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Effects Of Alternative Food Voucher Delivery Strategies On Nutrition Among Low-Income Adults

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Abstract

Nutrition assistance programs are the subject of ongoing policy debates. Two proposals remain uninformed by existing evidence: whether restricting benefits to allow only fruit and vegetable purchases improves overall dietary intake, and whether more frequent distribution of benefits (weekly versus monthly) induces more fruit and vegetable consumption and less purchasing of calorie-dense foods. In a community-based trial, we randomly assigned participants to receive food vouchers that differed in what foods could be purchased (fruit and vegetables only or any foods) and in distribution schedule (in weekly or monthly installments, holding total monthly value constant). The use of vouchers for fruit and vegetables only did not yield significantly greater improvements than the unrestricted voucher did in terms of fruit and vegetable consumption or Healthy Eating Index (HEI) score. Weekly vouchers also failed to yield significantly greater improvements than monthly vouchers did. Proposed policies to make assistance more restricted or more frequent, while holding benefit value constant, might not improve nutrition among low-income Americans.

Nutrition assistance programs governed by the 2018 Farm Bill have come under increasing scrutiny.[1,2] Federal programs such as the Supplemental Nutrition Assistance Program

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(SNAP) support the more than one in seven low-income Americans who receive a cash-equivalent food subsidy.[3] Nutrition assistance program reforms through the Farm Bill and attendant legislation could affect socioeconomic disparities in obesity, cardiovascular disease, and type 2 diabetes, given both the wide-spread participation in these programs and the elevated rate of nutrition-related chronic disease among low-income Americans.[4–6] In addition, a growing number of state and local food voucher programs are designed to supplement federal nutrition assistance programs and reach ineligible low-income populations.

Whether these nutrition assistance programs can support healthier diets by subsidizing healthier food options or restricting food options has been the subject of extensive discussion.[4,5] Some nutrition assistance programs already restrict food options. For example, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) explicitly restricts purchases to foods considered healthy, and the Food Insecurity Nutrition Incentive (FINI) Program matches payments only for fruit and vegetables.[3,7] State and local food voucher programs generally restrict eligible purchases to fruit and vegetables.[3] These programs assume that providing money for specific food categories will improve dietary intake by encouraging healthier food purchasing patterns. However, most people receiving nutrition assistance also use their own money for additional food purchases, so the extent to which such assistance alters dietary intake, rather than just the source of the money used to purchase the same foods, remains unclear.

To further improve nutrition assistance programs, behavioral economists have also suggested increasing the frequency of the benefit delivery.[8,9] Program benefits delivered in a monthly lump sum may contribute to a “consumption cycle”—the tendency for low-income Americans to spend their benefits immediately after receiving their monthly payment and then have limited money for food by month’s end.[10–13] Programs that provide food benefits in smaller increments distributed throughout the month may smooth this cycle and counteract the tendency to use once-monthly funding installments for purchasing calorie-dense processed foods immediately upon receipt of funds.[8,9,14] Whether nutrition assistance programs that increase the frequency of benefit delivery could meaningfully modify dietary intake has not been assessed in a randomized trial.

Our objective was to test two policy-relevant hypotheses in a randomized, 2×2-factorial, community-based trial. First, we tested whether food vouchers redeemable only for fruit and vegetable purchases would improve both fruit and vegetable consumption and scores on the Health Eating Index (HEI)—a measure of overall nutrition quality[15]—more than vouchers redeemable for any SNAP-eligible food. Second, to assess the impact of varying the distribution schedule, we tested whether food vouchers redeemable only in one-week increments would improve both fruit and vegetable consumption and HEI scores more than vouchers redeemable in monthly increments.

