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Changing the Tide: An Internet/Video Exercise and Low Fat Diet Intervention with Middle School Students

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Abstract: The rising tide of obesity erodes the health of youths and many times results in adult obesity. The purpose of this investigation was to examine the effectiveness of an eight-session health promotion/transtheoretical model Internet/video-delivered intervention to increase physical activity and reduce dietary fat among low-income, culturally diverse, seventh-grade students. Those who completed more than half the sessions increased exercise, $t(103) = -1.99$, $p = .05$, and decreased the percentage of dietary fat, $t(87) = 2.73$, $p = .008$. Responses to the intervention by stage of change, race, and income are examined.

1. Introduction

Poor diet, obesity, and inactivity result in more than 300,000 preventable deaths per year and chronic disease accounts for 60% of medical care expenditures in the United States (National Center for Disease Prevention and Health Promotion, 2001). When compared with early adolescents in other countries, those in the United States exercise less frequently and have less healthy diets (World Health Organization, 2000). Patterns established during middle-school years are important in the development of adult health-related habits (Leger & Nutbeam, 2000).

Nearly half of American youths aged 12–21 years lack vigorous activity on a regular basis. Inactivity is more common among young women (14%) than young men (7%) and among Black women (21%) than White women (12%). Participation in all types of physical activity declines strikingly as age or grade in school increases (National Center for Disease Prevention and Health Promotion, 2001).

Extensive reviews (Contento et al., 1995 and Kennedy, 1998) of research on the effectiveness of nutrition education revealed many studies in which nutrition knowledge and attitudes of children were improved. School-based interventions were more effective than interventions conducted outside the school setting (Contento et al.,

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1995). Harrell, McMurray, Gansky, Bangdiwala, and Bradley (1999) demonstrated population-based approaches in schools are as effective as intervening with those at most risk for cardiovascular disease. Dietz and Gortmaker (2001) identified the great impact of school-based approaches, which is important, given the increasing prevalence of problems that can be prevented with improved nutrition and exercise and does not further stigmatize those who are obese.

Prior studies have demonstrated the usefulness of health promotion/transtheoretical model (HP/TM) constructs in predicting dietary fat intake among low-income, culturally diverse, middle-school students (Frenn & Malin, 2003 and Frenn et al., 2003). The HP/TM constructs guiding intervention development (shown in Fig. 1) included (a) increasing benefits/decreasing barriers to change, (b) fostering access to healthy foods and opportunities for physical activity, (c) stage-tailored feedback, emphasizing consciousness-raising (e.g., reading food labels) and self-reevaluation (analyzing fat grams in previous daily intake), and (d) building self-efficacy by modeling refusal of junk food and substituting activity for sedentary behavior with friends. A four-session classroom-based intervention using the HP/TM resulted in significant decreases in dietary fat intake and increases in physical activity as did a four-session Internet/video delivery of the intervention (Frenn et al., 2003 and Frenn et al., 2003). Although reduced significantly compared with the control groups in these studies with similar low-income, culturally diverse, middle-school students, dietary fat intake was not reduced to *Healthy People 2010*-recommended levels of 30% of total calories. Subjects' dietary fat was reduced with each additional module in which they participated, suggesting that additional modules might help them achieve that goal.

