Maternal Influences on 5- to 7-Year-Old Girls' Intake of Multivitamin-Mineral Supplements

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ABSTRACT. *Objective.* **To examine diet quality of girls who do or do not take multivitamin-mineral (MVM) supplements and to evaluate predictors of girls' MVM use, including maternal eating behaviors, MVM use, beliefs, attitudes, and perceptions about child feeding, eating, and health.**

Design. **Participants were 192 mother and daughter pairs. Daughters were categorized as MVM supplement users or nonusers based on whether girls were consistently given MVM supplements at 5 and 7 years. Girls' and mothers' nutrient and food group intakes, maternal child-feeding practices, and maternal eating behavior were compared between the groups.**

Results. **Mothers who used MVM supplements were more likely to give MVM supplements to daughters. Excluding nutrients from MVM supplements, MVM users and nonusers did not differ in vitamin and mineral intake, either for girls or mothers, and patterns of food group intake were similar for users and nonusers. Mothers of MVM users reported the following: higher levels of pressuring their daughters to eat healthier diets, more monitoring of daughters' food intake, more success in dieting for weight control, more positive evaluations of their success in eating healthy diets, and lower body mass indexes than mothers who did not give MVMs to daughters.**

Conclusions. **Daughters' MVM supplement use was predicted by mothers' beliefs, attitudes, perceptions, and practices regarding mothers' own eating and child feeding practices, rather than by daughters' diet quality. For both MVM users and nonusers, daughters' food group servings were below recommendations, whereas vitamin and mineral intakes exceeded recommendations, a pattern indicative of girls' relatively high intakes of fortified foods. Mothers should be encouraged to foster healthier patterns of food intake in daughters, rather than providing MVM supplements. *Pediatrics* 2002;109(3). URL: http://www.pediatrics.org/cgi/content/full/109/3/e46; *children, vitamin-mineral supplements, diet quality, child-feeding practices.***

ABBREVIATIONS. AAP, American Academy of Pediatrics, MVM, multivitamin-mineral supplements; BMI, body mass index; DRI, dietary reference intake; NAR, nutrient adequacy ratio; MAR, mean adequacy ratio; USDA, US Department of Agriculture; TFEQ, 3-Factor Eating Questionnaire; PCE, Perceived Competence in Eating.

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In 1980, the American Academy of Pediatrics (AAP), Committee on Nutrition, addressed the vitamin and mineral supplement needs of children in the United States and concluded that, with few exceptions, children did not need multivitamin-mineral (MVM) supplements.[1] Exceptions included children at nutritional risk, especially those from deprived, low-income families; children who had poor appetites or anorexia; those on regimens to manage obesity; or children who were consuming vegetarian diets. Despite AAP guidelines, approximately half of children 4 to 8 years in the Continuing Survey of Food Intakes by Individuals were reported to be using vitamin and/or mineral supplements.[2] In general, children whose mothers were giving them MVM supplements were not at nutritional risk, as defined by the AAP criterion of living in a low-income family or suffering from deprivation. In fact, mothers who reported giving MVM supplements to their children were more likely to be from families with higher incomes, to have higher educational levels, to be married, and to have access to private medical care.[3]

However, little is known about why parents provide MVM supplements and which parents are more likely to do so. In the introduction to the AAP recommendations, the Committee commented that one possible reason for giving supplements to children was to correct for "real or imagined dietary shortcomings."[1] Yu et al[3] reported that preschoolers perceived by mothers as having poor appetites or eating problems were more likely to be taking MVM supplements. However, possible differences in diet quality in children who do and do not take MVM supplements have not been assessed. The present study was designed to address this issue. We also investigated maternal eating behaviors, weight status, and maternal beliefs, attitudes, and perceptions about child feeding as predictors of the maternal decision to give MVM supplements to her child.

