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Systematic Review of Easy-to-Learn Behavioral Interventions for Dietary Changes Among Young Adults

Dustin M. Moore, MS, RD¹; Isabella Madrid, BS²; Karen L. Lindsay, PhD, RDN^{1,3,4}

ABSTRACT

Introduction: Improving the diet quality of young adults may support chronic disease prevention. The approaches used and efficacy of promoting small dietary behavior changes through easy-to-learn (ETL) interventions (requiring no more than 1 hour to teach the behavior) among young adults have not yet been systematically reviewed.

Methods: Following Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, 2 independent electronic searches across 6 databases were conducted to identify any articles describing ETL interventions among young adults (aged 18–35 years) and reporting dietary intake outcomes.

Results: Among 9,538 articles identified, 9 studies met eligibility criteria. Five studies reported significant improvement in the selected dietary outcome. Of these, 3 studies used an implementation intentions approach, in which participants were given or asked to write out a simple dietary behavior directive and carry it on their person. Less than half of included studies were rated as positive for overall quality.

Discussion: The available evidence suggests that ETL interventions targeting the dietary behaviors of young adults may be effective in improving dietary intake. Limitations of included studies were lack of follow-up after the intervention period and low generalizability.

Implications for Research and Practice: Further dietary intervention studies targeting young adults should systematically evaluate the efficacy of ETL intervention approaches among diverse samples.

Key Words: young adults, diet quality, behavior change, small changes (*J Nutr Educ Behav.* 2023;55:509–522.)

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INTRODUCTION

Diet quality is an umbrella term frequently used to describe how well an individual's diet conforms to dietary recommendations.¹ Although there is no single definition for diet quality, it is generally accepted that a high-quality diet promotes good health through an optimal supply of foods and nutrients required for maintaining a healthy state and avoiding or minimizing foods and nutrients that contribute to toxicity,

ill-health, or a general lack of homeostasis. Population-level approaches to improving diet quality can be administratively complex but carry a lower absolute cost per person, whereas interventions aimed at individuals or specified subpopulations may be more feasible in certain contexts and can be used to inform appropriate population-level interventions.^{2–4} Although comparatively limited in reach, the value of interventions that require minimal time to learn is worth consideration given

the high prevalence of poor health behaviors and declining health status of individuals across the US, contributing to poor health outcomes and growing chronic disease.^{5–9} Data from nationwide diet evaluation surveys show evidence of poor diet quality among all age spectrums, including young adults, an age demographic defined as those aged 18–35 years.¹⁰ Young adults, many attending college, joining the workforce, or navigating newfound independence, report dietary patterns inconsistent with recommended dietary guidelines, putting them at increased risk for obesity and future chronic health conditions.^{11–14}

Despite poor diet quality, young adults are not usually a focal point for nutrition interventions, perhaps in part because of the low reported prevalence of diet-related chronic diseases, such as coronary heart disease, diabetes, and chronic kidney disease.^{8,9,15,16} However, this period may represent a window of opportunity for primary prevention of diet-related chronic conditions because poor dietary practices and obesity in

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this phase of life can predict the onset and risk of disease in later adulthood.^{17,18} Furthermore, young adulthood presents a unique opportunity to establish or amplify existing practices conducive to good health outcomes. These years represent a transitional milestone of learning to navigate independently without previous support systems, developing a more fixed identity, and showing greater interest in shouldering new responsibilities.^{12,19,20}

Dietary interventions designed for young adults vary in approach, sometimes taking the form of comprehensive health programs and classes or modifying environmental exposures, such as the presence of sugar-sweetened beverages (SSB).²¹ Other interventions employed educational interventions or modern technology, such as cooking demonstration videos posted online or social media and text messaging campaigns to inundate study participants with healthy eating messages.²² Although previous reviews suggest a measure of effectiveness, the reliability of the data is questionable given the variety of study designs, methods, targeted outcomes, and inherent limitations. Authors reported that successful interventions usually integrated visual cues into the students' lifestyles, such as messages on vending machines or food selections available at purchase.²²

Previous studies provide context for addressing the healthy eating barriers commonly cited by young adults. Among these are a lack of interest, poor self-perception of the ability to make a change, time management, or perceived feasibility.^{23–25} Given the internalized nature of these barriers, behavior change theory suggests that interventions that simplify or facilitate perceived effort may be an effective strategy for improving diet quality within this population.²⁶

Small-change approaches to improving diet and health typically focus on empowering individuals to make changes for the better within the prescribed circumstances. For this paper, we explored the effect of small-change approaches through easy-to-learn (ETL) interventions that would reasonably require no

more than 1 hour for researchers to teach or explain to participants how to perform the intervention. By contrast, diet interventions or behavior changes that are excessively challenging, complex, and considered restrictive are prone to attrition or a return to previous behaviors.^{27,28} The most commonly reported small-change approaches in the literature typically focus on weight reduction and, by extension, calorie modification.^{29,30} However, calorie modification does not necessarily result in an improvement in diet quality, which is the ultimate goal for improving diet-related health outcomes. Diet quality itself is a multicomposited outcome comprising the sum of various dietary constituents. Therefore, even when an intervention aims to alter the intake of a single dietary component, such as an individual food or nutrient, this can translate to a shift in overall diet quality, provided that other aspects of the diet remain constant. The effects of small-change approaches to improve diet quality, especially among the young adult population, have not been reviewed.

This review aimed to identify and synthesize the methods and findings of previously published studies among young adults aged 18–35 years, which tested the effects of ETL interventions compared with passive or alternative treatments on their overall diet quality or constituents of diet quality. The results of this systematic review are intended to guide future intervention studies to reduce the perceived effort of or offer simplified methods to making dietary changes that ultimately drive improvement in diet quality among young adults.