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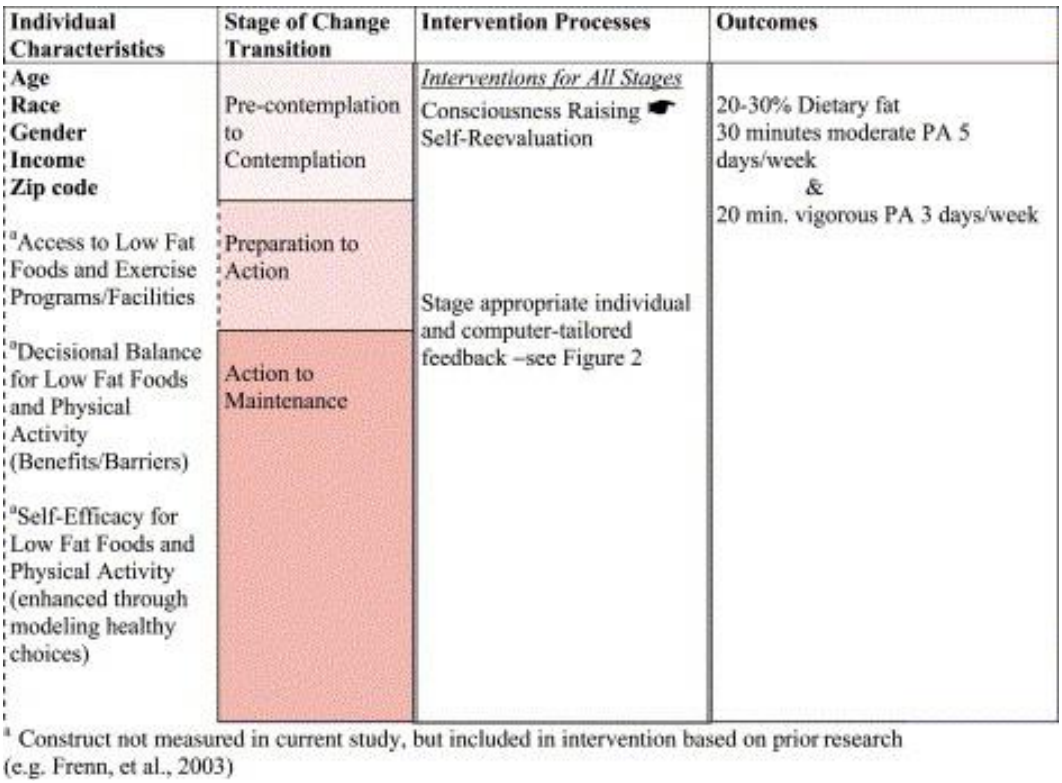

Fig. 1. The HP/TM guiding physical activity and low-fat diet intervention.

The purpose of this study was to examine the effectiveness of an eight-session HP/TM model Internet/video-delivered intervention to increase physical activity and reduce dietary fat among low-income, culturally diverse, seventh-grade students.

We hypothesized that subjects participating in more than half the intervention sessions would have (1) significantly ($p < .05$) higher physical activity and (2) significantly ($p < .05$) lower dietary fat intake as compared with those in the control group.

2. Methods

Following approval for protection of human subjects, the project was described and a consent form (in English and Spanish) sent home with students. A $1 school bookstore coupon was given for returned signed consent regardless of answer and a $2 coupon was awarded for completion of pre- and posttest data. A quasi-experimental design was used with subjects assigned to the intervention or control group based on classroom assignment to prevent diffusion of the intervention to the

control group. The intervention was conducted over a 1-month period. Pre- and posttest data were collected in both groups within 1 week before and upon intervention completion.

2.1. Setting and sample

The study was conducted in a Midwestern urban public middle school. A total of 178 seventh-grade students in six classes were invited to participate. Parental consent forms were printed with English on one side and Spanish on the reverse. The response rate was 77% with 46 students not returning a consent form. The total sample with pre- and posttest data on the dependent variables included 103 students for a 77% retention rate. The demographics of the sample are detailed in Table 1. There were no significant ($p < .05$) pretest differences between groups in age, sex, race, or free-lunch status. All students were able to read, write, and speak English, so the intervention was delivered in English.

Table 1. Demographic characteristics for intervention and control groups

Demographic	Characteristic	Intervention: frequency/valid (%)		Control: frequency/valid (%)	
		Diet[a]	Activity[b]	Diet	Activity
Income	Free lunch	**30** (4)/**75.0** (66.7)	**31** (9)/**72.1** (75.0)	35/71.4	42/70.0
	Reduced	**5** (0)/**12.5** (0)	**6** (1)/**14.0** (8.3)	6/12.2	8/13.3
	No reduction	**5** (2)/**12.5** (33.3)	**6** (2)/**14.0** (16.7)	8/16.0	10/16.7
Sex	Male	**12** (2)/**30.0** (33.3)	**14** (4)/**26.3** (33.3)	22/44.9	30/50.0
	Female	**28** (4)/**70.0** (66.7)	**29** (8)/**73.7** (66.7)	27/55.1	30/50.0
Age	12	**18** (3)/**45.0** (50.0)	**22** (6)/**51.2** (25.0)	25/51.0	28/46.7
	13	**17** (1)/**42.5** (16.7)	**16** (3)/**37.2** (50.0)	17/34.7	25/41.7
	14	**5** (2)/**12.5** (33.3)	**5** (2)/**11.6** (25.0)	7/14.3	7/11.7
Race	Asian	**0** (0)/**0** (0)	**0** (0)/**0** (0)	2/4.1	3/5.0
	Black	**8** (3)/**20.0** (50.0)	**9** (4)/**20.9** (33.3)	15/30.6	16/26.7
	Hispanic	**22** (1)/**55.0** (16.7)	**23** (5)/**53.3** (41.7)	17/34.7	24/40.0
	Native American	**1** (0)/**2.5** (0)	**0** (1)/**0** (8.3)	4/8.2	4/6.5
	White	**5** (0)/**12.5** (0)	**4** (1)/**9.3** (8.3)	4/8.2	4/8.9

