Frequency of **family meals** and **childhood overweight**: a **systematic review**.

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Frequency of family meals and childhood overweight: A systematic review

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Abbreviations

1. FFM: Frequency of Family Meals
2. BMI: Body Mass Index
3. SEP: Socio-economic position
4. CDC: Center of Disease Control

Abstract

Energy balance is influenced by understudied genetic, social, and other environmental factors. The frequency of family meals (FFM) may be one of these factors since it is associated with a healthier dietary pattern in children and adolescents. The objective of this review is to evaluate the scientific evidence on the association between FFM and the risk of childhood and adolescent overweight. The electronic literature search of five databases identified 394 articles published during 2005-2012. Of these, 15 studies gave precise information on the study association, of which four were longitudinal studies. We found great variability regarding the measurement of FFM. Six out of 11 cross- sectional studies and 1 out of 4 longitudinal studies found statistically significant inverse associations between FFM and being overweight, mainly in children, with odds ratios ranging from 0.11 to 0.93. Of those, only 1 adjusted for all the potential confounding factors considered: socio-demographic, physical activity and diet related variables. Therefore, this review only found evidence of a weak and inconsistent inverse association between FFM and risk of childhood overweight. In conclusion, further research is needed to establish whether family meals have an effect on childhood overweight. These studies should have longitudinal or experimental designs, a clear and standardized definition of the exposure under study, a measure of the exposure based on direct observation or validated questionnaires, and an adequate adjustment for potential confounders.

Introduction

The childhood obesity pandemic is a serious public health problem (1;2). The proximate obesity cause is an imbalance between energy intake and expenditure. However, the energy balance is influenced by understudied genetic, social and other environmental factors (3), which complicate the design of effective prevention interventions (4).

Frequent family meals may improve the energy balance since family meals are associated with a healthier and more varied dietary and nutritional pattern (5). This effect is bound to be especially significant for younger children when parents exert greater influence on the development of eating habits (6). Further, adolescents who eat with their families more often report higher psychosocial well-being as well as lower risk of addictive risk behaviors (7;8) and disordered eating behaviors (9).

The increase in prevalence of childhood obesity during the last decades of the twentieth century has paralleled the decrease in frequency of family meals (FFM) (10). However, although the first study that observed an inverse relationship between the body mass index (BMI) in children and FFM dates back to 2000 (5), an analysis of the potential influence of FFM on obesity adjusting for potential confounding factors was not performed until 2005 (11-13). If the protective effect of FFM on weight is confirmed, promoting family meals could be an effective strategy to prevent childhood overweight. Further, as a general health promotion measure bound to enhance children's intellectual, social, and emotional development, it should enjoy wide parental support.

A recent meta-analysis found that having family meals 3 or more times per week was associated with a 12% reduction in children and adolescent overweight risk (14). However, the analysis did not accounted for certain characteristics of the studies examined, such as study design (cross-sectional vs. longitudinal), whether height and weight were measured or self-reported, or the degree to which potential confounders were controlled for. It also failed to examine possible effect modifications by sex, age, or race/ethnicity. Finally, the meta-analysis did not consider studies regarding the association of interest when an OR couldn't be estimated, and, since its publication in 2011, new evidence has emerged that deserves consideration (15-17).

This work is a systematic review of the literature that evaluates the existing scientific evidence on the relationship between FFM and the risk of overweight among children and adolescents.

Materials and Methods

To ensure transparency and complete reporting, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement recommendations have been followed where applicable

(18), including a checklist (presented as supplemental information in Table S1) and a flowchart (figure 1) describing the study selection process.

Literature search and selection

In July 2011, five search engines were used to systematically locate articles published since 2005: PubMed, Scopus, PsycINFO, Global Health, and IBECS (Spanish Bibliographic Index for the Health Sciences). The following key words were chosen as the search terms: ("obesity" or "overweight" or "weight gain") and ("family meals" or "frequency of family meals" or "family dinner" or "frequency of family dinner"). During a second phase, two MeSH search terms were used in the search: "feeding behavior" and "parents child relations." We repeated the systematic search on January 2012. Reference lists of the articles identified were also reviewed for potential papers. The complete search strategy is presented as supplemental information in Table S2.

This review included original articles addressing children and adolescents (<18 years of age) which met the following criteria: 1) must be peer-reviewed; 2) written in English or Spanish; 3) reported findings from original research examining the relationship between FFM and any of the following variables: BMI, overweight prevalence, waist circumference, abdominal obesity, or any other measures of adiposity. We excluded studies with no information on the variables of interest as well as those that failed to analyze or present quantitative estimates of the study associations. We also excluded one study that reported significant associations only in aggregate form for a wide age band (10-29 year-olds). When same data were examined in more than one article, we selected the one that analyzed the relationship between FFM and overweight most directly.