PARTICIPANTS AND METHODS

Participants

The study participants were 192 non-Hispanic white girls and their mothers who were participating in a longitudinal project when the girls were 5 and 7 years old. Families with age-eligible female children within a 5-county radius also received mailings and follow-up phone calls. The eligibility criteria for girls' participation included living with both biological parents, the absence of severe food allergies or chronic medical problems affecting food intake or growth, and the absence of dietary restrictions involving animal products. On average, mothers were in their mid-30s (37.4 ± 0.3 years). Sixty-three percent of mothers were currently

employed, reporting an average of 20 hours of work per week; 22% of families had incomes below $35 000, 31% between $35 000-$50 000, and 47% above $50 000. Mothers were well educated; mothers' mean education was 15 ± 2 years (range: 12–20). All procedures were approved by Pennsylvania State University Institutional Review Board, and mothers provided written consent for their own and for their daughter's participation before data collection.

Measures

Girls' Measures

Weight Status and Skinfold Measurements

Girls' height and weight measurements were obtained at 5 and at 7 years to determine body mass index (BMI; weight[kg]/height^2[m]). Based on the recommendations of Lohman et al,[4] 3 height and weight measurements were collected for each girl by trained research assistants, and average weight and height were used to calculate the BMI score.

Girls' Supplement/Dietary Intake

Girls' food group, energy, and nutrient intake were measured at age 5 and 7 using three 24-hour recalls. Dietary supplement intake was also measured as additional questions during the 24-hour recall. Only MVM supplements were included in this study. To obtain a relatively conservative classification of girls as MVM supplement users, mothers had to consistently report whether daughters were given MVM supplements during both the 5- and 7-year-old dietary recall periods. Recalls were conducted with mothers in the presence of their daughters by trained staff at the Pennsylvania State University Diet Assessment Center using the computer-assisted Nutrition Data System for Research (Database Version 4.01 30, Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN), using the same method applied in the parent-child auto-tutorial dietary education program study.[5] Previous research has validated mothers' reports of dietary intake of 5-year-old children comparing mothers' reports with home observation.[6] Two weekdays and 1 weekend day were randomly selected over a 2-week period during the summer. Food portion posters (2D Food Portion Visual, Nutrition Consulting Enterprises, Framingham, MA) were used to estimate amounts of foods eaten. Nutrient data were averaged across 3 days to obtain an estimate of average energy and nutrient intake. Vitamin and mineral intakes in girls' diets were estimated without including those nutrients provided by MVM supplements. Nutrient intake data were calculated as average amount per day and were evaluated using dietary reference intakes (DRIs).[7–11]

To assess dietary adequacy, nutrient adequacy ratios (NARs) of 15 vitamins and minerals (vitamin A, vitamin D, vitamin C, thiamin, riboflavin, niacin, vitamin B6, vitamin B12, folate, calcium, phosphorus, magnesium, iron, zinc, and selenium) were calculated by dividing each girl's 3-day mean intake of each nutrient by DRI for that nutrient.[11] Based on that, mean adequacy ratios (MAR) were calculated as means of the NARs, truncated at 1.0 for each nutrient. The NAR scores were truncated to prevent intakes in excess of the DRI for 1 nutrient from overcompensating for low intakes of others.[12] A food group analysis was conducted on Nutrition Data System summary file data to determine the participants' mean number of US Department of Agriculture (USDA) Food Guide Pyramid servings from grains, vegetables, fruits, dairy, meat, fats, and sweets food groups.[13] The assignment of foods to food groups and the assessment of number of servings were based on USDA guidelines.[14] Mixed dishes were disaggregated into the corresponding components, and the sum of the gram weights of each component was used to calculate the number of servings for each food group. The number of food groups meeting the recommendation was calculated based on these data as another measure of diet quality.

Mothers' Measures

Mothers' Supplement/Dietary Intake

Mothers' MVM supplement intake, food group, energy, and nutrient intake were also measured using three 24-hour recalls. The same methods of analysis were applied as were described above for girls' dietary intake.