METHODS

Literature Search

This systematic review was registered in PROSPERO under ID no. CRD420-22306007, and conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses.³¹ A preliminary pilot search was conducted by a single author to assess the utility of search terms suitable for the review's

inclusion and exclusion criteria. Only currently published studies were considered as part of this review, wherein all original data were deidentified; therefore, according to institutional policy, no IRB approval was required. After collaboration with the other authors, results from this initial search were used to craft the following key terms connected by Boolean operators: [*Diet** OR *Nutr**] AND [*Nutrition intervention* OR *Nudge* OR *Dietary intervention* OR *Behavior modification* OR *Dietary change* OR *Dietary advice* OR *Simple approach* OR *Small change* OR *Habit formation* OR *Behavior change*] AND [*College* OR *18 years** OR *35 years** OR *Students* OR *young adult*]. These terms were entered into PubMed, Academic Search Complete (EBSCO), Web of Science, ERIC, and CINAHL. Google Scholar was also searched for literature, but its search capacity is comparatively limited, not permitting more than 1 Boolean operator. Therefore, a search line was entered made up of key terms from the previous search engines, connected by a single Boolean operator: [*simple dietary advice* OR *simple nutrition intervention* OR *dietary habit formation* OR *small change approach* OR *Nutritional nudges* OR *simple dietary advice*]. We manually screened the limited results returned in Google Scholar to identify potentially eligible articles.

In addition, we performed backward searches of reference lists from articles returned by the systematic review search to identify other potential articles not found using the original search terms. All searches were conducted between January 18, 2022 and February 24, 2022.

Inclusion And Exclusion Criteria

Criteria for inclusion within the review were (1) interventional studies (either with a control group or using a single-arm, prepost outcome assessment) that involved ETL behavior changes reasonably within the control of the participant, (2) measured at least 1 component of dietary intake as either a primary or secondary outcome, represented by the 2015 Healthy Eating Index (HEI), and (3)

addressed a young adult population aged 18–35 years. An ETL intervention refers to any reportable behavior change from the participant that required no more than 1 hour of engagement time to learn. This hour would not include the time required to complete the initial survey or data collection procedures. If a study did not specify the time to communicate the intervention, the authors used a reasonable inference on the basis of available information. Furthermore, ETL interventions are not defined by the perceived ease or time to complete a behavior. An intervention may be perceived as difficult or time-consuming to perform by some individuals, but so long as communicating and teaching the intervention to the target audience is a reasonably quick process, it would qualify as an ETL intervention.

If the study population was broad and exceeded the 18–35-year age range, it was excluded if the mean age of participants was > 35 years. There was no cutoff publication date for included studies. Only English- and Spanish-language articles were considered.

Article Selection and Review Process

The selection of articles relied primarily on 2 authors using a 2-pass method. This method requires authors to independently search the databases using the same key terms within the same time frame, first tagging potentially-relevant articles according to title and abstract, followed by a second pass in which full manuscripts are reviewed to evaluate eligibility on the basis of inclusion and exclusion criteria.³² The references from these manuscripts were also reviewed to identify additional studies that could be included, which yielded 16 studies for analysis on the basis of title and abstract. Outcomes from the independent searches were compared, and any disagreement that could not be resolved, whether for articles selected or qualification for inclusion, was remediated through appeal to a third author who made the final decision.

The review process involved careful analysis of the selected

manuscripts by 2 authors. First, a summary table was created with general descriptive information about each study, including title, year of publication, authors, country of origin, use of theory described in the study, study design, control groups, and a brief description of the ETL intervention applied in the study. Two authors independently entered the information for the summary table by reading each study. Once completed, 1 author-verified all information contained therein. This process was repeated for a second summary table that detailed information regarding the population of the study, a breakdown of the participants, a timeline of the intervention, diet-related outcomes of interest, Cohen's *d* effect size for each diet-related outcome, nondiet outcomes of interest, and a summary of the diet-related findings. Effect size is the standardized mean difference between groups of independent observations, calculated from mean differences of groups, standard deviations, and the number of group participants.³³ Cohen's *d* provides additional insight for interpreting the relevance of an effect between 2 groups. Typically, $d = 0.2$ is considered a small effect size, 0.5 is medium, and 0.8 is large.³⁴ Given the heterogeneous nature of the studies, including study outcomes, the measurement method of selected outcomes, and intervention lengths, a descriptive analysis of the evidence was conducted in lieu of a meta-analysis. Relevant features, methods, and outcomes of the studies were compared and discussed in relation to previous literature.

The summary of diet-related findings reported any significant or nonsignificant differences in diet-related outcomes within and between groups. Information regarding the stratification of study population demographics was included as reported in each study. Outcome data regarding nondiet outcomes were reported but not discussed in detail, as this was not within the purview of this review. Summaries of findings from authors were compared and reported regarding relevant conclusions and study limitations.

Quality Assessment of Included Studies

Study quality was analyzed using the Quality Criteria Checklist (QCC) for Primary Research, provided by the Academy of Nutrition and Dietetics.³⁵ This tool helps researchers identify concepts widely accepted as elements of rigorous scientific investigation, such as clearly stated research questions, bias assessment, comparable study groups, clear definitions of outcomes, and limitations because of funding bias. Two authors independently reviewed each study using the objective criteria outlined in the QCC, scoring as appropriate and then meeting to discuss findings and resolve discrepancies. A final evaluation of study quality was designated for each study on the basis of the QCC. The QCC offers a list of 10 questions to assess study quality. Based on the responses to those questions, offers 1 of 3 designations for the study's overall quality: positive, neutral, or negative.

