($P = 0·04$).

Associations between frequency of shared meals and dietary intake were next examined in models that additionally accounted for total energy intake among females (Table 3, Model 2) and males (Table 4, Model 2). Among females, intake of K ($P = 0·006$) was still significantly and positively associated with frequency of shared meals. Among males, frequency of shared meals continued to be positively associated with intake of fruit ($P = 0·003$) and statistically significant associations with higher intakes of Ca ($P = 0·04$) and K ($P = 0·008$) emerged. In contrast, a negative association between frequency of shared meals and intake of sugar-sweetened

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Table 3 Female young adults' adjusted mean daily food and nutrient intakes by frequency of shared meals in past the week: 10-year follow-up, Project EAT (Eating and Activity in Teens and Young Adults), Minneapolis/St. Paul, MN, USA, 2008–2009

		Model 1*									
		Never (*n* 85)		1–2 times (*n* 204)		3–6 times (*n* 418)		7+ times (*n* 283)			Model 2†
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	*P* trend‡	*P* trend‡
Food (servings)	DG										
Fruit	≥4	0·99	0·18	1·22	0·12	1·44	0·08	1·44	0·11	0·03	0·27
Vegetables	≥5	2·08	0·24	2·11	0·16	2·58	0·11	2·79	0·14	0·006	0·13
Milk products	≥3	1·50	0·18	1·81	0·12	1·86	0·08	2·08	0·10	0·008	0·12
Whole grains	≥3	1·66	0·17	1·90	0·12	1·76	0·08	1·97	0·10	0·19	0·66
Sugar-sweetened beverages	NA	0·64	0·13	0·61	0·09	0·78	0·06	0·58	0·07	0·33	0·03
Nutrients	DRI										
Energy (kJ)	NA	7539	402	8221	276	8343	184	8778	234	0·01	NA
Energy (kcal)	NA	1802	96	1965	66	1994	44	2098	56	0·01	NA
Energy from fat (%)	20–35 %	30·6	0·7	30·6	0·5	29·7	0·3	30·5	0·4	0·54	NA
Energy from saturated fat (%)	<10 %	10·6	0·3	10·6	0·2	10·1	0·1	10·6	0·2	0·79	NA
Energy from alcohol (%)	NA	2·0	0·4	2·4	0·3	2·2	0·2	2·6	0·2	0·30	NA
Fibre (g)	25	16·8	1·3	18·8	0·9	19·5	0·6	20·9	0·7	0·009	0·47
Ca (mg)	800	834	66	989	45	997	30	1079	38	0·002	0·13
Fe (mg)	8·1	12·9	0·8	15·1	0·6	14·4	0·4	15·2	0·5	0·02	0·87
K (mg)	4700	2515	162	2845	111	2979	74	3203	94	<0·001	0·006
Folate (μg)§	320	875	73	878	50	842	33	909	42	0·68	0·27

DG, servings recommended in the *Dietary Guidelines for Americans, 2010*[10] for a 8374 kJ diet; NA, not applicable; DRI, Dietary Reference Intakes[31–35] (DRI for Ca, Fe and folate are Estimated Average Requirements; reference values for K and fibre are Adequate Intakes).
*Weighted Model 1 is adjusted for age, race/ethnicity, employment status, parental status, living situation and baseline frequency of family meals.
†Weighted Model 2 is adjusted for the covariates in Model 1 and total energy intake.
‡*P* value for linear trend across categories of shared meal frequency.
§As dietary folate equivalents.