Study Data And Methods

TRIAL DESIGN

We conducted a randomized, 2×2-factorial,[16] open-label trial with equal allocation to each of four intervention groups, specified below. No changes to the prespecified methods were made after trial commencement. Information on the study protocol and Consolidated Standards of Reporting Trials (CONSORT) guideline checklist[17] is in online appendix exhibit 1.[18]

PARTICIPANTS

Inclusion criteria for participants were age twenty-one or older; household income less than 250 percent of the federal poverty level; regular access to a phone; English fluency sufficient to provide informed consent; residency in San Francisco, California; and willingness to be randomly assigned to a study arm. Exclusion criteria were participation in another dietary study or food voucher program, current diagnosis of cancer or congestive heart failure, or plans to move out of San Francisco within the following year. SNAP participation was not an explicit inclusion or exclusion criterion. The rationale for this was that while the trial would be relevant to SNAP, many cities and counties have food voucher programs to support low-income Americans who do not participate in SNAP, and an estimated 50 percent of SNAP-eligible Californians do not participate in the program.[19] We included participants with gross monthly household incomes of less than 250 percent of poverty, rather than the SNAP eligibility thresh-old of 130 percent of poverty, for two reasons: Income deductions included in calculating income for SNAP eligibility result in the participation of households with real incomes often higher than 130 percent of poverty, and the high cost of living in San Francisco translates into lower purchasing power than in most US cities.[20] Participants were recruited through transit advertisements, website advertisements, fliers at community centers, and word of mouth. Eligible participants, based on screening, attended an inperson orientation session to verify eligibility and provide informed consent. Enrollment occurred in the period February–October 2017.

INTERVENTIONS

The factorial design was used to randomly assign participants to receive via mail either fruit and vegetable–only or unrestricted vouchers and either weekly or monthly vouchers. The four arms were therefore as follows: Recipients of weekly fruit and vegetable– only vouchers received four $5 vouchers every month, with each voucher valid for a specified week of the month (that is, one voucher was valid for week 1 only, another for week 2 only, and so on). These vouchers were restricted to purchases of qualified fruit and vegetables, defined as fresh or frozen fruit, vegetables, or herbs without added sugars or fats. Recipients of monthly fruit and vegetable–only vouchers received four $5 vouchers every month, each valid for the entire month. Recipients of weekly unrestricted vouchers received four $5 vouchers every month, each valid for a specified week of the month. These vouchers allowed purchases of any SNAP-eligible food. Recipients of monthly unrestricted vouchers received four $5 unrestricted vouchers every month, each valid for the entire month.

Participants in all four study arms received $20 of vouchers (four $5 vouchers) by mail each month for six months. Vouchers were redeemable at any of nineteen vendors (three grocery stores, fifteen corner stores, and one farmers market) in various neighborhoods of San Francisco that were convenient to the low-income neighborhoods where we concentrated recruitment. For reference, $20 per month constituted 2 percent of the average monthly income for participants and could purchase a sample basket of a dozen bananas, a dozen eggs, a dozen tomatoes, six yellow onions, a sixteen-ounce jar of peanut butter, a loaf of whole wheat bread, a six-pack of chicken drumsticks, a gallon of milk, a one-pound box of pasta, and a twenty-four-ounce jar of pasta sauce.[20] Vouchers were preprinted on check-size paper and redeemable with the participant's signature. Vouchers were designed to have equal value, for ease of redemption by cashiers, and to have a small dollar value to minimize the need for a large voucher to be spent all at once. Start and expiration dates were stamped on each voucher according to the study arm. Vouchers were collected by the cashier when the participant checked out of a store or at the information booth at the farmers market, which enabled the participant to have the voucher's value immediately deducted from their grocery bill (similar to SNAP benefits). Vouchers could not be redeemed for cash, and change was not provided for partially used vouchers.

OUTCOMES

The prespecified primary outcome was change in fruit and vegetable intake measured in cup equivalents between baseline (month 0) and month 6 of the trial, using the National Health and Nutrition Examination Survey food grouping scheme to classify food items.[21,22] Fruit and vegetable intake was assessed by prescheduled twenty-four-hour dietary recalls administered by phone by registered dietitians blinded to study allocation. Recalls were collected using the Nutrition Data System for Research software, adopting the multipass approach for rigorous collection, supplemented by visual aids. Four dietary recalls were conducted in month 0, two during week 1 and two during week 4, to capture potential fluctuations in dietary intake related to the consumption cycle before the intervention began. Wherever possible, recalls were conducted on one weekday and one weekend day. Four follow-up dietary recalls were conducted after exposure to six months of vouchers (the final month of receiving vouchers), two during week 1 and two during week 4 of month 6.