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Demographic	Characteristic	Intervention: frequency/valid (%)		Control: frequency/valid (%)	
		Diet[a]	Activity[b]	Diet	Activity
	Other	**4** (2)/**10.0** (33.3)	**7** (1)/**16.3** (8.3)	7/14.3	9/15.0

[a]Values in boldface represent more than three sessions for diet. Values in parentheses represent less than three sessions for diet.
[b]Values in boldface represent more than two sessions for activity. Values in parentheses represent less than two sessions for activity.

2.2. Intervention

The intervention was based on the HP/TM, which was previously described and tested in a classroom format (Frenn, Malin, & Bansal, 2003) and in a four-session Internet/video format (Frenn, Malin, Bansal, Delgado, et al., 2003). In the current study, an eight-session Blackboard (http://www.blackboard.com/) platform-delivered Internet approach with four 2- to 3-min videos was used in seventh-grade science class. The intervention was conducted in a computer laboratory where each student had a computer (see Fig. 1 for the HP/TM and Table 2 for concept integration and a description of each session). As in our prior studies (Frenn et al., 2003 and Frenn et al., 2003), the focus of the intervention was on strategies appropriate for all stages of change, particularly for those in precontemplation and contemplation stages. According to the transtheoretical model (Prochaska, DiClemente, & Norcross, 1992), strategies appropriate across stages, and especially to the early stages of change (precontemplation and contemplation), include consciousness raising and self-reevaluation. Strategies for later stages (preparation, action, and maintenance) would be inappropriate for those in precontemplation and contemplation stages, so were not included in the intervention designed for the whole class. Computer-generated tailored feedback based on stage of change was provided to individual subjects for both physical activity and dietary fat (see Fig. 1 for a review of stages and feedback).

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Table 2. Schematic of concept integration in sessions for students in all stages of change

Concept	Sessions	
	Internet (40 min)	**Video (2.5–3 min)**
Consciousness raising[a]	1, 2, 5, 6, and 7	1 and 2
Self-reevaluation[a]	1, 5, and 6	1 and 2
Improve access to healthy foods and physical activity[b]	3, 4, and 7	3 and 4
Decisional balance[b]	3, 4, 5, and 8	3 and 4
♦ Reduce barriers to healthy foods and physical activity		
♦ Emphasize benefits for healthy foods and physical activity		

Sessions 1–4 have been previously detailed (Frenn, Malin, & Bansal, 2003). The additional modules tested with sessions 1–4 in this study are described below.

New sessions tested in current study (see Frenn, Malin, & Bansal, 2003, for a description of previously tested sessions and videos):

Session 5: This session involves students in preparing "on-line" healthy snacks. This session was designed to help students overcome barriers to eating healthy foods that they may not have realized they like and can prepare themselves. Discussion of ingredients and sharing of recipes that students can share with their families was designed to promote access to healthy alternatives. Not knowing how to prepare fruits and vegetables is a barrier for adolescents in including these foods in their diet (Baranowski, Cullen, & Baranowski, 1999).

Session 6: The focus of this session was raising awareness of the need for food early in the day. Night-eating syndrome, in which 50% or more of daily calories are eaten after 7 p.m., has been associated with obesity (Aronoff, Geliebter, & Zammit, 2001). Eating breakfast is also associated with improved cognition and school attendance (Pollitt, & Mathews, 1998). A game format was used to where students reviewed benefits and barriers and selected food at various times in the day to eat healthy.

Session 7: Consciousness raising includes participation in choosing activities. The focus was on activities that are accessible and possible to perform safely outside school so as to promote self-awareness of lifelong opportunities for physical activity and the amount of calories burned while doing the activity for 5 min.