Table 4 Male young adults' adjusted mean daily food and nutrient intakes by frequency of shared meals in past the week: 10-year follow-up, Project EAT (Eating and Activity in Teens and Young Adults), Minneapolis/St. Paul, MN, USA, 2008–2009

		Model 1*									
		Never (*n* 92)		1–2 times (*n* 239)		3–6 times (*n* 290)		7+ times (*n* 187)			Model 2†
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	*P* trend‡	*P* trend‡
Food (servings)	DG										
Fruit	≥4	0·94	0·13	1·03	0·08	1.06	0·07	1·32	0·09	0·004	0·003
Vegetables	≥5	1·99	0·21	1·79	0·13	2·18	0·12	2·46	0·16	0·06	0·10
Milk products	≥3	1·73	0·18	1·82	0·11	0·96	0·10	2·17	0·13	0·06	0·08
Whole grains	≥3	1·51	0·19	1·68	0·12	0·98	0·11	1·97	0·14	0·04	0·14
Sugar-sweetened beverages	NA	1·31	0·16	1·08	0·09	1·06	0·09	0·88	0·11	0·09	0·06
Nutrients	DRI										
Energy (kJ)	NA	8770	435	9364	263	9719	238	8903	318	0·58	NA
Energy (kcal)	NA	2096	104	2238	63	2323	57	2128	76	0·58	NA
Energy from fat (%)	20–35 %	30·4	0·7	30·8	0·4	29·9	0·4	30·1	0·5	0·56	NA
Energy from saturated fat (%)	<10 %	10·2	0·3	10·4	0·2	10·2	0·1	10·4	0·2	0·64	NA
Energy from alcohol (%)	NA	3·3	0·5	4·0	0·3	3·9	0·3	3·2	0·4	0·89	NA
Fibre (g)	38	16·3	1·2	17·9	0·7	19·2	0·7	19·4	0·9	0·08	0·14
Ca (mg)	800	922	67	990	41	1057	37	1085	49	0·05	0·04
Fe (mg)	6·0	13·3	0·9	14·6	0·5	15·8	0·5	14·9	0·6	0·10	0·06
K (mg)	4700	2773	163	2959	99	3181	89	3132	119	0·05	0·008
Folate (μg)§	320	663	53	683	32	766	29	763	39	0·06	0·16

DG, servings recommended in the *Dietary Guidelines for Americans, 2010*[10] for a 8374 kJ diet; NA, not applicable; DRI, Dietary Reference Intakes[31–35] (DRI for Ca, Fe and folate are Estimated Average Requirements; reference values for K and fibre are Adequate Intakes).
*Weighted Model 1 is adjusted for age, race/ethnicity, employment status, parental status, living situation and baseline frequency of family meals.
†Weighted Model 2 is adjusted for the covariates in Model 1 and total energy intake.
‡*P* value for linear trend across categories of shared meal frequency.
§As dietary folate equivalents.

beverages was observed among females ($P = 0{\cdot}03$) with a similar trend among males ($P = 0{\cdot}06$). All associations were similar when examined without adjustment for baseline family meal frequency; however, among males, frequency of shared meals was positively associated with intake of Fe ($P = 0{\cdot}03$) and the inverse association with sugar-sweetened beverage consumption was statistically significant ($P = 0{\cdot}03$).

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Young adults' dietary intake and regular shared meals among parents

Given the high average frequency of nearly five shared meals per week among young adult parents, associations of meal frequency with dietary intake were examined by contrasting parents who reported five or more meals per week with parents who reported fewer than five meals per week. Associations between the frequency of shared meals and dietary intake were first examined in models accounting only for sociodemographic characteristics and baseline family meals among young adult parents (females: Table 5, Model 1; males: Table 6, Model 1). Among female

Table 5 Female parents' adjusted mean daily food and nutrient intakes by frequency of shared meals in past the week: 10-year follow-up, Project EAT (Eating and Activity in Teens and Young Adults), Minneapolis/St. Paul, MN, USA, 2008–2009