Two researchers (J.V. and L.A.) selected and extracted the data independently; discrepancies were resolved by consensus or through case conference with a third researcher (M.A.R.).

Quality Evaluation of the Studies

The quality of the studies was evaluated based on sample representativeness and methodological design, measurement of the study variables, and the degree of adjustment for potentially confounding factors.

Response rate and retention rate were evaluated in cross-sectional and longitudinal studies, respectively. In the studies under examination, we evaluated whether the information on FFM was collected from the participants through a self-administered questionnaire, or an interview (face-to-face or via

telephone), or in their absence, whether data were collected from parents or guardians. We also examined whether the questionnaire included additional information explaining how a family meal was defined (number of diners, the location (home, away from home), whether the television is on during the meal). The source of the data for the outcome variables, i.e., whether weight, height, and waist circumference were objectively measured or self-reported, was also considered. When overweight and obesity were defined based on BMI, the method to define the cut points was also described. Finally, to evaluate degree of adjustment we considered four groups of control variables: 1) age and gender; 2) socio-economic position (SEP); 3) Physical activity and/or sedentary lifestyle; and 4) diet.

Data Analyses

The application of meta-analytical techniques was considered inappropriate due to the great methodological variability found among studies in terms of design, study population, definition and classification of variables of interest, measures of association used, and the results. We present the studies' information separately according to the study design. Longitudinal studies with satisfactory level of adjustment for confounding factors were assigned more weight in our discussion and conclusions sections.

Results

Figure 1 shows the flowchart of the study selection process. The electronic database search identified 394 articles. After discarding any duplicates, there were 302 left, of which 261 were excluded based on title and abstract because they did not address the association under study. Of the articles remaining, 26 were excluded after reading the full text. From these 26 articles, 12 did not contain data on the study variables, 7 did not report on the association among study variables, 3 were reviews, 2 did not report quantitative results, 1 did not disaggregate results for those under 18 years of age and 1 was an editorial. Consequently, this review included 15 articles.

Tables 1 and 2 describe the original studies' methods and main findings. Most studies (n=11) were cross-sectional (11;13;15-17;19-24) versus 4 longitudinal studies (12;25-27). Nine studies, including the 4 longitudinal ones, took place in the U.S.A., 3 in Canada, and the other 3 in New Zealand, Korea, and Japan. Sample sizes ranged between 139 and 16770 participants, for a total of 74080 participants aged 4 to 18 years. Six of the studies included only participants under the age of 12 (children) (13;17;19;21;23;26), 7 studies included only those over 12 years of age (adolescents) (11;15;16;20;22;25;27) and the last two studies included both children and adolescents (12;24). They all included subjects from both genders except one study of girls only (16). Two thirds of the studies used school-based samples (n=10) (13;15-17;20;22-26), whereas the rest (n=5) used national surveys of children and adolescents (11;12;19;21;27).

Table 3 shows aggregate results of the quality evaluation analysis. Studies were methodologically heterogeneous. All of them calculated BMI, however 40% (n=6) used self-reported weight and height data. Bauer et al. also calculated percent body fat using dual-energy X-ray absorptiometry (16). The only study to describe the relationship between FFM and waist circumference was excluded because it did not report quantitative estimates of said association (28). Eleven studies collected FFM through a self-administered questionnaire and four by interview. However, none of the studies offered a definition of a family meal, each study's question was worded differently, the required criteria were very heterogeneous (whether the meal was in the family home, sitting at the table or not, and which family members had to be present), and the reference time period varied. Furthermore, some studies asked about the frequency of only certain meals: evening meal/ dinner or supper/ breakfast or dinner (19;22;24-26). In 40% of the studies (n=6) this information was provided by the participants' parents or guardians, and in one study either the participants or their parents responded depending on the participant's age (23). Regarding the degree of adjustment for confounding factors, 4 studies (3 cross-sectional) controlled for the 4 variable groups considered (age and gender, SEP, physical activity, and diet); whereas most of the studies (n=7) only controlled for 2 variable groups. Variables least likely to be adjusted for were diet (9 studies) and physical activity (7 studies) related variables.

The majority of studies (73%; n=11) calculated odds ratios to estimate the strength of the association between FFM and overweight or obesity (11-13;17;19-21;24-27). One study described differences in obesity prevalence between FFM categories (23) and the other three calculated the regression coefficient for FFM in a model with BMI as dependent variable (15;16;22).