Session 8: This session focuses on balancing calories eaten with calories burned through various types of exercise. Students were asked how much they watch television and to consider benefits and barriers to doing something active rather than watch television. Gortmaker et al. (1999) found that television time mediated the intervention effect in that each hour reduction in television viewing was independently associated with better reduction in obesity. As a synthesis of what they have learned, students chose foods for meals and a snack interactively on the computer to balance their calories with those burned, while selecting from the food pyramid.

For all sessions, students were given tailored, stage-matched feedback structured from our pilot work (see Fig. 2 for examples; Frenn & Malin, 2003, Frenn et al., 2003 and Frenn et al., 2003).

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[a]Appropriate for students in all stages of change, but especially important in precontemplation and contemplation, hence, were the primary processes of change used for class sessions in which all students participated.
[b]Concept was not measured in current study but included based on prior research (Frenn, Malin, Bansal, Delgado, et al., 2003).

Our prior studies (Frenn et al., 2003 and Frenn et al., 2003) had shown significant improvement for dietary fat and physical activity in response to the four-session intervention, but dietary fat was not reduced to the 30% of calories recommended in *Healthy People 2010*. The current intervention included two additional sessions (five total sessions on dietary fat reduction). These sessions focused on raising awareness of ways to reduce dietary fat by eating more vegetables and fruit, eating breakfast and lunch, and choosing snacks wisely.

Participants were asked to evaluate their own behavior in regard to the recommendations and record these responses in a workbook provided and in an on-line discussion board.

Similarly, two additional sessions were added (total of three), which were focused on consciousness raising and self-reevaluation for physical activity. Prior research had demonstrated that use of a peer-led gym session increased physical activity in comparison to the single physical activity Internet session and video (Frenn, Malin, Bansal, Delgado, et al., 2003), and we sought to discover if additional Internet sessions might yield similar improvements in activity. We sough to discover whether the previous improvement had been a result of the additional session rather than the peer interaction.

Based on subjects' responses to the first four sessions in prior research (Frenn, Malin, Bansal, Delgado, et al., 2003), tailored computer-delivered feedback was generated for common subject responses (Fig. 2). Subjects selected from response options and were given computer-generated feedback appropriate to the selection. Individualized feedback was given via private e-mail for a 1-day food recall in the first session as well as responses for the additional four sessions. DiClemente, Marinilli, Singh, and Bellino (2001) describe individualized feedback as that wherein unstructured responses can be accepted and multiple personal characteristics are used to construct feedback, whereas tailored feedback is structured based on a known characteristic. In total, subjects were asked to respond to 16 radio

buttons with HP/TM-tailored computer-generated feedback and to type 10 discussion board answers for which individualized e-mailed feedback was given. They were provided a structured workbook in which to record their notes as they prepared to enter a response on-line. The workbook included an evaluation of the helpfulness of that particular session and the Internet sites provided with it that students were invited to visit on completion of each module. Each session lasted a class period (40 min).

Q Do you exercise regularly (at least 5 times a week for 30 minutes including Vigorous activity 3 times a week for 20 minutes)?	**Stage tailored Feedback – Physical Activity**
You answered: A. Yes, I have been for MORE than 6 months **(Maintenance Stage of Change)**	Congratulations you are a role model for your class!
You answered: B. Yes, I have been for LESS than 6 months **(Action Stage of Change)**	Hurray, you are on your way!
You answered C. No, but I plan to in the next 30 days. **(Preparation Stage of Change)**	A definite date and a plan mean you are on your way to healthy exercise!
You answered: D. No, but I plan to in the next 6 months. **(Contemplation Stage of Change)**	Thinking about being active is the first step in getting there – be a specific as you can about what you can start and WHEN!
You answered: E. No, and I do NOT plan to in the next 6 months. **(Pre-Contemplation Stage of Change)**	Think about some benefits of being active. We know you can!
Q Are you willing to do ALL 5 of the things to the right to eat healthy? **OFTEN** eat low fat snacks instead of high fat ones **ALMOST ALWAYS** eat pizza without meat or extra cheese **OFTEN** use low fat or no dressing on salads **SOMETIMES** avoid eating at fast food restaurants **OFTEN** use low fat margarine or no butter on bread products	**Stage tailored Feedback – Dietary Fat**
You answered: A. NO, and I do NOT intend to in the next 6 months. **(Pre-Contemplation Stage of Change)**	Think about some benefits of healthy eating.
You answered: B. YES, and I intend to in the next 6 months. **(Contemplation Stage of Change)**	Thinking about changing is the first step in getting there!
You answered: C. YES, and I intend to in the next 30 days. **(Preparation Stage of Change)**	A definite date to start with a plan means you are on your way to healthier eating!
You answered: D. YES, and I have been, but for LESS than 6 months. **(Action Stage of Change)**	Hurray, you are a success! Keep at it!!
You answered: E. YES, and I have been for MORE than 6 months. **(Maintenance Stage of Change)**	Congratulations! You can be a role model for your class!