Child Feeding Questionnaire

The Child Feeding Questionnaire[15] contains 31 items that assess dimensions of maternal control in child feeding and factors that may elicit maternal control. Among those, 3 hypothesized factors that assess maternal attitudes and practices about controlling child feeding strategies were used in this study: 1) Monitoring (3 items), assessing the extent to which mothers oversee their child's eating (eg, "How much do you keep track of the high fat foods that your child eats?"); 2) Restriction (8 items), assessing the extent to which mothers restrict their child's access to foods (eg, "I intentionally keep some foods out of my child's reach"); and 3) Pressure to Eat (4 items), assessing mothers' tendency to pressure their children to eat more food (eg, "My child should always eat everything on her plate"). All items were measured using a 5-point Likert-type scale, with each point on the scale represented by a word anchor. The internal consistency (Cronbach's α) was 0.92 for monitoring, 0.73 for restriction, and 0.80 for pressure to eat.[15]

Three-Factor Eating Questionnaire (TFEQ)

Parents' eating and weight control behaviors were measured using the TFEQ developed by Stunkard and Messick.[16] The measure consists of 51 items and 3 subscales designed to tap 1) dietary restraint (21 items), 2) dietary disinhibition (16 items), and 3) susceptibility to hunger (14 items), and only dietary restraint and disinhibition were used in this study. Respondents select among true/false and Likert-type response options to questions regarding restraint of cognitive control of eating behavior such as, "Life is too short to worry about dieting," and disinhibition of cognitive control of eating such as, "When I feel anxious, I find myself eating." Total scores for each subscale are calculated by summing respective items. Internal consistency scores were 0.87 for restraint and 0.83 for disinhibition.

Parent Self-Restriction

Mother's restriction of her own intake was measured using the Parent Self-Restriction measure. The measure was developed in the laboratory to assess the degree to which mothers limit the amount of foods they eat and/or deliberately keep out of the home. The Parent Self-Restriction consists of 35 food items including starches (8 items), savory (19 items), and sweets (8 items). Respondents are asked to indicate the degree to which they like or dislike a particular food using a 5-point response scale where 1 = "strongly dislike" and 5 = "strongly like." Next, respondents indicate the extent to which they restrict themselves from eating these foods using a 4-point response scale with options ranging from 1 "not at all" to 4 "constantly."

Perceived Competence in Eating (PCE)

Mothers' attitudes about their own competence in eating were measured using PCE scale, which was developed in our laboratory. The PCE scale measures 4 aspects relating to competence in eating: Importance (eg, Compared with other things in my life, eating healthy types of food is important to me), Effort (eg, I make an effort to eat healthy types of food), Performance (eg, I do well at eating healthy types of foods), and Affect (eg, The extent to which I am successful at having self-discipline to eat healthy types of foods makes me feel good about myself). The fifth subscale assessed external locus of control, regarding the extent to which an individual believes that the types and amounts of foods eaten are dictated by physiologically external influences (eg, My mood causes me to eat unhealthy types of food). All items were measured using 4-point scale, where 1 = "not at all true", and 4 = "totally true" for most items except for the items in Affect subscale (1 = "very bad", and 4 = "very good"). The internal consistency (Cronbach's α) for Importance, Effort, Performance, and Affect was greater than 0.85. Cronbach's α for External locus of control was 0.79.

Statistical Analysis

Girls were divided into 2 groups, based on their MVM supplement use. The MVM supplement group included girls who were given MVM supplements, both at age 5 and 7 (49 girls), and non-MVM users were defined as girls who did not take MVM supplements at either 5 or 7 years of age (87 girls). All analyses were performed using SAS software version 6.12 (Cary, NC). Given the dichotomous categorization, a χ^2 test was used to measure the relations between girls' and mothers' supplement use. Given the unequal sample sizes across groups, the general linear

model was used to conduct analysis of variance to compare MVM users and nonusers on maternal education, daughters' and mothers' nutrient and food group intakes, weight status, maternal feeding practices, maternal eating habits, and maternal perceived competence in eating. Hierarchical logistic regression was also performed to identify predictors of girls' MVM use. Predictor variables were entered in the following order: 1) maternal education as a control variable, 2) maternal feeding attitudes and practices (ie, restriction, pressure to eat, monitoring, perception of girls' eating and overweight), 3) maternal eating behavior (ie, TFEQ restraint, TFEQ disinhibition, self-restriction), 4) maternal MVM supplement use, and 5) maternal BMI.