RESULTS

Study Selection

The initial search yielded 9,538 articles for review. During the first pass, 136 articles were retained for additional review on the basis of title and abstract; manuscripts were read in full to determine eligibility for inclusion. A second review of the full manuscripts was performed among the selected studies, and brief notes were made about the reason for exclusion, when applicable. Commonly cited reasons for exclusion were failing to meet the review's definition of an ETL intervention, such as an intervention outside of the control of the participant or one that required more than an hour to learn (Brace AM. *Increasing Healthy Eating Behaviors Among College Students*. University of Georgia; 2012).³⁶ After a review of the full manuscripts, 18 articles were retained and discussed between 2 authors. By deliberation and appeals to a third author for resolution, 9 articles were retained for final inclusion within the review, none of which were in the Spanish language. The [Figure](#) presents an

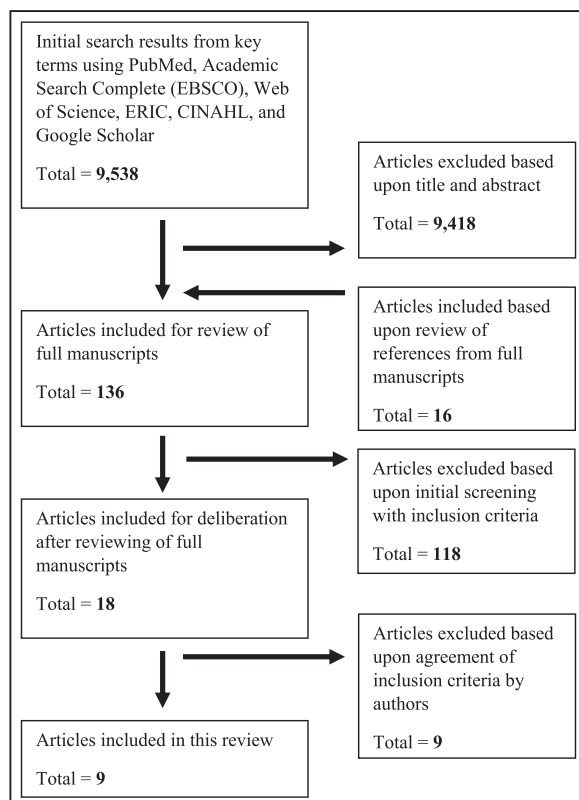


Figure. Flow chart for the article search process, from initial search results to included articles. EBSCO, Elton B. Stephens CO (company); ERIC, Education Resources Information Center; CINAHL, Cumulative Index to Nursing and Allied Health Literature.

overview of the study search and selection process.

Description of Included Studies

Table 1 describes the study design, behavior change theories employed, timeline of treatment, and details of the intervention and control for included studies. The studies span 25 years, with the most recent study published in 2021 and the oldest in 1997.^{37,38} Five studies originated in the United Kingdom, 2 from the US, 1 from Germany, and 1 from South Korea. The most commonly used study design was a randomized controlled trial (RCT) design using a pre-post assessment method. Only 2 studies were not RCTs; Park et al³⁸ conducted a single-armed feasibility design, and Heatherington et al³⁹ employed a repeated measures analysis for 4 different scenarios. Of the 7 RCT studies, only 1 had 2 intervention groups compared with the control group.⁴⁰

Five of the 9 studies discussed using theory in planning and executing the intervention. Two studies, both of which were conducted by the same author, used the theory of planned behavior (TPB).^{41,42} One study made use of social cognitive theory (SCT).⁴⁵ Another looked at Self-determination theory (SDT), whereas the final study drew from both SCT and SDT in planning its intervention.^{44,45}

The most commonly employed intervention was an implementation intentions approach, used by 4 studies wherein participants were given or asked to write out a simple health behavior directive and carry it on their person as a prompt.^{40–42,44} Two studies used media created by the researchers that were tailored to the target audience to communicate diet and nutrition-related messages.^{43,45} One study required a specific food item selected by the researchers to be consistently consumed by participants.³⁷ One study offered directives

on the makeup of the physical environment in which a person consumed a meal.³⁹ The final study borrowed from tenets of time-restricted eating and had participants select and stick to a time window within which they ate all their food.³⁸

Only 2 studies did not include any form of a control group in their design.^{38,39} Four studies used a passive control group, in which no instructions or alternative intervention were applied beyond collecting the same data required of the experimental group.^{37,40–42} The remaining 3 studies had alternative instructions or interventions provided to the control in contrast to the experimental group; 5-minute videos on sleep disorders instead of 15-minute culinary videos, implementation intentions for consuming water instead of diet beverages, and content identical to the Facebook group but without the use of a smartwatch.^{43–45}

The timeline for implementing these interventions, from baseline assessment to final contact with participants, ranged from 2 weeks to 5 months.^{42,43} Only 3 of the studies included a follow-up assessment after the designated endpoint of the intervention period, ranging from 1 week to 4 months, using the same dietary measures conducted at the interventions' endpoint.^{37,40,43}

Table 2 describes the study population, outcome measures, and diet-related results for included studies. Among the 9 studies included in this review, the total number of participants was 872. The largest study had 264 participants, whereas the smallest had 33.^{38,41} Except for Heatherington et al,³⁹ every study had more female than male participants. Considering the combined total of participants within all 9 studies, 67% (n = 584) were females and 33% (n = 288) were males. Only 1 study included data stratification of racial and ethnic backgrounds for study participants.⁴⁴ Aside from reporting race, sex, body mass index (BMI), and age, the only other participant demographics reported were campus living conditions and dining hall usage in 1 study.⁴⁵ Six of the 9 studies recruited college students, whereas the remainder of studies reported