Fig. 2. Example of computer-generated stage-tailored feedback.

The control group was comprised of three seventh-grade science classes who had their usual assignments. The intervention and control

group students were in separate academic units within the same school, which prevented transfer of intervention information to the control group. The intervention was password protected, and e-mail responses were collected on floppy disks that were secured at the end of each class session to protect privacy of information as well as further prevent diffusion of intervention effects. An assumption of the intervention protocol, based on prior research (Frenn & Malin, 2003, Frenn et al., 2003 and Frenn et al., 2003), was that the HP/TM approach was essential to foster behavior change. Only intervention group students were exposed to the HP/TM during their participation in the modules.

2.3. Measures

Staging questions were used, except that anchors such as "at the beginning of the school year" were given to help students think about how much fat they were eating 6 months ago (Frenn & Malin, 2003, Frenn et al., 2003 and Frenn et al., 2003). The dietary fat staging instrument included seven items. The first item included a 5-option Likert scale regarding intention to avoid eating high-fat food in the next 6 months. The next 5 items included yes/no options regarding selected high- and low-fat foods consumed. The seventh item was the staging question used for analysis: Subjects reported the length of time they had been eating low-fat foods or when they intended to start. Six subjects whose responses put them in the action or maintenance stages of change were restaged to precontemplation because their fat intake exceeded 30% as previously described (Frenn & Malin, 2003, Frenn et al., 2003 and Frenn et al., 2003).

The exercise staging question was a single item as in prior studies (Frenn & Malin, 2003, Frenn et al., 2003 and Frenn et al., 2003). Subjects describing themselves in the action or maintenance stages of change who did not have at least 90 min of exercise recorded in total for the 3 days would have been restaged to precontemplation, but no cases meeting this criterion were present in the sample.

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2.3.1. Outcome measures

The Child and Adolescent Activity Log was used to collect the physical activity data. This 22-item daily log of activities engaged in by youth required that subjects circle the number of minutes they spent the previous day in each activity. Subjects completed the logs for Sunday, Monday, and Tuesday pre- and posttest. The Child and Adolescent Activity Log (Garcia et al., 1995) was previously found to correlate with fitness as measured by sit-ups, push-ups, and post-step-test heart rate (*p* values ranged from .001 to .05 depending on test and season). Test–retest *r* during a 50-min period was .94. These have been deemed adequate estimates of reliability and validity for similar instruments measuring activity (Sallis & Saelens, 2000). The intensity of each activity was multiplied by the number of minutes to calculate mild-, moderate-, and vigorous-intensity activities (Garcia et al., 1995). Moderate and vigorous activities were summed, and pretest scores were subtracted from posttest scores to create this dependent variable. A positive difference score for activity indicates the desired intervention effect.

The Food Habits Questionnaire (FHQ) was used to measure percentage dietary fat as in prior studies (Frenn & Malin, 2003, Frenn et al., 2003 and Frenn et al., 2003). This instrument includes a 21-item series of questions about frequency of consumption of high- and low-fat foods with a 5-option response format. Low-fat items were reverse scored and an algorithm used to calculate percentage of fat, such that the resulting total score indicated percentage of fat in food consumed during the last month. The FHQ has been found to classify 93% of adult subjects in one sample and 87% of subjects in a second sample consuming more than 30% of calories from fat and was determined to be a satisfactorily specific measure for the current study. Although there is lack of precision in dietary intake measurement, low-middle-income, urban, sixth- and seventh-grade students have been shown to be able to provide valid estimates of their food intake. The FHQ has been found to be a better measure of fat-reducing behaviors and correlate better with stage of change than the Food Frequency Questionnaire among adult populations. The FHQ was previously used in ethnically diverse, middle school-aged populations (Frenn & Malin, 2003, Frenn et al., 2003 and Frenn et al., 2003). An algorithm was used to calculate percentage dietary fat from

responses on the FHQ. A higher number indicated a higher percentage dietary fat. The pretest percentage dietary fat was subtracted from the posttest percentage to create a difference score for analysis as the dependent variable. A negative difference score for percentage dietary fat and a posttest score below 30% of calories from fat indicated the desired intervention effect.