RESULTS

Percentage of MVM Users: Girls and Mothers

The percentage of girls who were using MVM supplements at age 5 was 44.4%, and the percentage was reduced to 35.6% at age 7; 26% of girls used MVM supplements at both age 5 and 7. This latter group of girls was defined as MVM users in additional analyses. Fifty-five percent of mothers were using MVM supplements, and Table 1 shows the relationship between mothers' and girls' MVM use. Maternal MVM supplement use predicted daughters' use: compared with mothers not taking MVM supplements, mothers who used MVM supplements were about 4 times more likely to give MVM supplements to daughters (odds ratio: 4.01; confidence interval: 2.17–7.42).

Characteristics of MVM Users and Nonusers

Table 2 compares characteristics of MVM users and nonusers. As shown, mothers' education did not differ between MVM users and nonusers, but mothers' mean BMI was higher in nonuser group. Girls' BMI at age 7, and girls' BMI changes from age 5 to 7 were higher among nonusers of MVMs. Family income did not differ across groups; in both groups, >70% had income higher than $35 000 per year.

Dietary Intake of Girls and Mothers: MVM Users Versus Nonusers

As shown in Table 3, girls' energy intake, and macronutrient composition at age 7 did not differ between MVM users and nonusers. Vitamin and mineral consumption of MVM users and nonusers did not differ when nutrients from MVM supplements were excluded. MVM users and nonusers also had similar numbers of servings from the USDA Food Groups, except that nonusers consumed more fats and sweets. The overall diet quality measured by MAR and the number of USDA food groups meeting the recommendations did not differ between the 2 groups. For both groups, the average vitamin and mineral intake obtained from foods was above recommended levels, and MAR scores were very close to 1.0, which means that, for most girls, almost all vitamins and minerals were above recommended levels. However, dietary fiber intake was low for both groups relative to the recommendations.[17] When the recommendations for intake from various food groups were considered, the number of food groups meeting the recommendations was less than 2 of 5 food groups. On average, only the dairy group met the recommended number of servings. The same pattern of results was obtained from dietary intake data of girls at 5.

Based on classification of the girls as MVM users or nonusers, we compared maternal dietary intake of the 2 groups. Maternal energy intake, macronutrient composition, vitamin and mineral intake in their diet, food group intake, MAR, and number of food groups meeting recommendations did not differ between mothers of MVM users and nonusers (Table 4). The number of servings of vegetables was higher in mothers of nonuser girls, but when French fries and potato chips were excluded from the vegetable group, vegetable intake did not differ.

In summary, with the exception of MVM nonuser girls consuming more fats and sweets, there were no differences in measures of diet quality between MVM users and nonusers. Mothers who themselves used MVM supplements were more likely to give MVM supplements to their daughters.

TABLE 1. Girls' MVM Supplement Use at Age 7 by Mothers' MVM Supplement Use

	Mother MVM User		Mother Nonuser	
	N	%	*N*	%
Girl MVM user	45	53	23	22
Girl nonuser	40	47	82	78
Total	95	100	115	100

Mothers who were MVM users were more likely to give MVMs to daughters (odds ratio: 4.01 (2.17–7.42); $X^2 = 19.69$; $P < .001$).