Table 1. Study Design Characteristics of Included Studies

Year	Authors	Country	Study Title	Theory Involved	Study Design	Control Group	Description of Simple Intervention	Timeline of Intervention
2004	Armitage ⁴¹	United Kingdom	Evidence that implementation intentions reduce dietary fat intake: a randomized trial	TPB	RCT: CON + EXP groups	Passive CON group	Using a single note card, participants write a detailed description of how to consume less fat in the diet and carry this card on their person	1 mo (prepost assessment)
2007	Armitage ⁴²	United Kingdom	Effects of an implementation intention-based intervention on fruit consumption	TPB	RCT: CON + EXP groups	Passive CON group	Write and carry an implementation card stating when and where to eat an extra piece of fruit each day for the duration of the study	2 wk (prepost assessment)
2009	Clifford et al ⁴³	US	Good Grubbin': impact of a TV cooking show for college students living off campus	SCT	RCT: CON (n = 51) + EXP groups (n = 50)	Viewing 4, 5-min programs on sleep disorders	Watching 15-minute episodes of a cooking program 1 wk for 4 wk	4 wk + follow-up at 4 mo
2006	Hetherington et al ³⁹	United Kingdom	Situational effects on meal intake: a comparison of eating alone and eating with others	None	Repeated measures (×4 conditions for each participant)	Repeated measures design, so no functional CON group	Consuming meals in 1 of 4 settings; being alone, with friends, with strangers, and watching TV	4 eating appointments (over 2 wk)
2020	Judah et al ⁴⁴	United Kingdom	A habit-based randomised controlled trial to reduce sugar-sweetened beverage consumption: the impact of the substituted beverage on behaviour and habit strength	None	RCT: water (n = 79) + diet drink (n = 57) groups	Comparison, water-consuming group	Writing out an implementation intentions card that the participant carries, which describes when and where participants usually purchase SSB and how they plan to swap these for non-SSB	2 mo (prepost assessment)
1997	Kirk et al ³⁷	United Kingdom	Dietary fat reduction achieved by increasing consumption of a starchy food—an intervention study	None	RCT: CON (n = 22) + EXP (n = 26) groups	Passive CON group	Consumption of 60 g of a ready-to-eat breakfast cereal (Kellogg's Corn Flakes, Rice Krispies, or Special K) with 1% milk daily	4 wk + follow-up at 3 mo
2021	Park et al ³⁸	South Korea	The effect of four weeks dietary intervention with 8-hour time-restricted eating on body composition and cardiometabolic risk factors in young adults	None	Single-arm feasibility study	No CON group	Select an 8 h length of time in the day, and restrict all eating activity to that period for the study duration	4 wk
2019	Pope et al ⁴⁵	US	Use of wearable technology and social media to improve physical activity and dietary behaviors among college students: a 12-week randomized pilot study	SCT/SDT	RCT: comparison (n = 19) + EXP group (n = 19)	The comparison included content identical to the Facebook group but without a smartwatch	Wear a Polar M400 smartwatch and enroll in a Facebook group that promotes evidence-based health and diet education tips 2× wk	12 wk (baseline, 6 wk, 12 wk)
2013	Ungar et al ⁴⁰	Germany	Increasing fruit and vegetable intake: "Five a day" vs "just one more"	SDT	RCT: CON (n = 29), 5 a day group (n = 28), and just 1 more group (n = 27)	Instructions to eat as usual during the next week	A simple instruction to participants to either eat 5 a day of FV or eat 1 more servings of fruit or vegetable today than they usually do	1 wk + follow-up at 1 wk

CON indicates control; EXP, experimental; FV, fruit and vegetable; RCT, Randomized Controlled Trial; SCT, Social Cognitive Theory; SDT, Self-determination Theory; SSB, sugar-sweetened beverages; TPB, Theory of Planned Behavior.

Table 2. Population Descriptions, Effect Size, and Outcomes of Included Studies

Authors	Population	Participants	Dietary Outcomes	Standardized Effect Size (Cohen's d)	Alternative Outcomes Measured	Summary of Diet-related Findings
Armitage ⁴¹	UK citizens recruited from a company aged 18–75 y (mean, 33 y)	n = 264 (159F/106M); no race/ethnicity data reported	Fat intake (g/d), SFA (g/d), Fat intake (%)	0.24, 0.22, 0.1	TPB variables (attitude, subjective norm, perceived behavioral control)	All measures of fat intake significantly decreased within the EXP, but not the CON. Fat intake also decreased significantly between groups. Differences could not be explained by motivation between both groups
Armitage ⁴²	UK college students aged 18–20 y (mean, 19.5 y)	n = 120 (96F/24M); no race/ethnicity data reported	Fruit intake (pieces of fruit, by brief FFQ)	0.38	TPB variables (attitude, subjective norm, perceived behavioral control), behavioral intention	Fruit intake significantly increased within the EXP but not the CON. Change in fruit intake was also significant between groups
Clifford et al ⁴³	US college students from upper-level nonhealth courses	n = 101 (74 F/37 M); 94 living off campus/7 elsewhere; 74 do not eat at the dining hall/27 eat at the dining hall); no race/ethnicity data reported	Total servings of FV intake (by short FFQ)	0.04	Program feedback survey, adherence questions, knowledge/attitudes/behaviors related to FV intake and cooking	No significant change within or between groups for FV intake at either posttreatment or follow-up assessments
Hetherington et al ³⁹	Staff and students at a UK university, aged 18–54 y (mean, 28.3 y)	n = 37 (16F/21M); no race/ethnicity data reported	Energy intake (kcal) with subanalysis of added sugar and high-fat foods	NA ^a	Participant behavior (videotaped and then coded), duration of the meal, % of time spent eating, memory test of how much food eaten, appetite, mood	Energy intake was significantly higher when watching TV or eating with friends than alone. Added sugar and high-fat foods were the only food choice significantly higher, but only when eating with friends
Judah et al ⁴⁴	UK and US citizens recruited through an online crowdsourcing website, aged 18–74 y (mean, 31.5 y)	n = 158 (69F/67M); predominantly White (n = 49), Asian (n = 7), Black (n = 7), other (n = 16)	SSB intake (portions/wk)	NA ^a	Habit (automaticity), Hedonic liking	Significant reduction in SSB consumption in the diet drink group, with a large and non-significant reduction in the water drink group. No significant difference in reduction between groups
Kirk et al ³⁷	College undergraduates from UK college, aged 17–30 y (mean, 20 y)	n = 48 (46F/2M); no race/ethnicity data reported	Protein (g/d), fat (g/d) (SFA, PUFA, MUFA), sugars (g/d), fiber (g/d)	0.25, 0.98, 0.08, 0.43	Weight and BMI	SFA intake saw a significant reduction from baseline in the EXP at both 4 and 12 wk and at 4 weeks when compared with CON, with no observed changes within the CON. There was a corresponding significant increase in protein from baseline at 4 and 12 wk and 12 wk when compared with CON. No significant change in sugar for both groups, and a significant reduction in fiber intake from baseline within EXP at 4 and

(continued)

Table 2. (Continued)