Secondary outcomes included changes from month 0 to month 6 in the scores on the Healthy Eating Index[15] and the Alternate Healthy Eating Index;[23] voucher use rate (the percentage of vouchers mailed over six months that were redeemed at participating vendors, based on vouchers returned by vendors for reimbursement); change from month 0 to month 6 in food insecurity, as measured by the six-item Department of Agriculture Food Security Survey module;[24] responses to an ease-of-use survey at month 6 (see the appendix for survey questions);[18] and change in the consumption cycle (ratio of total calorie intake in week 4 to that in week 1). The outcomes were reassessed at month 12 (six months after voucher discontinuation) to assess the maintenance of effect. For reference, the HEI score is scaled from 0 to 100, where 100 corresponds to perfect adherence to the Dietary Guidelines for Americans: 2015–2020,[25] and the average score among the US population is 59.[23] The Alternate Healthy Eating Index (AHEI) score is scaled from 0 to 110, based on intake levels of nine components associated with reduced chronic disease risk in observational cohort

studies.[23] The HEI has a greater emphasis on lowering fats as opposed to carbohydrates than does the AHEI, although both are correlated to all-cause mortality and cardiovascular mortality—among other chronic disease outcomes.[26]

Appendix text 1 contains details on the sample size power calculation, randomization, and blinding.[18]

STATISTICAL METHODS

The primary outcome was calculated as change in mean fruit and vegetable intake between months 0 and 6, based on dietary recalls. The secondary outcome of the HEI score was calculated using composite macros from the National Institutes of Health.[15]

We conducted an intention-to-treat analysis using linear mixed effects models to estimate changes in the primary and secondary outcomes between months 0 and 6, with main effects for treatment arm and assessment month and a random effect for study participant to adjust for each individual's baseline consumption levels.[27]

LIMITATIONS

The study had several inherent limitations. First, our results were dependent on dietary recalls, which are subject to under-reporting and social biases.

Second, our trial was conducted in one city, and the results might not be fully generalizable to other localities. Relatedly, even within this one city—in which we were able to involve nine-teen stores, including most of the target neighborhoods' large supermarkets, small corner shops, and the farmers market—not all stores in which participants shopped were in our vendor network.

Third, we were limited in terms of the value and frequency of the vouchers in our study. It was not feasible to study a fuller range of either.

Finally, we recruited into the study a broader population than current SNAP recipients, and our findings might therefore have differed if the study had been implemented among SNAP recipients only.

We elaborate on some of these issues below in the context of interpreting our results.

Study Results

PARTICIPANT FLOW

Of 1,393 people assessed for eligibility (appendix exhibit 2),[18] 211 did not meet inclusion criteria, 815 who visited the study website and met initial eligibility criteria did not attend a study orientation session to enroll, and 8 were excluded for other reasons such as failure to present for informed consent after attending a study orientation session, leaving 359 participants for random assignment to a study arm. In each arm, four to eight people were lost to follow-up or discontinued participation, leaving a total of 332 (92.5 percent) who completed at least one dietary recall at month 6 for analysis.

BASELINE DATA

As shown in exhibit 1, eighty-six participants were randomly assigned to receive weekly fruit and vegetable–only vouchers, ninety to receive monthly fruit and vegetable– only vouchers, ninety-two to receive weekly unrestricted vouchers, and ninety-one to receive monthly unrestricted vouchers. Baseline demographic characteristics for the overall sample depict a population of whom the majority were female, and approximately 45 percent were members of ethnic/racial minority groups. Fewer than one-third of participants had a college degree. They had very low incomes, averaging $1,180 per month, and two-thirds lived in a single-person household. The nutritional characteristics of the overall sample show that more than a quarter were SNAP participants, and about 3 percent participated in WIC. Two-thirds experienced food insecurity, defined by Department of Agriculture measures of low and very low food security. Participants averaged 1.1 cup equivalent of fruit and vegetables per day and had a mean HEI score of 56.6 at baseline.

OUTCOMES

The primary outcome of fruit and vegetable consumption did not improve significantly between months 0 and 6 in any study arm (exhibit 2). While fruit and vegetable consumption between months 0 and 6 increased among all groups, receiving fruit and vegetable–only vouchers did not significantly increase fruit and vegetable consumption compared with receiving an unrestricted voucher. Also, weekly vouchers did not significantly increase fruit and vegetable consumption compared with monthly vouchers (exhibit 3).