		Model 1*					Model 2†
		<5 times (*n* 72)		5+ times (*n* 120)			
		Mean	SE	Mean	SE	*P* trend‡	*P* trend‡
Food (servings)	DG						
Fruit	≥4	1·02	0·27	1·98	0·24	0·01	0·01
Vegetables	≥5	2·16	0·27	2·92	0·24	0·14	0·37
Milk products	≥3	1·96	0·22	1·97	0·19	0·79	0·78
Whole grains	≥3	1·52	0·15	1·75	0·13	0·23	0·38
Sugar-sweetened beverages	NA	1·00	0·17	0·89	0·16	0·30	0·14
Nutrients	DRI						
Energy (kJ)	NA	8874	477	9330	422	0·68	NA
Energy (kcal)	NA	2121	114	2230	101	0·68	NA
Energy from fat (%)	20–35 %	31·6	0·7	29·6	0·6	0·05	NA
Energy from saturated fat (%)	<10 %	11·3	0·3	10·5	0·3	0·10	NA
Energy from alcohol (%)	NA	0·9	0·3	1·4	0·3	0·90	NA
Fibre (g)	25	16·9	1·5	21·9	1·3	0·04	0·02
Ca (mg)	800	1009	76	1053	67	0·58	0·60
Fe (mg)	8·1	14·9	0·9	15·8	0·8	0·63	0·94
K (mg)	4700	2945	204	3405	182	0·18	0·13
Folate (μg)§	320	842	87	1005	78	0·23	0·59

DG, servings recommended in the *Dietary Guidelines for Americans, 2010*[10] for a 8374 kJ diet; NA, not applicable; DRI, Dietary Reference Intakes[31–35] (DRI for Ca, Fe and folate are Estimated Average Requirements; reference values for K and fibre are Adequate Intakes).
*Weighted Model 1 is adjusted for age, race/ethnicity, employment status, parental status, living situation and baseline frequency of family meals.
†Weighted Model 2 is adjusted for the covariates in Model 1 and total energy intake.
‡*P* value for linear trend across categories of shared meal frequency.
§As dietary folate equivalents.

Table 6 Male parents' adjusted mean daily food and nutrient intakes by frequency of shared meals in past the week: 10-year follow-up, Project EAT (Eating and Activity in Teens and Young Adults), Minneapolis/St. Paul, MN, USA, 2008–2009

		Model 1*					Model 2†
		<5 times (*n* 32)		5+ times (*n* 47)			
		Mean	SE	Mean	SE	*P* trend‡	*P* trend‡
Food (servings)	DG						
Fruit	≥4	1·04	0·20	1·43	0·16	0·26	0·13
Vegetables	≥5	1·96	0·46	2·95	0·37	0·16	0·03
Milk products	≥3	2·04	0·42	2·23	0·34	0·88	0·67
Whole grains	≥3	1·80	0·30	1·97	0·24	0·79	0·39
Sugar-sweetened beverages	NA	1·60	0·23	0·84	0·18	0·01	0·03
Nutrients	DRI						
Energy (kJ)	NA	10 962	770	10 054	619	0·33	NA
Energy (kcal)	NA	2620	184	2403	148	0·33	NA
Energy from fat (%)	20–35 %	30·5	1·1	29·7	0·9	0·63	NA
Energy from saturated fat (%)	<10 %	11·1	0·5	10·2	0·4	0·23	NA
Energy from alcohol (%)	NA	3·2	0·8	2·0	0·6	0·48	NA
Fibre (g)	38	18·5	2·4	21·7	1·9	0·39	0·04
Ca (mg)	800	1065	136	1171	109	0·64	0·22
Fe (mg)	6·0	16·9	1·7	17·6	1·3	0·74	0·01
K (mg)	4700	3316	323	3511	260	0·74	0·04
Folate (μg)§	320	601	83	821	67	0·05	<0·001

DG, servings recommended in the *Dietary Guidelines for Americans, 2010*[10]for a 8374 kJ diet; NA, not applicable; DRI, Dietary Reference Intakes[31–35] (DRI for Ca, Fe and folate are Estimated Average Requirements; reference values for K and fibre are Adequate Intakes).
*Weighted Model 1 is adjusted for age, race/ethnicity, employment status, parental status, living situation and baseline frequency of family meals.
†Weighted Model 2 is adjusted for the covariates in Model 1 and total energy intake.
‡*P* value for linear trend across categories of shared meal frequency.
§As dietary folate equivalents.