Cross-sectional studies (Table 1)

The average response rate of the 11 cross-sectional studies was 72.4% (range: 36-99%). Eight studies (73%) used objective measures of height and weight (11;13;15-17;19;20;22), whereas 3 used self-reported data (21;23;24). To classify overweight children based on height and weight 4 studies used the Centers for Disease Control (CDC) (16;20;21;24) growth tables, 3 studies used the international tables by Cole et al.(11;13;19), Tokushima tables in the Japanese study(23), and the national ones in the Korean study .

Of the 11 studies, 6 reported statistically significant inverse associations between FFM and BMI or being overweight. Of those, only one adjusted its analyses for the aforementioned four groups of potentially confounding factors (Figure 2) (13). Four were carried out in children, with OR ranging from 0.11 to 0.77 (13;17;19;21) for those reporting higher FFM. In one of the studies the association was only significant among non-Hispanic white children (21). The other 2 studies were carried out in adolescents (15;20). In one

of the studies, the OR was 0.36 for those reporting dinner in family 5-7 times a week versus never (20), while in the other the association was only significant among girls (15).

Longitudinal studies (Table 2)

The median retention rate of the four longitudinal studies was 65.1% (range: 49-87.5%), with an average follow-up time of 3.5 years. One study measured height and weight (26) whereas 3 studies used self-reported data (12;25;27). To classify overweight children one study used the Clinical Guidelines for Overweight in Adolescent Preventive Services standards (25) and the other 3 studies used the CDC growth tables (12;26;27).

The two studies that presented separate results for their cross-sectional and longitudinal analysis reported an inverse cross-sectional association between FFM and obesity risk (only among non-Hispanic white adolescents in one of the studies) which was not confirmed by the longitudinal analyses (12;27). Regarding the two remaining studies, one detected an inverse association between FFM and obesity risk among children (26), with an OR of 0.93 for being overweight after 3 years of follow-up for each breakfast or dinner eaten together as a family. The last study failed to find any kind of association among its adolescent population (25). This study, besides having the longest follow-up period (5 years), was the only one that adjusted its analyses for diet-related variables, including energy intake (Figure 2).

Figure 2 also shows that 3 out of 4 studies adjusting for the four groups of potentially confounding factors didn't find statistically significant associations between FFM and overweight. In addition, the majority of studies that found statistically significant results (6 out of 7) failed to adjust for physical activity or diet related variables.

Discussion

Our results show that the evidence regarding the relationship between FFM and reduced risk of childhood and adolescent overweight is still limited. Fifteen articles were included in our review. Six out of 11 cross sectional studies and 1 out of 4 longitudinal studies found statistically significant inverse associations between FFM and being overweight, with OR ranging from 0.11 to 0.93. Of those, only 1 study adjusted for the 4 groups of potentially confounding factors considered relevant. In addition, the original studies suffer from two major limitations: 1. lack of a standard definition of a family meal (at home or away from home, sitting at the table or not, and number and degree of familial relationship of the diners); and 2. scarce information on the characteristics of the family meals (meal time length and food nutritional quality, TV viewing). Therefore, further research is needed, preferably using longitudinal studies with good adjustment for potential confounders from which to draw conclusions about the potential relationship between FFM and overweight in children and adolescents.

Family meals are associated with greater fruit and vegetable consumption and lower consumption of foods high in calories, (5;29) better family cohesion, and reduction of behavioral problems (30;31). Time dedicated to family meals helps children to establish additional healthy routines such as limiting TV viewing time, eating breakfast regularly, or avoiding snacking between meals (19;20;22). In addition, it gives parents the opportunity to serve as models of healthy eating habits. It is not clear, however, whether these benefits translate into a lower obesity risk (32). In this review, most of the cross-sectional studies showed an inverse association between FFM and BMI or overweight, though this finding was more consistent among children than among adolescents, with OR ranging from 0.11 to 0.77 for those reporting higher FFM. This association was also observed in one longitudinal study, the magnitude being lower (OR=0.93); albeit the one with the lowest retention rate, but also the only one that did not include adolescents and measured the children's height and weight (26). In the meta-analysis of Hammons et al. (14), which included 8 original studies on the association between FFM and overweight, this only study (26) pulled the global estimate to the significant direction. However, of the 3 remaining longitudinal studies, 2 found associations in cross-sectional analyses but not in longitudinal ones. Additionally, the longitudinal study with the longest follow-up time (5 years) and the only one that adjusted for all four control variable groups considered in our evaluation did not detect any association among adolescents after stratifying for sex and age (25). A possible interpretation of the lack of association in adolescents is that they avoid family meals as a way of dieting.