The secondary outcome of HEI score did not improve significantly between months 0 and 6 in three of the four arms, and it improved only modestly in the weekly unrestricted voucher arm (exhibits 2 and 3). Receiving fruit and vegetable– only vouchers did not significantly increase HEI scores compared with receiving unrestricted vouchers, and receiving weekly vouchers did not significantly increase HEI scores compared with receiving monthly vouchers. The AHEI score paralleled the HEI score, with no significant increases across study groups.

The secondary outcome of voucher use was higher in the monthly than in the weekly voucher arms (on average, 80 percent versus 68 percent; exhibit 2). Voucher use rates were 74.3 percent, on average, across arms over the six-month intervention period. Participants with fruit and vegetable–only vouchers had similar use compared to participants with unrestricted vouchers.

The secondary outcome of food insecurity improved across all groups. Participants with fruit and vegetable–only vouchers and those with unrestricted vouchers had similar improvements, and participants with weekly vouchers and those with monthly vouchers had similar improvements.

At month 6 of the study, using a scale of 0 (not easy) to 3 (very easy), participants reported fruit and vegetable–only vouchers to be easier to use compared to unrestricted vouchers (exhibit 2). Weekly vouchers did not differ compared with monthly vouchers.

In terms of the consumption cycle, dietary recalls conducted in week 1 and those conducted in week 4 at baseline revealed similar nutrition profiles (appendix exhibit 2).[18] Similar results were observed in month 6 (fruit and vegetable cup equivalent intake: 1.21 in week 1 versus 1.15 in week 4; HEI score: 57.6 in week 1 versus 57.9 in week 4; average week 4 to week 1 calorie ratio: 1.03) (appendix exhibit 3).[18]

Outcomes were not substantially different in month 12, six months after voucher receipt ended (appendix exhibit 4).[18]

Discussion

There are ongoing policy debates about whether and how to leverage nutrition assistance programs to reduce the burden of chronic disease in low-income communities.[28] Despite vigorous discussion of the merits and ethics of various policy reforms, few proposed reforms have had rigorous empirical study. Nutrition assistance program reforms are difficult to research, as they require large-scale, randomized assessments of programs in which food can be purchased from a large number of stores.[29,30] A pilot test has examined the implementation of financial incentives built into the SNAP program in Massachusetts; it suggested that a 30-cent reward for each $1 of fruit and vegetables purchased with SNAP benefits produced a 0.24 cup equivalent per person per day increase in fruit and vegetable intake.[31] Other studies also suggest that fruit and vegetable purchasing incentives can effectively increase the purchasing of fruit and vegetables.[32–37] Notably, a randomized trial in Minnesota found that pairing a 30 percent financial incentive for fruit and vegetable purchasing with a restriction preventing purchases of sugar-sweetened beverages, sweet baked goods, or candy produced greater reductions in calorie intake and greater improvements in HEI scores and fruit intake than either an incentive or restriction alone.[38] Yet essentially no data exist to inform policy makers on two other key proposed modifications to nutrition assistance programs: whether restricting added benefits to just fruit and vegetables, similar to existing voucher programs, improves fruit and vegetable intake or overall dietary quality more than unrestricted food vouchers do; and whether more frequent distribution schedules improve dietary quality by smoothing the consumption cycle characterized by purchasing calorie-dense foods soon after monthly benefit receipt and running out of funds for food by month's end.[4,6,11,39]

We performed the first randomized, community-based experiment to empirically assess both proposed policy modifications. We did not find evidence that restricting benefits to only fruit and vegetables (rather than all foods) or distributing benefits weekly (rather than monthly) significantly enhanced fruit and vegetable intake, overall dietary quality, or food insecurity.