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parents, frequency of shared meals was positively associated with intakes of fruit ($P = 0{\cdot}01$) and fibre ($P = 0{\cdot}04$). Among male parents, frequency of shared meals was negatively associated with intake of sugar-sweetened beverages ($P = 0{\cdot}01$).

Associations between frequency of shared meals and dietary intake were also examined in models that additionally accounted for total energy intake among female (Table 5, Model 2) and male (Table 6, Model 2) parents. Among female parents, intakes of fruit ($P = 0{\cdot}01$) and fibre ($P = 0{\cdot}02$) were still significantly and positively associated with frequency of shared meals. Among male parents, frequency of shared meals continued to be negatively associated with intake of sweetened beverages ($P = 0{\cdot}03$) and was positively associated with intakes of vegetables ($P = 0{\cdot}03$), Fe ($P = 0{\cdot}01$), K ($P = 0{\cdot}04$) and folate ($P < 0{\cdot}001$). All associations remained when examined without adjustment for baseline family meal frequency, and among female parents, frequency of shared meals was also inversely associated with intake of energy from fat ($P = 0{\cdot}02$) and saturated fat ($P = 0{\cdot}03$).

Discussion

The present study described shared meal patterns and examined associations with dietary intake among a diverse population of young adults, including those who are parents. The results suggested that nearly two-thirds of young adults shared mealtimes with all or most of the people living in their household at least three times per week. Further analyses indicated that having more frequent family meals during adolescence longitudinally predicted a higher frequency of shared meals in young adulthood; this relationship was found to be independent of associations between shared meal frequency and sociodemographic characteristics of young adults, including gender, age, race, employment status, household composition and parental status. In addition, the results showed that a higher frequency of shared mealtimes in young adulthood was related to greater intakes of some healthful foods and nutrients of public health concern. Together, the 10-year longitudinal and cross-sectional findings emphasize the potential importance of establishing shared meal patterns with one's family during adolescence and supporting young adults in having more frequent shared meals in order to help them get closer to meeting national dietary recommendations. However, regardless of shared meal frequency, average young adult intakes of fruit, vegetables, milk products, whole grains, fibre and K fell short of national recommendations[10].

These results support and extend prior research relating to factors that influence the frequency of shared meals. A previous study in the Project EAT sample found that having more family meals as a high-school student predicted a higher priority for social eating and meal structure five years later during late adolescence and the transition to adulthood; however, it did not examine the actual frequency of shared meals[43]. The 10-year longitudinal design of the current study uniquely allowed for an exploration of how family meal frequency during adolescence is related to the frequency of having shared mealtimes with household members in young adulthood. The magnitude of this association was noteworthy; young adults who had seven or more family meals per week during adolescence had an average of one additional shared meal per week compared to young adults who never had family meals during adolescence. Although future research will need to confirm these findings, the results add weight to numerous prior studies that have emphasized the importance of having frequent family meals during adolescence due to observed associations with better psychosocial health, nutrition and academic outcomes[6,8,40,44–46].

In agreement with prior research among children and adolescents regarding the nutritional benefits of family meals[1–8], the current study additionally observed that having shared meals in young adulthood was related to some markers of better diet quality. Having more frequent shared meals in young adulthood was associated with greater intake of fruit among males and females and with higher intakes of vegetables, milk products and key nutrients such as Ca among females. However, these associations appeared to be influenced in part by total energy intake, which tended to be higher among females who reported having more frequent shared meals. Although frequency of shared meals was unrelated to most markers of diet quality after accounting for differences in total energy intake, the results suggested that young adults who had more frequent shared meals tended to drink fewer sugar-sweetened beverages. Also, while fewer statistically significant associations with dietary intake were found among young adult parents, possibly due to the small size of the parent subset and limited variability in family meal frequency among this group, the results indicated that having more frequent shared meals may have supported better nutritional intake among parents. This finding is notable given that the dietary behaviours modelled by parents represent an important influence on the development of children's food preferences and eating behaviour[47,48].