Authors	Population	Participants	Dietary Outcomes	Standardized Effect Size (Cohen's d)	Alternative Outcomes Measured	Summary of Diet-related Findings
Park et al ³⁸	Young adults in South Korea without a metabolic disorder or recent 10% weight change, aged 18–28 y (mean, 22.5 y)	n = 33 (25F/8M); no race/ethnicity data reported	Added sugar (%), SFA (%), protein (%), energy intake (%)	NA ^a	Body composition, BMI, waist circumference, insulin, blood glucose, lipid panel, HOMA-IR, physical activity, sleep quality, and other indeterminate lifestyle factors	12 wk, but not when compared with CON NS differences in added sugar and SFA intake between baseline and termination of the study
Pope et al ⁴⁵	College undergraduates from a Midwest University in the US, aged 18–35 y	n = 38 (28F/10M); no race/ethnicity data reported	Fruit intake (cups), vegetable intake (cups), whole grains (oz eq), SSB (calories)	0.09, 0.07, 0.07, 0.35	Intervention interest, use and acceptability, adherence, retention, physical activity, cardiorespiratory fitness, BMI, body composition, social support, enjoyment of health-related behaviors, perceived health behavior barriers, outcome expectancy, interest/enjoyment	No significant changes were reported between both groups in FV intake, whole grain, and SSB intake, nor were significant changes reported from baseline to 6 and 12 wk for both groups with all diet-related outcomes.
Ungar et al ³⁹	German college undergraduates recruited on campus (mean age, 23.4 y)	n = 84 (71F/13M); no race/ethnicity data reported	FV intake (servings)	0.3	None	Between baseline and the end of the intervention, all 3 groups had significantly higher FV intake, but at the 1-wk follow-up, only the 5 a day group had significantly higher FV intake than its baseline. At follow-up, only the 5 a day group had significantly higher FV intake than CON. There was no significant difference in FV intake between all groups from baseline to follow-up

BMI indicates body mass index; CON, control group; EXP, experimental group; F, females; FFQ, food frequency questionnaire; FV, fruit and vegetable; HOMA-IR, Homeostatic Model Assessment for Insulin Resistance; MUFA, monounsaturated fatty acids; NA, not available; NS, nonsignificant; PUFA, polyunsaturated fatty acids; SFA, saturated fatty acids; SSB, sugar-sweetened beverages; TPB, Theory of Planned Behavior.

^aData necessary to calculate effect size (SD, t value) were missing.

that the mean age of participants was < 35 years. The oldest mean age of any study's population was 33 years.⁴¹

Three studies selected > 1 marker of diet as outcome measures, such as whole grain intake or fruit and vegetable consumption, whereas the rest of the studies only assessed a single marker of diet quality.^{37,38,45} The most commonly reported dietary intake marker was fruit and/or vegetables, though these were measured in a distinct method for each study.^{40,42,43,45} In addition to fruit and vegetable intake,^{40,42,43,45} other measures of dietary intake assessed included total and saturated fat,^{37,38,41} added sugar,^{37–39} total protein,^{37,38} whole grains,⁴⁵ SSBs,^{44,45} and macronutrients as a percentage of total energy.³⁸ Except for Ungar et al,⁴⁰ every study included secondary outcomes that exceeded the scope of dietary intake. These were highly varied within each study and included program feedback, participant behavior (ie, activity during mealtimes, physical activity), BMI, and hedonic liking.

Results of Diet-related Outcomes

Only 3 studies did not report any significant dietary changes within or between groups.^{38,43,45} Of these, 2 studies^{43,45} prescribed media for communication of nutrition messages (cooking program, Facebook group) but failed to detect any significant changes in diet-related outcomes, though Clifford et al⁴³ reported improvements for knowledge in fruit and vegetable recommendations as a secondary outcome. Park et al³⁸ had a single group complete 4 weeks of time-restricted eating but did not observe any changes within the group when comparing intake patterns at baseline and end of the study.

Five studies reported some dietary improvements between their intervention and control groups, whereas 1 study only reported a within-group difference. Armitage⁴¹ observed significant reductions in fat intake for the experimental group compared with the control group. In a later study observing fruit intake, Armitage⁴² again reported higher fruit intake for the experimental arm than

the control. Between baseline and the end of the study, Ungar et al⁴⁰ noted that all 3 groups had significantly higher fruit and vegetable intake, but at the 1-week follow-up, only the 5 a day group's intake remained elevated compared with both baseline and the control group. Heatherington et al³⁹ prescribed an intervention that had participants eat a meal within 1 of 4 circumstances: alone, with strangers, with friends, and watching television. Among the 4 exposures, energy intake was significantly higher while watching television or eating with friends when compared with eating alone. Kirk et al³⁷ measured multiple dietary outcomes at weeks 4 and 12 of their intervention, which involved daily consumption of ready-to-eat breakfast cereal. Compared with the control group, the experimental group reported a significant decrease in saturated fat at week 4. A decrease in fiber intake was noted within the experimental group at both time points, but this change was not significantly different from changes observed in the control group. The experimental group's protein intake significantly increased between baseline and weeks 4 and 12, although only the change at week 12 was significantly different compared with the control group. There was no significant change in added sugar intake at any time point for either group. Judah et al⁴⁴ reported a reduction in SSB intake for both the diet drink implementation intentions group and the water implementation intentions group, although the reduction was only significant for the former group, whereas the difference in SSB reduction was not significant between groups.

Six studies disclosed enough information to calculate the standardized effect size using Cohen's *d* formula.³³ Clifford et al⁴³ reported on total fruit and vegetable intake servings, which produced the smallest effect size of 0.04, whereas Kirk et al³⁷ reported the largest effect size of 0.98 for fat intake. Among all 6 studies, the average effect size was 0.26.

Study Quality

Table 3 displays the quality rating for each included study. Four of the 9 studies received a positive

designation regarding study quality.^{41,42,44,45} Correspondingly, 2 of these studies scored perfectly by receiving a positive designation for each of the 10 questions asked by the QCC.^{44,45} The remaining 5 studies were given a neutral designation, and no studies received a negative rating. The study evaluated to have the lowest quality was Park et al,³⁸ which used time-restricted eating as an intervention. The question most commonly missed by each study was a disclosure of funding or sponsorship source. The only item which every study addressed positively was the method of handling and disclosing withdrawals.