In this study, all participants received the same total dollar value of benefits. Our study therefore stands in contrast to several previous studies that demonstrated improvements in fruit and vegetable intake through financial incentives for fruit and vegetable purchases that increased the total dollars available for foods.[31,40] For example, a fruit and vegetable–only voucher program in the United Kingdom increased fruit and vegetable consumption by 15 percent, despite having an equivalent relative purchasing power to the vouchers in our study.[41] Importantly, we found no substantial difference in fruit and vegetable consumption or

overall dietary quality between the group with vouchers restricted to fruit and vegetable intake and the group with unrestricted vouchers. This finding suggests that at least to some extent, participants use their own income to supplement benefit dollars for purchases of foods that are not allowed through their benefit dollars. For SNAP participants receiving approximately $4 per day for thirty days, the additional $20 voucher represented an increase of about 17 percent in assistance funds. Food insecurity was notably reduced across all study arms in our assessment.

We listed study limitations above, and we elaborate on several of them here. First, our limitation to nineteen stores may have altered participants' purchasing patterns. Second, the amount of the voucher may have been insufficient to generate a more robust effect than we observed. However, for our results to be maximally generalizable, we chose a voucher value that corresponded to current policy discussions, existing local voucher programs, and the value thought to increase fruit and vegetable consumption sufficiently to derive clinically significant reductions in cardiovascular disease risk.[4–6] In addition, the observed voucher use rate was high, which indicates that the incentive was large enough for most participants to choose to use it in most weeks. Third, the weekly frequency may have been too inconvenient to participants, and the effect of changing frequency might have been more pronounced if we had used a twice-monthly versus a weekly distribution schedule.

Despite these limitations, our findings suggest that a food voucher program providing a limited subsidy ($20 per month) for fruit and vegetable purchases will have no greater effect on fruit and vegetable intake or overall dietary quality than a food voucher program that places only limited restrictions (consistent with current SNAP restrictions) on foods purchased with voucher funds. Our findings also suggest that distributing voucher funds weekly offers no nutritional benefit over distributing funds monthly.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Exhibit 1

Participant characteristics at baseline, by type and frequency of voucher for food purchase in San Francisco

	Fruit and vegetable–only voucher receipt		Unrestricted voucher receipt		
Characteristic	**Weekly (*n* = 86)**	**Monthly (*n* = 90)**	**Weekly (*n* = 92)**	**Monthly (*n* = 91)**	**Total (*N* = 359)**
Mean age (years)	52.2	50.7	52.4	50.9	51.5
Female (%)	65.1	65.6	65.2	62.6	64.6
Black (%)	29.1	32.2	28.3	26.4	29.0
Hispanic (%)	16.3	15.6	14.1	16.5	15.6
Education level (%)[a]					
Less than high school	8.1	6.7	8.7	8.8	8.1
High school diploma	62.8	57.8	58.7	49.5	57.1
College degree	26.7	28.9	25.0	33.0	28.4
Mean monthly household income ($)	1,251.2	1,158.9	1,218.9	1,093.1	1,179.7
No. of people in household (%)					
1	61.6	68.9	70.7	67.0	67.1
2–3	24.4	22.2	19.6	28.6	23.7
4 or more	14.0	8.9	9.8	4.4	9.2
SNAP participation (%)	25.6	28.9	28.3	27.5	27.6
SNAP participation by another member of the household (%)	2.3	6.7	2.2	3.3	3.6
WIC participation (%)	3.5	3.3	4.3	1.1	3.1
WIC participation by another member of the household (%)	2.3	0.0	2.2	0.0	1.1
Food security (%)[b]					
High	27.9	30.0	40.2	31.9	32.6
Low	24.4	26.7	23.9	30.8	26.5
Very low	47.7	43.3	35.9	37.4	40.9
Mean kilocalories consumed per day	1,643.8	1,727.2	1,641.6	1,744.5	1,689.7
Whole fruits and vegetables (cup-eq) consumed per day[c]	0.99	1.09	1.17	1.04	1.07
Mean Healthy Eating Index score[d]	54.5	56.7	58.7	56.4	56.6
Mean Alternate Healthy Eating Index score[e]	53.0	55.2	56.5	54.4	54.8

SOURCE Authors' analysis.

NOTES At baseline, 359 study participants provided data. Fruit and vegetable–only vouchers were redeemable only for those items. Unrestricted vouchers were redeemable for any food. SNAP is Supplemental Nutrition Assistance Program. WIC is Special Supplemental Nutrition Program for Women, Infants, and Children. "Cup-eq" is cup equivalent.

