Research and Professional Briefs

Telephone Counseling Promotes Dietary Change in Healthy Adults: Results of a Pilot Trial

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ABSTRACT
Telephone counseling is increasingly reported to be an effective behavior change strategy, but more studies in broader populations are needed. This uncontrolled pilot trial investigated whether a 3-month/eight-call telephone counseling intervention could promote dietary changes associated with reduced chronic disease risk in adults consuming <5.0 servings of vegetables and fruits daily. Between 2002 and 2004, 97 adults (mean age 46 years; range 21 to 84 years) completed the intervention and a follow-up assessment at 6 months. Approximately half were of nonwhite ethnicity (53%). The majority were women (95%) and had never had cancer (89%). The intervention promoted daily intakes of three to five vegetable servings, two to four fruit servings, and three whole-grain and/or beans/legumes servings. Average total daily intake of vegetables, fruits, whole grains, beans/legumes, fiber, and fat were assessed at baseline and at 6 months, each by a set of three 24-hour recalls. Plasma carotenoids were measured on a subsample (n=41) as an objective biomarker of vegetable and fruit intake. Change in mean self-reported dietary intake (ie, vegetables, fruit, whole grains, beans/legumes, fiber, and fat) and plasma carotenoids were compared by paired *t* tests. The intervention was associated with a significant ($P<0.001$) increase in vegetable servings per day (baseline 2.1 servings per day, 6 months 3.5 servings per day; 67% increase), fruit servings per day (baseline 1.4 servings per day, 6 months 2.4 servings per day; 71% increase), and whole-grain and/or bean servings per day (baseline 1.0 serving per day, 6 months 1.4 servings per day; 40% increase). These changes were corroborated by a significant ($P<0.001$) increase in total plasma carotenoids. This 3-month/eight-call telephone counseling intervention was associated with dietary change in healthy adults consuming fewer than five servings per day of vegetables and fruit at study entry.
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There is strong scientific consensus that diet may help prevent and manage chronic diseases, including cancer, heart disease, hypertension, and diabetes (1-4). Despite public health campaigns, only about 40% of Americans are consuming an average of five or more servings of vegetables and fruits daily, and mean intakes of orange, dark green, cruciferous, and other nutrient-dense vegetables remain low, as do intakes of whole grains and beans (5,6).

Dietary interventions have successfully used telephone counseling to improve dietary intake, with most programs targeting goals, including increased intakes of vegetables, fruits, and fiber and decreased fat intake (2,7). Telephone-based interventions can enhance health promotion messages, relapse prevention treatments, and clinical advice, especially for people with limited access to medical services, according to several studies (2,8-10). A recent review reported that longer-term interventions (6 to 12 months) with a greater number of calls were generally more successful at changing dietary intake than shorter interventions with fewer calls (7).

Although evidence is mounting that telephone counseling may be a cost-effective and efficient way to change dietary intake in intervention studies, it is not yet clear whether this counseling method can be effective in real world settings across broad segments of the population. And no study has yet rigorously explored the relationship between number of calls and dietary change.

The Cancer Prevention research team at the University of California, San Diego, has demonstrated that telephone counseling promoted significant changes in dietary intakes, primarily among female cancer survivors (11-14). The purpose of our study was to test the effectiveness of a shortened version of this program in a healthy population of men and women (from the University of California, San Diego, Healthy Eating Program). Under the direction of a registered dietitian, experienced dietary counselors delivered a 3-month intervention that targeted increased intakes of vegetables, fruits, whole grains, and beans. It was hypothesized that consumption of the targeted foods would be significantly greater at 6 months compared to baseline intakes, and that plasma carotenoid concentrations would corroborate self-reported vegetable and fruit intake, as observed in a similar intervention (15).

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METHODS

Study Population

Participants in the Healthy Eating Program were recruited during 2002 and 2003 at American Cancer Society events and services, and through an Avon Foundation outreach program. The study enrolled 343 adults who completed a set of three 24-hour dietary recalls at baseline. Participants reporting fewer than 5.0 daily servings of fruits and vegetables (47%; N=161) were offered dietary telephone counseling if they were able to communicate in English and not currently undergoing cancer treatment or on a prescribed diet that limited fruit and vegetable intake. Of the 133 participants who began counseling, 97 completed both the counseling intervention and the follow-up 6-month dietary recalls (63% retention); and 41 of these also provided both baseline and 6-month blood samples for carotenoid analysis. Participants' mean age was 46 years (range 21 to 84 years); approximately half were of nonwhite ethnicity (53%); and the majority were women (95%) and had never had cancer (89%). The Institutional Review Board at the University of California, San Diego, approved the protocol, and all participants provided informed consent.