2.3.2. Measure of participation in the intervention

As in our prior work (Frenn, Malin, Bansal, Delgado, et al., 2003), we did not wish to make a Type III error in which the study outcomes are evaluated based on the number of interventions delivered, rather than the number in which subjects actually participated. For that reason, subjects were asked to respond to questions in each module by recording their answers in notebooks provided and on-line. Subject responses were tallied on completion of the study to determine their level of participation. Those subjects who completed more than half the intervention modules (as indicated by notebook or on-line responses) were included in the intervention group (more than three sessions for diet and more than two sessions for activity) and those in the classes not receiving the intervention comprised the control group for analysis.

2.4. Analyses

Data were examined for accuracy and implausible values were removed from the analysis (e.g., two subjects who circled more minutes of activity than possible in 1 day). *t* Tests for independent samples were used to examine groups on pretest. General linear model analyses, recommended for repeated measures designs with more than one dependent variable, could not be used to examine activity and diet behaviors simultaneously with stage of change transition and demographic variables given that subjects who completed half of the activity sessions did not necessarily complete half of the diet sessions, so *t* tests were used. Descriptive analyses are shown graphically by race and stage of change.

3. Results

3.1. Hypothesis 1: Physical activity

No significant differences ($p < .05$) were found in demographic, stage of change, or outcome variables on pretest. Of the initial 137 subjects, 60 were included in the control condition and 43 in the intervention condition with complete data on pre- and posttest for physical activity. Intervention classroom students ($n = 12$) who did not complete at least half the exercise sessions were not included in the subsequent analyses, although their change in activity was not significantly different from the control group students, $t(13) = 1.53$, $p = .15$. Intervention students who completed more than half of sessions increased moderate/vigorous exercise by an average of 22 min, compared with a decrease of 46 min for the control group, $t(103) = -1.99$, $p = .05$. Those who completed all three sessions ($n = 39$) increased activity by 33 min.

3.2. Hypothesis 2: Dietary fat

For the dietary fat data, 49 subjects were in the control group. In the intervention group, 40 subjects received more than half the nutrition modules; 6 participated in less than half the sessions and were removed from analysis. Those participating more than half the sessions decreased percentage of dietary fat from 30.7 to 29.9, $t(87) = 2.73$, $p = .008$, whereas those in the control had 31.5% dietary fat on pretest and 31.6% on posttest. Those participating in less than half the diet sessions were not significantly different than students in the control group classes, $t(16.6) = -1.843$, $p = .08$.

Intervention effectiveness for subjects with the lowest income (eligible for free lunch) in various races are displayed graphically in Fig. 3 and Fig. 4. For those participating in more than half the activity sessions, moderate and vigorous activity were increased for all racial groups, whereas activity decreased in each racial group for those in the control group. Dietary fat was decreased across all racial groups participating in more than half the sessions, whereas it increased for African Americans and Hispanics and decreased less for Whites in the control condition.

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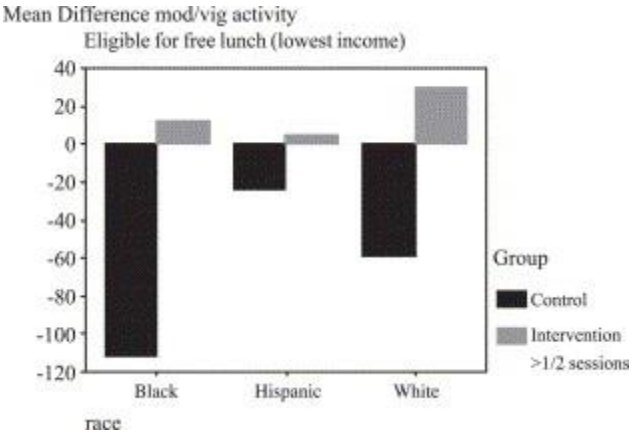

Fig. 3. Comparative change in moderate/vigorous for activity intervention and control groups among lowest income by race.