Child Feeding Attitudes and Practices, Maternal Eating Habits, and Girls' MVM Use

In contrast to our failure to note group differences in nutrient intake and diet quality, as shown in Table 5, mothers' perceptions of children's eating, feeding practices, and mothers' own dieting and eating habits differed between MVM users and nonusers: mothers who gave MVM supplements to their daughters were more concerned that their daughters were not eating enough of the right foods, applied more pressure to their daughters to eat, and reported more monitoring of daughters' food intake in comparison to the mothers of nonuser girls. There was also a trend for mothers of MVM users to use more restrictive feeding practices with their daughters ($P = .07$). Mothers' perception of girls' weight status did not differ between groups, despite the fact that girls in the MVM nonuser group had higher BMIs at age 7, and greater increases in BMI from 5 to 7 years. Mothers of nonusers were more likely to perceive themselves as overweight, reflecting their significantly higher BMIs.

These BMI differences may reflect group differences in mothers' own eating habits (Table 5). Mothers of MVM users, who had lower BMIs, reported that they used more restriction to control their own food intake, and were less disinhibited than the mothers of nonuser girls and that they were more successful in eating healthy diets and maintaining their weight. Mothers choosing to give MVM to their daughters were also less likely to report that their eating was affected by external factors (Table 5).

TABLE 2. Characteristics of MVM Users and Nonusers

	MVM User (49)*	Nonuser (87)	*P* Value
Mothers' years of education	15.1 ± 2.2	14.5 ± 2.2	NS
Mothers' BMI	25.1 ± 4.9	28.5 ± 6.9	.0019
Girls' BMI at age 5	15.7 ± 1.9	16.1 ± 1.7	NS
Girls' BMI at age 7	16.0 ± 2.5	17.2 ± 2.7	.014
Girls' BMI change 5–7	0.3 ± 1.0	1.1 ± 1.5	.0019
Girls' height per age percentile–age 5	54.6 ± 26.9	51.3 ± 29.1	NS
Girls' height per age percentile–age 7	60.0 ± 28.5	55.9 ± 26.5	NS
Girls' height per age percentile change	4.9 ± 7.9	2.9 ± 9.6	NS

NS indicates nonsignificant.
* MVM user was defined in terms of use at 5 and 7 years old.

TABLE 3. Macronutrient and Food Group Intake of MVM Users and Nonusers at Age 7

Dietary Variables	MVM User (49)*	Nonuser (87)	*P* Value
Energy intake (kcal)	1644.5 ± 348.6	1682.9 ± 325.9	NS
Carbohydrate (% of total energy)	57.1 ± 5.3	56.8 ± 5.5	NS
Fat (% of total energy)	31.0 ± 4.9	31.2 ± 4.9	NS
Protein (% of total energy)	13.6 ± 2.1	13.7 ± 2.6	NS
Fiber (g)	11.0 ± 6.7	11.1 ± 3.3	NS
Vitamin A (% DRI)†*	183.5 ± 79.6	193.7 ± 79.8	NS
Vitamin C (% DRI)†	292.6 ± 177.3	309.0 ± 174.2	NS
Riboflavin (% DRI)†	311.9 ± 76.1	296.9 ± 84.0	NS
Niacin (% DRI)†	209.2 ± 55.1	212.8 ± 52.7	NS
Calcium (% DRI)†	114.2 ± 37.1	104.8 ± 39.5	NS
Iron (% DRI)†	115.2 ± 38.3	113.0 ± 35.9	NS
Zinc (% DRI)†	172.8 ± 56.3	168.0 ± 50.4	NS
MAR	0.98 ± 0.04	0.97 ± 0.04	NS
Number of food groups that met recommendations	1.6 ± 1.0	1.7 ± 1.0	NS
Grain–number of servings‡	5.3 ± 1.4	5.5 ± 1.6	NS
Vegetables–number of servings‡	1.5 ± 0.8	1.8 ± 0.9	.076
Vegetables without fries/chips‡	1.1 ± 0.9	1.4 ± 0.9	NS
Fruits–number of servings‡	1.8 ± 1.6	1.9 ± 1.5	NS
Dairy–number of servings‡	3.1 ± 1.2	2.8 ± 1.3	NS
Meat–number of servings‡	1.3 ± 0.5	1.4 ± 0.6	NS
Fats and sweets–number of servings‡	4.2 ± 2.1	5.1 ± 2.6	.032