Dietary Targets. The intervention encouraged a dietary pattern that included three to five vegetable servings per day, two to four fruit servings per day, and three whole-grain and/or bean/legume servings per day. To maximize intake of protective nutrients and phytochemicals, participants did not count fruit juice, iceberg lettuce, and white potatoes as fruit and vegetable servings. Counselors recommended at least one serving per day each of bold (ie, big color and strong flavor) vegetables and fruits, because these tend to be good sources of protective phytochemicals (13). Bold vegetables included allium, cruciferous, dark green leafy, orange, tomato, and 100% vegetable juice. Bold fruit included berries, citrus, melon, and other orange-colored fruit. Beans/legumes included all cooked dried beans, lentils, peas, but not soy or soy products because they are often low in fiber. Within the context of these dietary targets, counselors guided participants to obtain adequate intakes of essential nutrients.

Telephone Counseling Intervention

Experienced dietary counselors supervised by a registered dietitian delivered the intervention, which consisted of eight calls over 3 months. Call length ranged from 25 to 50 minutes, with calls more frequent and of longer duration during the early phases of counseling. Training and quality assurance protocols have been published previously (13,16). The intervention was based on Social Cognitive Theory (17) and facilitated one-on-one advice tailored to the needs of each participant. Counselors used motivational interviewing techniques (18) to activate participants' self-regulatory skills and help them set short-term goals, self-monitor, and evaluate performances in a way that built self-efficacy.

The telephone counseling intervention was a condensed version of the Women's Healthy Eating and Living Study stepwise, three-phase protocol, which averaged about 31 calls over 4 years, compared to eight calls over 3 months in our intervention. Also, the Women's Healthy Eating and Living Study had five dietary targets, whereas our study had only three. More details on the Women's Healthy Eating and Living Study counseling protocol and the dietary change achieved have been published elsewhere (13,16).

As in the Women's Healthy Eating and Living Study, a highly structured computer-assisted protocol helped standardize the intervention, and quality control was enhanced by providing the counseling from a centralized location, thus enabling weekly case management meetings and considerable flexibility in scheduling calls to accommodate participants' needs. Counselor performance was monitored and regular feedback provided. Eligible participants were assigned a dietary counselor and mailed a Participant Notebook that included strategies to achieve the dietary targets, reference tools to help participants estimate intakes of targeted foods, recipes, and articles about diet and cancer.

Phase 1 counseling (four calls every 3 to 4 days) focused on education and the rapid development of self-efficacy, and helped the participant set realistic short-term goals. The counselor analyzed self-reported dietary intake interactively using dietary analysis software (The Food Processor for Windows, versions 7.8 to 8.2, 2001-2003, ESHA Research, Salem, OR) to help the participant evaluate performance.

Phase 2 (three calls at <10-day intervals) was less intensive and involved overcoming barriers to adopting the dietary pattern. Counselor-suggested changes to the participant's food environment included modifying household foods, recipes, cooking techniques, and portion sizes. Participants monitored their performance regularly and counselors encouraged goal setting and review using a study-specific Weekly Food Checklist.

Phase 3 (one call) served as a booster session, where the counselor provided feedback to help the participant maintain the study targets.

Dietary Assessment

The study assessed dietary intake at baseline and 6 months each from a set of three 24-hour recalls and plasma carotenoid analysis on a subsample. Trained assessors conducted the recalls via telephone on randomly selected days that were stratified for weekend vs weekdays over a 3-week period using the multipass recall protocol of the Nutrition Data System for Research (Food and Nutrient Database 32, version 4.04, 2001, Nutrition Coordinating Center, University of Minnesota, Minneapolis). Details of quality control measures and dietary assessment methodology are presented elsewhere (12,16).