[a]Data were missing for two participants who received fruit and vegetable–only vouchers weekly and six who received them monthly, and for seven participants who received unrestricted vouchers weekly and eight who received them monthly.

[b]Per Department of Agriculture recommendations, households with low food security and very low food security are considered food insecure.

[c]Includes all whole fruits (citrus and noncitrus) and whole vegetables (dark green, deep yellow, and starchy vegetables and tomatoes).

[d]Score ranges from 0 to 100, as explained in the text.

[e]Score ranges from 0 to 110, as explained in the text.

Exhibit 2

Changes in outcomes from baseline to month 6, by study arm, and between-group effects, study of food purchase vouchers in San Francisco

Outcome	Change from baseline to month 6, by type and frequency of voucher (mixed effects model)				Between-group effects	
	Fruit and vegetable–only, weekly	Fruit and vegetable–only, monthly	Unrestricted, weekly	Unrestricted, monthly	Fruit and vegetable–only versus unrestricted	Weekly versus monthly
PRIMARY OUTCOME						
Whole fruits and vegetables (cup-eq) consumed per day, mean[a]	0.18	0.08	0.09	0.04	0.07	0.07
SECONDARY OUTCOMES						
Healthy Eating Index score	1.2	0.7	2.1**	−0.3	0.1	1.5
Alternate Healthy Eating Index score	0.2	0.2	0.6	0.1	−0.2	0.3
Voucher use rate over all six months (%)	66.8	81.8	67.8	80.4	0.3	−13.7**
Food insecurity (OR)	0.70	0.75	0.71**	0.62**	0.73 vs. 0.66[b]	0.71 vs. 0.68[b]
Ease of use of vouchers[c]	2.87	2.72	2.56	2.58	0.22**	0.06

SOURCE Authors' analysis.

NOTES Month six was the end of the intervention, when 332 of the original 359 study participants provided data. Changes in each variable were estimated using a linear mixed effects model with main effects for treatment arm and assessment month, and a random effect for study participant to account for baseline differences in consumption among participants—except for food insecurity odds ratios (ORs), which were estimated using generalized estimating equations. Significance in the mixed effects model is based on comparisons of the single arm to every other arm, while significance in the between-group effects is based on comparisons between the groups indicated. The vouchers and the score ranges for the Healthy Eating Index and Alternate Healthy Eating Index are explained in the notes to exhibit 1. Appendix exhibit 4 presents 95% confidence intervals (see note 18 in text). "Cup-eq" is cup equivalent.

[a]Includes all whole fruits (citrus and noncitrus) and whole vegetables (dark green, deep yellow, and starchy vegetables and tomatoes).

[b]Odds ratios reported for each category; estimated using generalized estimating equations.

[c]Composite score (ranging from 0 to 3) based on individual scores (0 or 1) in response to three questions at month 6 (the questions are in the appendix), which assessed participants' understanding of how to use the vouchers, ability to determine which foods were redeemable, and ease of redeeming the voucher with a cashier.

**$p < 0:05$

Exhibit 3

Changes in outcomes from baseline to month 6, by type and frequency of voucher, study of food purchase vouchers in San Francisco

	Weekly vouchers		Monthly vouchers	
Outcome	**Unrestricted**	**Fruit and vegetable–only**	**Unrestricted**	**Fruit and vegetable–only**
Whole fruits and vegetables (cup-eq) consumed per day[a]	0.0855	0.1763	0.0371	0.0818
Healthy Eating Index score (from 0 to 100)	2.058	1.220	−0.286	0.703
Alternate Healthy Eating Index score (from 0 to 110)	0.6101	0.1505	0.0845	0.155
Food insecurity (odds ratio, month 6 versus month 0)	0.706	0.704	0.621	0.747

SOURCE Authors' analysis.

NOTES The notes to exhibit 2 give the numbers of study participants at both points in time and explain how the changes in outcomes were estimated. The notes to exhibit 1 explain the vouchers and the score ranges for the Healthy Eating Index and Alternate Healthy Eating Index. Appendix exhibit 4 is a fuller version of this exhibit with 95% confidence intervals (see note 18 in text). "Cup-eq" is cup equivalent.

[a]Includes all whole fruits (citrus and noncitrus) and whole vegetables (dark green, deep yellow, and starchy vegetables and tomatoes).