The magnitude of the association identified after 3 years of follow-up (26) was considerably smaller than the one observed in cross-sectional studies (13;15;17;19-21). Gable et al. chose the more stringent 95th percentile cut off point for overweight instead of the 85th percentile used by most studies, which may have

contributed to weaken the effect. Still, the relationship was statistically significant on a large, US nationwide study sample. Thus, despite its moderate effect size, it may be relevant to public health as overweight affects about 1 out of 3 children in countries like Spain or the U.S. (33). As a whole, the review's findings denote that the potential protective effect of family meals may be limited to younger children (4-7 year-olds) which is consistent with the evidence showing that it is the age when dietary behaviors are developed (6;34). Moreover, there is a trend towards lower FFM and decreasing family time as children enter adolescence (29).

One of the 3 longitudinal studies with adolescent samples found an inverse association between FFM and overweight that approached significance among middle-school girls (25). Goldfield et al's recent study, designed to examine this age- and gender- interaction among adolescents, confirmed the observed relationship (15). Although in need of further study, this potential association could reflect the greater tendency among adolescent females, compared to males, to suffer eating disorders such as binge eating and dieting, which are linked to a greater obesity risk (35-37), but which could be prevented by having family meals (38).

In two studies, family meals were associated with lower obesity risk among higher white children and adolescents but not among Hispanics (21;27). This could reflect the greater nutritional value of the meals and the time spent during family meals promoting healthy eating habits in higher socioeconomic households with highly educated parents (39). Based on cross-sectional analyses of a 93% non-Hispanic white children sample at baseline, Taveras and colleagues (12) found an inverse association between FFM and overweight. However, this was the only longitudinal study that failed to adjust for any socioeconomic position indicator which is directly related to FFM (16;29) and inversely related to obesity (40). These results suggest that future investigations must examine the effect of race/ethnicity on the potential benefit of family meals, adjusting for socioeconomic position.

Although many studies measured height and weight, others drew on parent-reported or self-reported data which tend to overestimate height and underestimate weight (41;42). In addition, classification scales and cutoff points defining overweight varied across studies which hinders results comparison (43). However, the main limitation of the original studies is the measurement of the independent variable of interest, the frequency of family meals, as summarized in table 4. FFM was never evaluated through direct observation but, instead, based on self-administered questionnaires or interviews which varied across studies. The most common question was how often or how many days all or the majority of family members ate together in the last week or in a "typical week," or during the last 5 school days (19-22;24;25). But some studies enquired about the general frequency of family meals (giving respondents the option of vague answers, e.g., *some days*, *most days*, or *a few times a week*) (11;16;17;23). Some questions asked specifically about

breakfast and/or dinner (12;26). In some studies, in order to qualify as family meal, it was sufficient if '*other family members*, *some family members* or *one of the parents'*, sat together at the table to share a meal (12;19;24;26). Further, none of the studies defined what was meant by *family meal* nor took into account the mechanisms through which family meals may potentially affect obesity such as the length of the meal (44), nutritional value, or whether the family watched television during the meal (39).

Although some of the studies did adjust for the number of hours children spent watching TV (11;16;19;26), none examined whether TV viewing took place during the meals. This variable is important due to the evidence suggesting that it increases the risk of obesity in children and adolescents (45) even after adjusting for total TV viewing time (46). Several mechanisms explaining this effect have been described. First, eating while watching TV disrupts the body's signals of fullness which leads to a greater caloric intake among children (47;48)while reducing the amount of fruits and vegetables available at the table (49). Second, exposure to the food industry advertisements while eating is associated with a lower dietary quality in children and adolescents (48;50). And, finally, having the TV turned on disrupts communication among family members thus reducing the chances of instilling healthy eating habits into the youngest in the family (51). In sum, keeping the TV on while eating could counteract the potential protective effect of family meals on obesity risk (49).

In conclusion, the evidence on the association between FFM and risk of childhood overweight is still weak and inconsistent. Consequently, further research is needed, preferably in the form of longitudinal or experimental studies with clear and standardized definitions of family meals. Meal-related information should be considered such as length of the meal, its dietary composition, location, and TV viewing during the meal. In addition, it would be highly desirable to evaluate family meals through direct observation or validated questionnaires. Analyses should be adjusted for the most relevant confounding variables such as physical activity and sedentarism, energy consumption, socioeconomic position, and race/ethnicity. Finally, it would be valuable to simultaneously study various interrelated eating behaviors such as skipping breakfast and the daily meal frequency (24), within a suitable theoretical framework (52).

Conflict of interest statement

No conflicts of interest declared by the authors.

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M.A.R. conceived the review. M.A.R. and J.V. wrote the draft of the manuscript. All authors were involved in writing the final paper and had approval of the submitted and published versions.

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