DISCUSSION

This systematic review aimed to assess the efforts, analyze the methods, and evaluate the effectiveness of intervention trials that employed ETL interventions among young adults. Most studies identified from this effort were RCTs, and among those, most used a health behavior theory as a rationale for their intervention. Although no 2 studies employed the same intervention protocol, 4 studies used an implementation intentions approach that had participants write out a personalized, simple directive for improving a diet component or were provided with this simple directive and would carry it on their person throughout the study. Three of these 4 studies reported significant dietary behavior changes in the experimental vs control groups. These findings are congruent with a previous study exploring the effect of implementation intention interventions on dietary habits, wherein moderate to small effects were reported for including healthier foods in the diet and reducing unhealthy eating patterns.⁴⁶ Another study compared the effects of 2 types of implementation intention approach and a basic dietary and self-weighting goal-setting approach on weight and diet-related outcomes among college students. Although this study did not detect significant effects for either implementation intentions group on the participants' HEI score, it was noted that both groups exhibited more

Table 3. Quality Assessment of Included Studies using the Quality Criteria Checklist

Validity Questions	Armitage ⁴¹	Armitage ⁴²	Clifford et al ⁴³	Hetherington et al ³⁹	Judah et al ⁴⁴	Kirk et al ³⁷	Park et al ³⁸	Pope et al ⁴⁵	Ungar et al ⁴⁰
1. Was the research question clearly stated?	Yes	Yes	Yes	Unclear	Yes	Yes	No	Yes	Yes
2. Was the selection of study subjects/patients free from bias?	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
3. Were study groups comparable?	Yes	Yes	Yes	Unclear	Yes	Unclear	N/A	Yes	Yes
4. Was the method of handling withdrawals described?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5. Was blinding used to prevent the introduction of bias?	Yes	Yes	Unclear	NA	Yes	No	Unclear	Yes	Unclear
6. Were intervention/therapeutic regimens/exposure factors or procedures and any comparisons described in detail? Were intervening factors described?	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	Yes
7. Were outcomes clearly defined, and were the measurements valid and reliable?	Yes	Yes	Yes	Unclear	Yes	Unclear	Unclear	Yes	Yes
8. Was the statistical analysis appropriate for the study design and type of outcome indicators?	Yes	Yes	Yes	Unclear	Yes	No	No	Yes	Unclear
9. Are conclusions supported by results with biases and limitations taken into consideration?	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
10. Is bias because of the study's funding or sponsorship unlikely?	Unclear	Unclear	Unclear	Unclear	Yes	No	Yes	Yes	Yes
Overall assessment ^a	A	A	B	B	A	B	B	A	B

NA indicates not available.

^aLetter A indicates that the report has addressed inclusion/exclusion, bias, generalizability, and data collection and analysis; letter B indicates that the report is neither exceptionally strong nor exceptionally weak.

goal-congruent behavior over the intervention period compared with the basic goal-setting group.⁴⁷ Only 3 of the 9 studies included in this review failed to observe significant improvements in selected dietary markers within and between experimental and control groups. This systematic review of ETL intervention approaches to dietary intake among young adults addresses an important gap given that this life stage generally has poor diet quality, which has been linked to increased future risk for chronic diseases.

A small-changes approach to health improvement via ETL interventions is a concept that has been applied to research previously, with varying degrees of success, but notably does not have a standardized or agreed-on definition. Lally et al⁴⁸ conducted an intervention among 104 adults with obesity. Participants in the experimental group were instructed to read a brief leaflet with 10 simple and practical tips that promoted dietary energy reduction, self-awareness of food intake, and routine. In this instance, significant weight loss was reported after 8 weeks, with the intervention condition losing an average of 2.0 kg, whereas the control reported a 0.4 kg loss. At a 32-week follow-up, the between-group difference remained significant.

Findings from Lally et al⁴⁸ conflicts with another systematic review that sought weight management interventions in which participants had been instructed to perform actions that resulted in a caloric deficit of 200 kcals/d.²⁹ The included weight gain prevention trials observed an aggregate loss of 0.7 kg between groups at the program end, not considered effective for weight loss, although it may offer initial evidence in support of weight gain prevention. An additional study following a single cohort of 47 residents of Louisiana, most of whom lived in rural areas and were aged > 50 years, failed to observe any changes in dietary patterns after a 4-week program that taught behavior change using a small-changes framework.⁴⁹

Based on these previous studies, there is inconsistent evidence regarding the value of a simple change

approach to improving health. Principally, there is general discordance over how simple changes are defined and operationalized for study purposes. Graham et al²⁹ set this definition as any action that prompted a daily 200 kcals reduction. Hill et al³⁰ proposed a similar definition but at 100 kcals/d. Adhikari and Gollub⁴⁹ tautologically referred to it as “conscious small changes in lifestyle behaviors” and required participants to complete a minimum of 6 hours of coursework over 4 weeks. Furthermore, a small-changes approach is more commonly applied to weight-centered outcomes rather than improving diet quality. This systematic review puts forward an operating definition of small behavior change that expects performance of at least 1 reportable behavior that requires minimal time to learn and perform. Furthermore, this review departs from previous research assessments by placing the locus of change on diet quality, rather than weight.