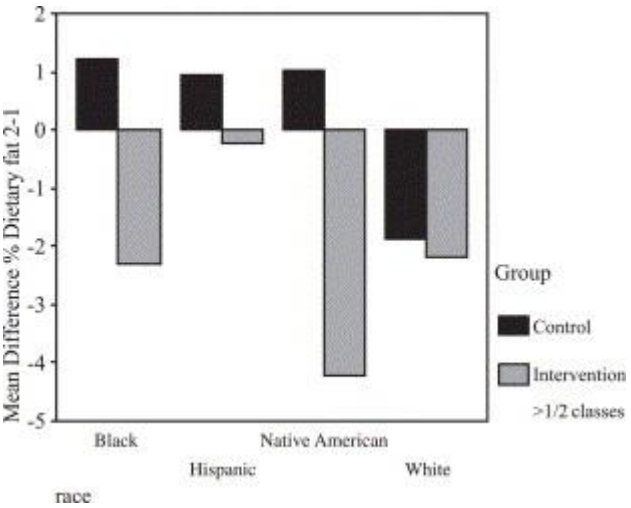

Fig. 4. Change in percentage dietary fat intervention and control groups by race.

Pre- and posttest activity and dietary fat for subjects in each stage of change (for those completing half or more of the intervention) are shown in Fig. 5 and Fig. 6. Tailoring appeared to be effective for all stages except for those in preparation for physical activity.

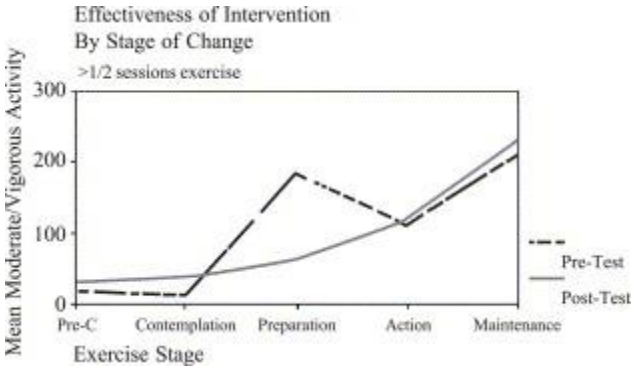

Fig. 5. Changes in activity by initial stage of change.

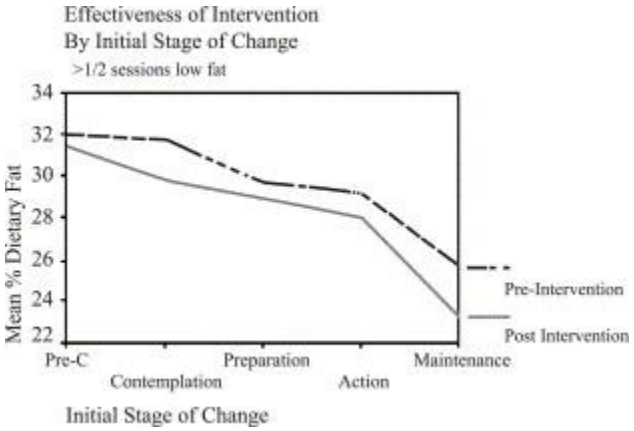

Fig. 6. Changes in dietary fat by initial stage of change.

4. Discussion

The findings of this study further add to the body of literature suggesting that computer-tailored interventions are effective in improving health behaviors in middle-school students.

Computer-tailored interventions for dietary fat have been deemed more effective than general nutrition information (Brug, Oenema, & Campbell, 2003). Computer-tailored intervention studies have been reported with high-school students and adults for dietary fat and physical activity (Bull et al., 1999 and Kreuter & Strecher, 1996), but only our prior four-session trial (Frenn, Malin, Bansal, Delgado, et al., 2003) has been reported for both behaviors with middle-school students. Brug et al. (2003) called for studies examining tailored interventions for more than one behavior. The currently reported eight-session intervention was effective across racial groups

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for those with the lowest income, which represents the highest risk groups for health problems that can be ameliorated by improvements in exercise and diet (National Center for Health Statistics [NCHS], 2001).

Interventions in this study were tailored based on subjects' initial stage of change. The intervention was effective for subjects in each stage of change, except for activity preparation. Additional content specific to those in preparation (as well as for those in precontemplation stage, because these improvements were minimal) will be added to the activity component of the intervention as a result.