Servings of vegetables, fruits, whole grains, and beans (legumes) were quantified using software developed by the Cancer Prevention Program at the Moores University of California, San Diego, Cancer Center (14). A serving was defined as ½ c cut-up fresh or cooked fruit or vegetables, 6 fl oz 100% fruit or vegetable juice, ¼ c dried fruit, 1 medium piece fresh fruit, 1 c raw leafy green vegetables or melon, or equivalent amounts provided by multi-ingredient dishes. A serving of whole grains was defined as 1 slice of whole-grain bread, ¾ c dry whole-grain cereal, ½ c cooked whole-grain cereal, rice, or pasta. A serving of beans (legumes) was defined as ½ c cooked dried beans, lentils, or peas.

Dietary factor	Baseline	6 Mo	% change	*P* value
	← *mean±standard deviation* →			
Total vegetable[a] (servings/d)	2.1±0.8	3.5±1.6	+67	<0.0001
Total targeted vegetables (servings/d)	1.7±0.8	3.1±1.5	+82	<0.0001
Total bold vegetables[b] (servings/d)	1.2±0.7	2.2±1.2	+83	<0.0001
Other vegetables (servings/d)	0.5±0.4	0.8±0.7	+60	<0.0001
Vegetables not targeted[c] (servings/d)	0.5±0.4	0.4±0.5	−20	0.59
Total fruit[d] (servings/d)	1.4±0.9	2.4±1.5	+71	<0.0001
Total targeted fruit (servings/d)	1.1±0.8	2.1±1.4	+91	<0.0001
Total bold fruit[e] (servings/d)	0.3±0.5	0.8±0.9	+167	<0.0001
Other fruit (servings/d)	0.7±0.8	1.3±1.1	+86	<0.0001
Fruit not targeted[f] (servings/d)	0.4±0.5	0.3±0.4	−25	0.25
Whole grain+beans (servings/d)	1.0±1.0	1.4±1.0	+40	0.002
Whole grain (servings/d)	0.8±0.9	1.2±0.9	+50	0.01
Beans/legumes[g] (servings/d)	0.2±0.3	0.3±0.4	+50	0.07
Fiber (g/d)	14.1±4.5	18.7±6.5	+33	<0.0001
Fiber (g/1,000 kcal/d)	9.0±2.7	12.5±3.7	+39	<0.0001
Energy (kcal/d)	1,609±447	1,530±436	−5	0.07
% Energy from fat	34.0±7.4	32.2±8.2	−5	0.04

Table 1. Dietary intakes among Healthy Eating Program participants who completed baseline and 6-month assessments (N=95)

[a]Total vegetable servings include iceberg lettuce and white potatoes.
[b]Bold vegetables include allium, cruciferous, dark green, orange, tomato, and 100% vegetable juice.
[c]Vegetables not targeted included lettuce and potatoes.
[d]Total fruit servings include fruit juice.
[e]Bold fruits include berries, citrus, melon, orange/high-carotenoid.
[f]Fruit not targeted included fruit juice.
[g]Beans/legumes include dried beans, lentils, and peas, but not soy or soy products.

Measurement of Plasma Carotenoids

Fasting blood samples were collected on a subsample (n=41) at baseline and 6 months. This subsample was similar in age to participants who did not give blood, but differed in sex (100% women vs 95%), race/ethnicity (74% nonwhite vs 53%), and cancer history (100% no cancer history vs 84%). Blood samples were separated and quantified with a Varian Star 9010, 9050 system (Varian Analytical Instruments, Walnut Creek, CA) as previously described (16), then analyzed for concentrations of beta carotene, α-carotene, lutein/zeaxanthin, lycopene, and β-cryptoxanthin.

Statistical Methods

Change in mean self-reported intake of vegetables, fruits, whole grains, and beans/legumes (servings per day), as well as in energy (kilocalories per day), fiber (grams per day), energy-adjusted fiber (grams per 1,000 kcal), and fat (as percent of energy) were compared by paired t tests. Change in plasma α-carotene, beta carotene, lutein, lycopene, and β-cryptoxanthin were also compared by paired t tests, as was the combined total of α-carotene, beta carotene, and lutein.

RESULTS AND DISCUSSION

Data are reported for 95 of the 97 participants who completed both baseline and 6-month dietary assessments and the counseling intervention (two participants who reported an average energy intake <750 kcal/day were excluded). Those who completed all study phases were similar to those who did not in most demographic variables (eg, ethnicity, sex, and cancer history), as well as in their baseline diet (eg, vegetables, whole grains, beans, and percent of energy from fat). However, the completers did consume significantly more fiber at baseline (14.0 g vs 11.9 g), and they were significantly older (46 vs 40 years).