At its core, the small behavior change approach considers operable actions that are within the control of the individual despite circumstance or setting, and there is evidence and rationale for this approach. For one, eating environments can be extraordinarily complex given personal circumstances and available food options, but opportunity to learn about and navigate simple, personalized approaches to dietary improvement are considered feasible and effective.⁵⁰ Second, choosing between broad, environmental interventions and small-change, ETL interventions is a false dichotomy. These can be conducted in tandem with one another, with small changes potentially contributing to reduce or reshape the environmental factors that may adversely influence diet quality.³⁰ Third, when individuals feel a heightened sense of ability to act, such as through easily understood or relatable behavior changes, they are more likely to act and sustain action.^{51,52}

The findings from this review suggest that a small-change, ETL intervention approach that focuses on improving diet quality within young adult populations can provide benefit from minimal effort. Of the 9 studies

identified, 5 reported significant improvements between their intervention and control groups in their selected dietary markers. Except for Hetherington et al³⁹ that prescribed changes to the eating environment rather than changes in dietary content, the other 4 studies^{37,40–42} exhibited 2 common qualities. First, each intervention used implementation intentions or small directive dietary prompt which resulted in significant benefit to their experimental groups, with respect to changes in dietary intakes. Although Judah⁴⁴ only reported a significant within-group reduction of SSB intake but no significant difference between groups, the authors noted this may be attributed to the study design wherein both groups targeted a reduction in SSB intake, albeit through different approaches (diet beverages vs water). A second common quality among these 4 studies is that their interventions applied a focused behavioral objective; modifying intake of either fruit and vegetables, SSBs, or fat.^{40–42,44} When it comes to dietary management, having a narrower focus of established goals, at least initially, can plausibly increase perceived behavioral control and elevate chances for successful change.^{26,51,52}

Follow-up assessments are useful for diet-related studies to assess sustainability of effects, as any purported benefit that cannot be maintained once the intervention period ends is likely going to encounter problems with translational research for practical effect.^{53,54} Only 3 of the studies in this review had follow-ups after the intervention period ended, with Kirk et al³⁷ measuring intake again at 3 months, Clifford et al⁴³ at 4 months, and Ungar et al⁴⁰ at 1 week. With a relatively short follow-up, Ungar et al⁴⁰ reported a fruit and vegetable intake still significantly higher compared with the control. However, intake had decreased and it is unknown whether any improvements would disappear after a few more weeks. Clifford et al⁴³ had the longest follow-up with no observed improvements, but this was a likely scenario given the failure to report any dietary improvement postintervention. Kirk et al³⁷ reported significant protein increase in

the experimental group at a 3-month follow-up, compared with the control group. Although that suggests sustainability in practice, the study does not report whether the specific intervention (required consumption of breakfast cereal) was continued postintervention. Thus, it is unknown if the sustained change in dietary intake was due to consumption of breakfast cereal or some alternative eating behavior.

In addition to observing statistical significance between groups within studies, we can further assess the relevance of ETL interventions through analysis of effect size, using a standardized measure previously used in diet-related studies for both diet quality and weight loss.^{55,56} It is generally regarded that if group means do not differ by at least 0.2 standard deviations, the difference in selected outcomes between the groups is likely not meaningful, even when statistically significant.⁵⁶ As ETL interventions are simple and small in their approach, we would not anticipate many moderate to strong effect sizes, a notion supported by an average effect size of 0.26 among all studies included in this review. Regardless, a few outcomes yielded relatively impressive effect sizes, given the nature of the study's intervention. Three studies reported an effect size greater than or equal to 0.3 for improving fruit and vegetable intake or reducing SSB intake.^{40,42,45} Except for Clifford et al,⁴³ every study from which effect sizes could be calculated contained at least 1 outcome whose group differences would not be considered trivial. The intervention by Kirk et al³⁷ generated the largest effect size for reducing total dietary fat through the daily introduction of breakfast cereal, a low-fat food. However, this result should be interpreted cautiously as a reduction in all forms of fatty acids was observed, including more desirable monounsaturated and polyunsaturated fatty acids. The authors also noted a prepost decrease in dietary fiber intake in the experimental group, but the difference was not statistically significant compared with the control.

Among the 3 studies that did not see a significant improvement, Park

et al³⁸ lacked a control group and was relatively low-powered, with only 33 participants, limiting the generalizability and validity of findings. The remaining 2 studies, Clifford et al⁴³ and Pope et al,⁴⁵ had a common feature of implementing a media platform to communicate health-based messages. Although Clifford et al⁴³ did not measure compliance, only 59% of the original participants completed the 4-month follow-up survey; although by the authors' calculations, the sample size was large enough to provide 90% power to detect changes in participants' nutrition knowledge through the cooking program intervention. In Pope et al,⁴⁵ the social media and wearable technology interventions were rated high by participants regarding feasibility and interest, and all completed their allocated treatments.

These 2 studies alone are insufficient to dismiss the effectiveness of an ETL intervention that uses media channels to deliver health messages. Prior studies targeting different population groups have reported successful health changes using media-based approaches. For example, in Caplette et al,⁵⁷ in which the sample comprised predominantly middle-aged Caucasian women (mean age, 42 years), the experimental group read short blog posts weekly over 6 months, which resulted in significant improvement in fruit and vegetable intake compared with the control group without access to the blog. Another study with a similar population reported significant weight loss and increased fruit and vegetable intake in the group who listened to 24 episodes of a theory-driven podcast on weight loss over 12 weeks, compared with the control group.⁵⁸ Whether the difference between the studies in our review vs these latter 2 examples is a matter of exposure length, content dosage, or differences in population demographics remains to be explored. Furthermore, whether interventions are conducted in person or through technology and media, both approaches demonstrate significant but minimal effects for improving the health of young adults.⁵⁹

In addition, it is worth considering the 1 study in this review, which

functionally required a food prescription by instructing participants to consume a specified food (breakfast cereal with milk) daily throughout the study protocol.³⁷ Although this study found an increase in protein and a reduction in saturated fat intake compared with the control, a reduction in fiber intake was also observed in the experimental group. In most circumstances, reducing fiber intake is considered a reduction in diet quality. In another study of a similar design, participants were randomized to consume either an ounce of almonds before dinner or an isocaloric amount of cheese over 8 weeks, but no change in fiber, fat, protein, or energy intake was observed between the groups (Jahns M. *Almond Consumption and Dietary Compensation in Overweight and Obese Adults*. Arizona State University; 2011). This latter study experienced an extremely high attrition rate, perhaps broadcasting one of the critical limitations of studies that require such rigidity in eating patterns. Reasonably, the best dietary approach meets the participant's nutritional needs and can be maintained long-term. Allowing greater flexibility in dietary choices while following healthy dietary principles is likely more acceptable to individuals. Although a rigidly prescribed dietary pattern may appear simple in theory, this approach is not in concordance with successful adherence strategies according to behavior change theories. Longitudinal studies often suffer from extraordinarily high attrition rates.^{26–28,51}