NS indicates nonsignificant.
* MVM user was defined in terms of use at 5 and 7 years old.
† Dietary Reference Intakes.[7–11]
‡ Based on USDA Food Guide Pyramid Recommendations.[13]

Predictors of Girls' MVM Supplement Use

Hierarchical logistic regression was used to identify predictors of girls' MVM use (Table 6). Mothers' education was entered first as a control variable, and this variable was not a significant predictor. In the second step, mothers' child feeding attitudes, practices, and perceptions were entered as a block, including restriction, pressure to eat, monitoring, and perception of daughters' overweight. The addition of this block of mothers' feeding attitudes and practices improved the model significantly. In the next step, variables measuring mothers' own eating behavior were entered as a block: TFEQ restraint, TFEQ disinhibition, and self-restriction. This step also improved the model significantly. Among the 3 predictor variables entered at this step, self-restriction and maternal dietary disinhibition were related to the girls' MVM use. Mothers who chose to give their daughters MVM supplements reported using more self-restriction, and reported that they were more "in control" of their eating and were less disinhibited. Mothers' own supplement use was entered in the next step, to examine whether a direct relationship between mothers' and girls' MVM use was still seen, after controlling the other factors previously entered into the model. After controlling for education, maternal feeding practices, and mothers' own eating behavior, mothers' own MVM use independently predicted girls' MVM use, (odds ratio: 6.20), and this step significantly improved the model, as indicated by a χ^2 difference 17.4 ($P < .001$). After controlling for all these factors, mothers' BMI was not related to girls' MVM use.

DISCUSSION

The percentage of girls using MVM supplements in our study was 44.4% at age 5 and 35.6% at 7, similar to other recent data for girls in the United States: 45.8% for 3- to 5-year-old girls, and 33.5% for 6- to 11-year-old girls.[18] The percentage of girls categorized as MVM users is surprisingly high within our sample and in national data, considering that the AAP does not recommend MVM supplementation for children, except for those in high-risk groups. Almost none of the children in our sample could be categorized as at high risk and in need of MVM supplements, based on the AAP definition.[19]

In making their recommendations, the AAP committee pointed out that vitamin and mineral supplementation may be used to correct real or perceived

TABLE 4. Mothers' Macronutrient and Food Group Intake by Girls' MVM User Status

	MVM User (49)*	Nonuser (87)	*P* Value
Energy intake (kcal)	1650.5 ± 394.5	1617.3 ± 383.0	NS
Carbohydrate (% of total energy)	54.3 ± 8.2	53.0 ± 8.5	NS
Fat (% of total energy)	30.9 ± 6.1	32.0 ± 7.1	NS
Protein (% of total energy)	15.4 ± 3.5	15.6 ± 3.4	NS
Fiber (g)	13.6 ± 4.6	14.1 ± 5.7	NS
Vitamin A (% DRI)†	124.4 ± 97.7	125.5 ± 79.8	NS
Vitamin C (% DRI)†	101.6 ± 71.9	102.9 ± 67.8	NS
Riboflavin (% DRI)†	148.4 ± 47.9	145.4 ± 49.2	NS
Niacin (% DRI)†	133.0 ± 39.8	135.2 ± 39.0	NS
Calcium (% DRI)†	76.4 ± 33.0	68.3 ± 29.2	NS
Iron (% DRI)†	74.1 ± 29.8	70.9 ± 26.1	NS
Zinc (% DRI)†	106.1 ± 31.5	108.2 ± 38.0	NS
MAR	0.85 ± 0.11	0.85 ± 0.10	NS
Number of food groups which met recommendations	1.7 ± 1.1	1.9 ± 1.4	NS
Grain–number of servings‡	5.6 ± 1.8	5.7 ± 2.0	NS
Vegetables–number of servings‡	2.3 ± 1.1	2.8 ± 1.5	.02
Vegetables without fries/chips‡	1.1 ± 0.9	1.4 ± 0.9	NS
Fruits–number of servings‡	1.5 ± 1.2	1.6 ± 1.3	NS
Dairy–number of servings‡	2.1 ± 1.2	2.0 ± 1.1	NS
Meat–number of servings‡	1.6 ± 0.7	1.7 ± 0.8	NS
Fats and sweets–number of servings‡	6.2 ± 3.1	5.7 ± 3.3	NS