Certain strengths and limitations are important to consider in drawing conclusions from the present study. Strengths of the study included the longitudinal design and large sample of young adults who were diverse in terms of race, educational attainment, employment and parental status. The comprehensive examination of usual dietary intake using a validated FFQ was another study strength[36,37]; however, the tool did not specifically allow for investigation of the types of foods and beverages served at shared meals. The measure of shared meals in young adulthood assessed the frequency of eating with

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all or most other household members, but no additional information was collected regarding which members were involved in preparing or purchasing meals, which members participated in meals or the mealtime environment. It is further possible that young adult participants in the current study who did not report having shared meals with household members were sharing meals on a regular basis with a partner or friends living outside their household. The observed associations with dietary intake may differ according to the living situations of young adults as it is likely that meals shared with individuals not residing in the same household are more often purchased at restaurants or cafeterias *v.* prepared at home. Some misclassification on young adults' living situation may have influenced the results due to a difference between the time period referenced in the measure of shared meals (past week) and the period referenced in the measure of living situation (past year). Finally, non-response at EAT-III might have produced biases not fully corrected by the use of propensity weighting. These concerns regarding non-response bias were lessened by analyses comparing responders and non-responders that showed no association between response at EAT-III and family meal frequency at baseline regardless of whether the models used propensity weights.

Results of the study indicated that having more family meals during adolescence was associated with more frequent shared meals in young adulthood. Additionally, the frequency of having shared meals in young adulthood was related to some indicators of better diet quality. Food and nutrition professionals should encourage families to share meals often and establish the tradition of eating together, and work with young adults to ensure healthy food and beverage choices are offered at mealtimes. Developing cooking skills and learning strategies for preparing quick and healthy meals may be of particular benefit to young adults employed outside the home as this demographic group was found to have fewer shared meals compared with young adults who were not employed. Only a small number of interventions have been developed to support families in sharing meals and, to the best of the authors' knowledge, no evaluated programmes have been targeted to young adults. However, published evaluations of initiatives designed to promote shared meals have suggested it may be particularly beneficial to address barriers such as lack of time or support and parenting knowledge in messages targeted to parents and to teach food preparation skills to school-aged children and adolescents so they can help with family meal planning and preparation[49–51].

Future studies in young adult populations will be needed to confirm the results of the current study and further inform the development of programmes and services. Research should be conducted to build a better understanding of shared mealtime environments among young adults with diverse living arrangements. There is a need for exploration of hypothesized reasons why having shared meals may contribute to better dietary intake and why associations between shared meal frequency and dietary quality may be weaker during young adulthood *v.* childhood and adolescence, particularly among those who are parents. Having more frequent shared meals in young adulthood may contribute to better diet quality if social eating facilitates mindful food choices at the table or if household members are more likely to take the time to shop for and prepare healthful foods when their efforts will be shared with others; however, research is needed to confirm such potential mechanisms. As parents reported a higher average frequency of shared mealtimes than non-parents and parental modelling is key to the development of healthy eating patterns in early childhood[47], it will be especially important to develop a better understanding of how young adults involve their children in mealtimes. Additional qualitative studies focusing on young adult populations could also build on what is known about the aspects of paid employment that are the greatest barriers to having shared mealtimes and help to identify successful coping strategies[52–55]. Finally, there is a need for studies to examine meal structure, the types of foods and beverages served at home-prepared meals and how frequently shared meals are consumed at restaurants to guide strategies for promoting healthy choices.

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