A few studies reported high attrition rates, with > 50% of those originally enrolled dropping from the study before the final point of data collection.^{41–43} The reasons for these attrition rates were not usually offered. One study noted attrition was due to participants failing to provide a personal code necessary to identify their questionnaire for data inclusion and analysis.⁴⁰ Another study excluded subjects reporting > 4 servings of fruits/vegetables at baseline to ensure the 2 study arms (just 1 more and 5 a day) communicated different messages.⁴¹ In general, it was uncommon for any of the included studies to comment on or verify

compliance rates within the study. This may be an intentional choice in the study design, on the presumption that a simple behavior change study would not require a compliance check.

When interpreting the overall results of this review, one should consider the makeup of the populations and the diversity of geographical locations studied. Each of the nations represented within the included studies may have different food environments, cultural norms, and economic challenges that could influence the dietary habits of young adults beyond the prescribed ETL intervention. The general audience of interest as young adults is a broad categorization with subgroups engaged in various activities, living conditions, and circumstances. We acknowledge that those who attend college, work, or experience different living conditions will have varied capacities to implement dietary behavior changes. In addition, most of the participants in the included studies were female, and few studies reported demographic data such as socioeconomic status or racial and ethnic makeup, limiting the generalizability of the findings among young adults. This is a common problem in many studies that should be addressed when recruiting and sampling populations of interest in which health-related studies sample Caucasian females disproportionately, albeit unintentionally.^{21,59}

One more notable gap from the literature is that not all components of diet quality were represented, as overall diet quality is measured according to summary indexes that account for multiple aspects of the diet and their relationship to one another, such as the HEI-2015.⁵ Notably absent from this review was an assessment of ETL that address sodium, dairy, plant-based proteins, and refined grain intake. The diets of young adults are typically low in fruit and vegetables, plant-based protein, and dairy, whereas added sugar, refined grain, and sodium intake are all high, thus justifying their need to be assessed.⁶⁰

Limitations for this systematic review may include the inclusion criteria and operating definition for ETL

interventions, given the lack of consensus for how to best define a small-changes approach to health improvement, and a lack of scientific consensus means there may be a more valid way to capture this approach. Currently, a small-change approach to improving dietary intake is justified, but how to best implement it is limited by current data.^{29,30,49} ETL interventions are based largely on time required to learn and successfully perform a behavior, but this fails to identify studies that could address important personal factors that also impact diets, such as socioeconomic status, readiness to change, or education level. Although chosen on the basis of the results of a pilot search, the key terms we selected may have limited access to studies that fit this review's definition of an ETL intervention. Furthermore, given the limited number of studies available, all studies were included that met the criteria regardless of study power or quality.

IMPLICATIONS FOR RESEARCH AND PRACTICE

When discussing health promotion methods through the lens of simple behavior changes, researchers must carefully consider how they define this approach. Although it may not be possible to centralize a definition of simple behavior change, efforts can be made to clarify descriptions of what this practically looks like within the study. This review provides evidence for how changes in diet quality is achievable within young adult populations through the performance of at least 1 reportable behavior that requires minimal time to learn.

Additional efforts in future studies to recruit a more broadly diverse body of young adults may help increase the generalizability of findings, whether those participants are working, in college, or still assessing their course of life. Currently, most studies tend to oversample Caucasian females. Although there is some evidence from this review to demonstrate the effectiveness of an ETL intervention approach, there may be inherent shortcomings or barriers to

this approach when applied to specific populations.

Furthermore, although our review did not yield any discernible patterns in the use of theory and diet-related outcomes, designing an intervention that uses a theoretical framework is still encouraged. Interventions that incorporate theory are more likely to achieve significant results than those which do not.⁶¹ This review's focus on ETL interventions to improve diet quality is justified within health behavior theory, used to design numerous health interventions that yielded positive and sustained effects within their study population.⁶²

Each of the studies assessed a measure of diet quality, and with 1 exception, all captured additional data unrelated to dietary intake. The most assessed diet component was fruit and vegetable, with fat, added sugar, total protein, whole grain, and SSB intake also assessed. These are important components of diet quality, but as previously stated, there are additional elements of diet quality that need consideration, given their association with the diets of young adults and chronic disease risk, including refined grains, sodium, dairy, and plant-based proteins. It is also worth noting that interventions can be tailored to improve diet quality independent of weight outcomes, as only 3 studies within this review tracked the weight of the participants. Given the population of interest, this approach may be preferable for 2 reasons. First, there is evidence of benefit for interventions that deliberately ignore any emphasis or measure of weight loss, opting to promote diet quality through modification of dietary choices and behaviors.⁶³ Second, weight-centered approaches may increase the risk of developing eating disorders (EDs) among at-risk populations. Data indicate a higher-than-average prevalence of ED symptoms among young adults compared with the general population, and the average age of onset for various EDs range from 18.9 to 25.4 years.^{64,65}

We reiterate that small-scale and individualized efforts to promote healthy behavior change need not conflict or are at odds with large, structural changes to the food environment. There may be ways in

which small and large changes can mutually support one another. Cost-effective strategies that maximize positive outcomes from limited resources may need to be explored and developed.

In promoting population-level diet quality, data from this review indicate that ETL interventions can be counted as a tool that may effectively assist in this endeavor. What these interventions may lack in scale as currently designed, they may make up for in efficacy by empowering individuals to make changes despite setbacks or circumstances. There is no reason to suspect this ETL intervention approach would be at odds with or be detrimental to efforts on a broader and more systemically applied scale. Rather, it can be another tool in the pantheon of interventions that health care and public health professionals have to assist individuals in achieving more optimal health.

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