NS indicates nonsignificant.
* MVM user was defined in terms of use at 5 and 7 years old.
† Dietary Reference Intakes.[7–11]
‡ Based on USDA Food Guide Pyramid Recommendations.[13]

TABLE 5. Mothers' Feeding Practices and Eating Habits of MVM Users and Nonusers

	MVM User (49)*	Nonuser (87)	*P* Value
Mothers' feeding practices			
Restriction	2.9 ± 0.9	2.6 ± 1.0	.07
Pressure to eat	2.6 ± 1.0	2.2 ± 0.9	.05
Monitoring	3.8 ± 0.9	3.3 ± 0.9	.0027
Perceived child overweight	2.9 ± 0.5	2.9 ± 0.3	NS
Perceived mother overweight	2.9 ± 0.5	3.2 ± 0.5	.0028
Mothers' eating habit			
Mothers' restraint	9.3 ± 5.1	7.7 ± 4.8	.07
Mothers' disinhibition	6.0 ± 3.6	7.9 ± 4.1	.0099
Mothers' self-restriction	2.2 ± 0.5	1.9 ± 0.6	.0015
Mothers' perceived competence in eating			
Performance in eating well	2.7 ± 0.4	2.5 ± 0.6	.03
Feeling associated with eating	2.9 ± 0.4	2.8 ± 0.5	.077
External locus of control	2.1 ± 0.6	2.3 ± 0.5	.053

NS indicates nonsignificant.
* MVM user was defined in terms of use at 5 and 7 years old.

dietary shortcomings.[1] At least in this sample, there was no evidence that MVM supplement use was warranted, based on inadequate nutrient intakes. Vitamin and mineral intakes did not differ for users and nonusers, and, in general, both groups' intakes exceeded the DRIs. MVM users did not have lower diet quality than nonusers, and, in fact, MVM users had lower intakes of fats and sweets, suggesting that MVM users' diets were more consistent with USDA dietary recommendations. Consumption of the 5 major food groups did not differ between users and nonusers, although food group intakes tended to be low among both groups. Consistent with this finding, national studies conducted in 1980s indicated that supplement users had higher intakes of nutrients from foods.[20,21] Another national study also reported that children who were taking MVM supplements consumed more fruits and vegetables than those not taking supplements.[22]

Although increases in BMI from 5 to 7 and BMI at 7 were lower among the MVM supplement group in our study, we did not note differences in height, or height change from age 5 to 7, between MVM users and nonusers. These results provide additional evidence that MVM users were growing normally, did not have poorer quality diets, and were not at nutritional risk. In fact, the nonusers had higher BMIs at age 7, greater increases in BMI from 5 to 7, and higher intake of fats and sweets, suggesting that the nonuser girls may be at higher risk for overnutrition and overweight.

In summary, there was no evidence that mothers' choice to give MVM supplements to daughters reflected actual differences in daughters' dietary quality. In fact, the only evidence of a difference in diet quality between the MVM user and nonuser girls was that girls taking MVM supplements consumed fewer fats and sweets, an indicator of higher diet quality among the MVM user group. Taken together, the pattern of nutrient intakes exceeded the recom-