Intake of targeted foods increased significantly from baseline to 6 months (Table 1) as follows: vegetables (67%), fruit (71%), bold vegetables (83%), bold fruit (167%), whole grains (50%), and beans/legumes (50%), whereas intakes of the less nutrient-dense iceberg lettuce, white potatoes, and fruit juice decreased, although not significantly. Although the intervention did not specifically target fat or fiber, it was hypothesized that the intervention diet would influence these variables. As expected, fiber intake increased by 33% and fat intake decreased by 5%.

This change in self-reported dietary intake was validated by increases in plasma carotenoid concentrations (Table 2), which are considered objective biomarkers of vegetable and fruit intake (19,20). Plasma concentrations of all carotenoids (except lycopene) assessed in the subsample (n=41) increased: α-carotene (24%); beta carotene (29%), lutein (13%); and beta-crytoxanthin (10%). The combined total of plasma α-carotene, beta carotene, and lutein increased significantly (P<0.004). In addition to corroborating dietary intake, carotenoid concentrations may be an indicator of disease risk. α-Carotene, beta carotene, and lutein are of particular interest, because low intakes of these carotenoids may be associated with increased risk of breast cancer (21). Recently published

Table 2. Plasma and dietary carotenoids in a subsample (n=41) of Healthy Eating Program participants

Carotenoid	Plasma				Diet			
	Baseline μmol/L	6 Mo μmol/L	% change	*P* value	Baseline μg/d	6 Mo μg/d	% change	*P* value
α-Carotene	0.085	0.105	+24	0.08	366	620	+69	0.10
Beta carotene	0.389	0.500	+29	0.02	2,216	3,397	+53	0.01
Lutein	0.372	0.420	+13	0.05	1,912	3,162	+65	0.001
Lycopene	0.862	0.808	−6	0.23	3,628	7,228	+99	0.02
β-cryptoxanthin	0.174	0.191	+10	0.47	77	132	+71	0.003
α-Carotene+beta carotene+lutein	0.846	1.024	+21	0.004	4,484	7,179	+60	0.001
Total carotenoids[a]	1.883	2.025	+8	0.14	8,198	14,538	+77	0.001

[a]α-Carotene+beta carotene+lutein+lycopene+β-cryptoxanthin.

baseline data from the Women's Healthy Eating and Living Study also indicates that higher levels of plasma carotenoids are associated with a lower risk of recurrence in breast cancer survivors (22).

These results suggest that a 3-month individualized telephone counseling intervention implemented by trained counselors can substantially improve dietary patterns among adults consuming less than five servings/day of vegetables and fruit. This intervention was effective in individuals of mixed ethnic background (approximately half nonwhite). Other strengths include the standardized procedures for dietary assessment, quality assurance methods applied to counseling and assessment, and an objective measure of dietary adherence (carotenoid concentrations).

Since study completion, the recommended intake of vegetables and fruits has increased from five servings per day (23,24) to five to nine servings per day, emphasizing colorful vegetables (ie, bold dark green leafy and yellow-orange), whole grains, and beans (1), as new research suggests that specific vegetables and fruits may reduce risk for chronic diseases (25). This intervention encouraged consumption of these nutrient-dense (ie, bold) vegetables and fruits rich in protective phytochemicals. The increased intakes of vegetables and fruits observed among healthy adults (1.8 servings per day) in this study were higher than in other published studies using telephone interventions in adults without chronic disease (2).

Study limitations include the lack of a matched control group and the reliance on self-reported dietary data; however, self-reported dietary changes were validated with concurrent changes in dietary biomarkers. The study population limits the generalizability of findings, which might not apply to a younger population or to the broader general United States population; also, those who volunteer to participate in a nutrition study may be differentially responsive to these intervention efforts. This study did not assess long-term adherence. Further research and longer-term studies testing these strategies in a controlled clinical trial will help address some of these limitations.

CONCLUSIONS

Individualized telephone-based dietary counseling was associated with increased vegetable, fruit, whole-grain, bean, and fiber intake, and decreased fat intake, a dietary pattern consistently associated with reduced risk for chronic disease. These results suggest that experienced counselors under the direction of a registered dietitian can facilitate dietary change in healthy adults. Further study will help determine whether volunteer counselors with less training and experience working in community agencies like the American Cancer Society can effectively deliver this intervention.

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