4.1. Limitations

Measures of acculturation were not included in this study to reduce instrumentation fatigue, despite a large number of Hispanic youth. Using extensive measures of acculturation, Carnvajal, Hanson, Romero, and Coyle (2002) found no significant ethnic differences in healthy eating, although Latino boys were more likely to eat five servings of fruit and vegetables than Latino girls. Cullen et al. (1998) similarly found few differences in the number and type of fruit, juice, and vegetable consumption of African American and Euro American middle-school-aged boys. More Whites reported being physically active than Latinos in study of 1119 randomly selected sixth- and seventh-grade California students (Carnvajal et al., 2002). However, McKenzie et al. (2002) found no differences in movement skills between Mexican and Anglo-American children. Importantly, the intervention in the current study improved both physical activity and dietary fat for subjects in each racial group.

This study did not include family interventions apart from handouts sent home for breakfast ideas and a healthy snack recipe. It has been argued that family interventions may be more effective in lowering dietary fat (Nader, Sallis, Abramson, & Broyles, 1992) despite significant problems with recruitment, nonattendance, and dropout (Baranowski et al., 1990 and Perry et al., 1987). The need for family intervention remains to be proven, according to researchers conducting a family intervention including two adolescents and both parents to reduce dietary fat (De Bourdeaudhuij & Brug, 2000).

Access to healthy foods could represent a limitation to intervention effects among the predominately low-income, middle-school students included in the study. However, the current study took place in a school system where breakfast and lunch are available at free or reduced fee delivered via ID card for all students to prevent possible stigmatization. Several years before this study, the audited school meal fat content had already been maintained at 29.8%: 70% of students were eligible for free or reduced fee meals, but less than 50% ate the lunch and only 15% ate the school breakfast (Michael Turza, Director, Department of Parent and Student Services Milwaukee Public Schools, personal communication, July 12, 1999). Participant observation at a middle school demonstrated that the majority of students not eating school lunch ate nothing or ate soda and chips (Frenn, unpublished data). Therefore, the current intervention emphasized the benefits of healthy food choices, eating breakfast and lunch, as well as choosing healthy snacks from the options students had available. One video and one Internet session modeled healthy food requests from parents/guardians, because parents buy 61% of what is requested (Sallis et al., 1995). Options for asking for healthy foods, not the unhealthy foods advertised, were presented as a way to foster self-reevaluation.

Although no measures of fruit and vegetable intake were included as a part of this study, dietary fat intake appears to be most associated with obesity and other health problems (National Center for Health Statistics, 2001 and U.S. Department of Health and Human Services, 1995). Measures of high-glycemic-index carbohydrates and proportions of dietary saturated and *trans* fats also were not collected as a part of this study, although the intervention was designed to foster vegetables, fruit, and complex carbohydrate choices to lower dietary fat. Lower dietary fat intake has been correlated with lower serum lipids (Nicklas et al., 2002) and reduced obesity among children (Rodriguez-Artalejo et al., 2002). Continued study and intervention is especially important because the dietary fat intake of children increases, especially as children grow older (Zive, Berry, Sallis, Frank, & Nader, 2002).

These study findings are limited because they are based on self-report measures. However, similar questionnaire methods have been found to be less subject to bias than person-to-person interviews and

to questionnaires dealing with behaviors that have associated social and legal sanctions (e.g., sexual behavior, drug use; Turner et al., 1998). It is possible study findings were influenced by a Hawthorne effect, although research assistants collecting all data were blind to treatment condition.

The effectiveness of stage tailoring found in this study is limited by the small cell size for some stages of change. Further study with a larger sample is indicated.

4.2. Implications for nursing practice and research

The study demonstrates positive effects of Internet/video intervention with low-income, culturally diverse, middle-school students. Nurses in schools, primary care, or other settings could potentially use such an intervention modality. The current intervention should be tested in a larger number of schools over a longer period before wide-scale implementation. Similar to findings with smoking, it is important that evaluation of intervention effectiveness include the number of sessions required to accomplish desired changes.

The staging questions (shown in Fig. 2) can be used by nurses in any setting to assess stage of change and to plan appropriate nursing interventions. The HP/TM interventions have worked in a nurse-delivered classroom format (Frenn, Malin, & Bansal, 2003), a four-session Internet/Video format (Frenn, Malin, Bansal, Delgado, et al., 2003), and with even greater achievement of *Healthy People 2010*'s objectives in the currently reported eight-session format. Based on the decrease in dietary fat intake and increase in activity that were demonstrated, those in the intervention group would lose about half pound per week (Williams, 1997). These changes are congruent with *Healthy People 2010*'s goals for dietary fat, physical activity, and reduction in prevalence of obesity and will help to change the tide toward greater health in the future.

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