TABLE 6. Hierarchical Regression Predicting Girls' MVM Supplement Use*

Variable Entered	Odds Ratio	95% Confidence Interval	χ^2	$\Delta\chi^2$ (P Value)	*df*	Association of Predicted Versus Observed (% Concordant)
Step 1: Mothers' education	1.136	0.97–1.33	175.3		1	46.1%
Step 2: Mothers' feeding practices			163.2	−12.1 ($P < .025$)	5	69.6%
Restriction	1.104	0.68–1.78				
Pressure to eat	1.256	0.81–1.96				
Monitoring	1.819	1.13–2.93				
Perception of girls' overweight	0.603	0.22–1.63				
Step 3: Mothers' eating behavior			146.0	−17.2 ($P < .001$)	8	77.3%
Mothers' restraint	0.977	0.88–1.08				
Mothers' disinhibition	0.845	0.75–0.95				
Self-restriction	3.494	1.38–8.86				
Step 4: Mothers' supplement use	6.198	2.47–15.59	128.6	−17.4 ($P < .001$)	9	83.7%
Step 5: Mothers' BMI	0.952	0.86–1.05	127.5	−1.1 (NS)	10	83.6%

NS indicates nonsignificant.
* MVM user was defined in terms of use at 5 and 7 years old.

mendations for both groups, whereas food group intake for both groups was low. This seemingly paradoxical pattern reflects that the diets of both MVM users and nonusers include high levels of intake of fortified foods, such as cereals and fortified drinks.[23] These findings, in combination with girls' low fiber intake across groups, imply that the focus of anticipatory guidance for both groups should be to increase the number of servings girls consume from the whole grains, fruit, dairy, meat, and vegetable groups, and to make better choices within each food group, rather than to provide MVM supplements to girls whose vitamin and mineral intakes from food are adequate. The American Dietetic Association and the 1989 Recommended Dietary Allowance also suggested that intake of a wide variety food is preferred over dietary supplement or fortification.[20,24]

Mothers' own vitamin and mineral intake and diet quality did not differ for mothers who did or did not give their daughters MVM supplements, and the absence of diet quality differences for either daughters or mothers in the MVM user and nonuser groups suggests that maternal decisions regarding whether to give daughters MVM supplements were based neither on girls' diet quality nor on mothers' own diet quality. Although we failed to see differences in diet quality that could explain mothers' decisions regarding MVM use, a clear constellation of maternal factors were associated with mothers' decision to give daughters MVM supplements. The maternal decision to give MVM supplements was predicted by elevated levels of concern and investment in both maternal and child diet quality, as reflected in higher levels of monitoring, restricting, and pressuring their children to eat. These women also reported that for them, consuming a healthy diet was important, and they perceived that they were relatively successful at their attempts to restrict their own intake to healthy foods, and that they felt "in control" of their intake. The pattern of findings suggests that mothers who gave MVM supplements to their daughters may have been attempting to address perceived, rather than real, shortcomings in their own and their daughters' diets. These mothers reported using a variety of strategies to attain healthy diets for themselves and their daughters, including attempting to promote consumption healthy foods, placing limits on the consumption of "unhealthy" foods, and using MVM supplements for both themselves and their daughters as a nutritional "safety net." Mothers who gave MVM supplements were likely to report that, with respect to their own eating, they were successful at dieting, weight control, and healthy eating, and attained success via self-restriction. In addition to giving MVM to daughters, maternal feeding strategies and control tactics included greater monitoring of daughters' eating, a trend toward greater use of restriction of daughters' intake of "junk" or snack foods, and greater pressure to eat "healthy" foods. In this sample, mothers who decided to provide daughters with MVM supplements seemed to give daughters MVM supplements as one among several child feeding strategies designed to assure that daughters had adequate nutrient intakes.

The present research has several limitations, including a sample that is exclusively white, 2-parent families. This restricted sample precludes generalizing the findings to other socioeconomic, ethnic, and racial groups. Yu et al[3] previously reported that children receiving MVM supplements tended to have mothers who were non-Hispanic white, more educated, and had greater household income. We failed to note differences between MVM users and nonusers in education or income, perhaps because our sample was small and relatively homogeneous.

CONCLUSION

These findings indicate that mothers could benefit from advice and support to foster healthier patterns of dietary intake among their daughters, especially to increase the number of servings and variety of foods girls are offered from 5 major food groups, including whole grains, fruits, vegetable, dairy, and meat

groups, rather than providing vitamin and mineral supplements.

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