Integrative Biomedical Sciences

Research Article

A Comparison Between a Paper Dietary Questionnaire and Web-based Dietary Questionnaire in the 4th Grade Student's Elementary Students

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Received: April 04, 2015; Accepted: April 8, 2015; Published: April 10, 2015

Abstract

Paper-based Dietary Assessment questionnaire and Web-Based Dietary Assessment Questionnaire was developed as a surveillance instrument to measure dietary and physical activity behaviors in children and adolescents. But it is not known how reported food intakes by children using a Web-based version of a food frequency questionnaire compare on a paper-based version of the same questionnaire. This research used data that was collected from same the group of pre-adolescents. Using two versions of the same food frequency questionnaire, this analysis compares differences in reported intake between the two versions of instruments. This research provides a comparison of dietary eat patterns between a paper-based dietary questionnaire and a web-based of the same dietary questionnaire at elementary school of the 4th grade students. A comparison two assessment dada was assessed by comparing food items selected on the questionnaire with food items reported from a single 24-hour recall covering the same reference period. To identify and describe the major dietary eating patterns in the WT Cheney Elementary School and South Wood Elementary of the 4th grade students in Pine Bluff Arkansas. Fourth-grade student volunteers (N=87). The two dietary questionnaires of the instrument were first compared for all participants using analysis of variance (ANOVA) with the instruments as the grouping variable. Multiple regression analysis and analysis of covariance (ANCOVA) was also used to determine differences between instrument versions while controlling for differences related to participant. The mean weekly reported servings did not vary significantly between the two paper dietary questionnaires and web-based dietary questionnaire of the questionnaire. However, the web-based questionnaire produced lower intake estimates (after adjustment for between-school differences) for all of the food groupings. In summary, while the use of technology did not resolve reporting issues that are well known with children and the paper dietary assessment instrument questionnaire method, the potential advantages offered by technology-based methods merit continued exploration in future studies.

Keywords: Paper-based dietary questionnaire; Web-based dietary questionnaire; Comparison; Elementary school

Introduction

Introduction dietary assessment of humans is fraught with opportunity for error. The challenges are particularly evident in the dietary assessment of children. Difficulties in recalling recent intake, instrument-specific reporting tendencies, and inadequate knowledge of food details such as preparation method, are but a few of the

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reporting issues. Children may also have less interest in participating in a dietary assessment data collection which could impact reporting accuracy. Children also tend to have greater daily variation in their diets than adults which can add to the difficulty of assessing usual diet [1]. All of these issues add to the challenge of accurate assessment of children's usual dietary intakes.

Technology might offer some advantages to the field of dietary assessment particularly as it applies to children. For example, the use of digital photography could help children visualize food items and portion sizes. The use of computers may enhance respondent interest in the dietary data collection effort. The computer programming of a technology-based instrument can be such that the burden of navigational decisions through a series of "if yes/then" questions is lessened which may in turn decrease respondent error in questionnaire completion. In terms of data entry and management, Web-based databases can store respondent responses automatically and thus eliminate the need for data entry, another potential source of error. One widely used method of dietary assessment is the food frequency questionnaire. A food frequency questionnaire typically consists of questions regarding frequency of intake of individual food items. The questionnaire may include foods most commonly consumed by the population of interest or may be tailored to provide information on specific food items and nutrients. By asking about frequency of intake over a specified time period (typically one week to one year), the food frequency questionnaire is intended to supply information regarding usual patterns of dietary intake. Data collection and processing of food frequency questionnaires usually incurs lower costs than other dietary assessment methods [2]. Respondent burden is also lessened in that no recording of dietary intake is required.

Given these potential advantages, the food frequency questionnaire method has been explored among children. A tendency towards over-reporting of intake has been reported, particularly among younger children [3]. Reported intake of children using a food frequency questionnaire has been poorly correlated with reported intake of 24-hour recall interviews and dietary records [3]. Moderate correlations have been found between reported intakes on two occasions using variations of a

food frequency questionnaire with children and adolescents [4,5]. It is not known how reported food intakes by children using a Web-based version of a food frequency questionnaire compare to a paper-based version of the same questionnaire. This research used data that was collected from same the group of pre-adolescents. Using two versions of the same food frequency questionnaire. This analysis compares differences in reported intake between the two versions of instruments.

This research provides a comparison of dietary eating patterns between a paper-based dietary questionnaire and a web-based of the same dietary questionnaire in the 4th grade student's elementary school.

Methods

Participants and setting

To identify and describe the major dietary eating patterns in 87 4th grade students at WT Cheney Elementary School and south wood elementary school located in pine bluff, Arkansas.

Method of dietary questionnaire

At each school, the students were completed paper-based of the dietary questionnaire and the web-based dietary questionnaire in the morning, followed by a 24-hour dietary recall interview at least 2 hours later. The question wording and response categories did not vary between the papers based and web-based questionnaires. The response categories for the frequency questions on both questionnaires were as follows: Zero times last week, 1 time last week, 2 times last week, 3 times last week, 4 times last week, 5 times last week, 6 times last week, and 7 times or more last week.

The 24 hour dietary recall, paper-based and web-based of questionnaire was administered by research assistants to the students during school day and was coordinated for the convenience of the classroom teacher. Data collection during the school day is followed because dietary habits tend to vary on weekends more than weekdays. In addition, data not be collected on the day following a holiday. A typically, research assistants went

to the school to start the paper and web-based questionnaires for foods consumed the previous day, and then begin individual 24-hour recalls with face-to-face interviews. Five students participated in the study per day. A 24-hour recall tool also included the use of disposable cameras to photograph the eating patterns of the participants. The team members were coordinated with the school officials and selected participant students.

Students were given a disposable camera with specific simple instructions: to take a picture of what they ate or drank, including snacks. Team members developed protocols to ensure the accuracy of the food intake photographed during the 24-hour period. Accuracy may include taking "before and after" photographs of a meal. The disposable cameras were collected the next day and taken for processing. The photos were processed onto a compact disc to be viewed on a computer during the face-to-face interview. The photographs assist the child in recall of the meals and assisted the team member with the interview. The photographs and the interviews were used to validate calories consumed, food combinations, and portion sizes, and amount of fat, fruits, juices, vegetables. Validity testing and reproducibility testing of the original web-based questionnaire are reported.

The web-based questionnaire was password protected and hosted at the Internet Web address of UAPBblackboard.com. The site was accessible only to research staff members to prevent children from re-visiting the site and entering additional data.

Data analysis

Dietary questionnaires were coded into the following food groupings: fruits, vegetables, juices, and high fat foods. The fruits category included these items: ba-

nanas, apples, grapes, pears, kiwi, oranges, raisins, and mixed fruit. The vegetable category included these items: collards, green beans, other types of beans, sweet potatoes, other types of non-fried potatoes, corn, tossed salads, carrots, and broccoli. The juices category included only sources of 100% fruit juice: apple juice, orange juice, and grape juice. The high fat food grouping included items typically containing at least 30 percent of the calories from fat. These questionnaire items that met this criteria included: whole milk, honey buns, potato chips, cheese, hot wings, fried chicken, macaroni and cheese, fried rice, hamburgers, pizza, ice cream, snack cakes, cookies, ice cream, and chocolate candy.

The two dietary questionnaires of the instrument were first compared for all participants using analysis of variance (ANOVA) with the instruments as the grouping variable. Multiple regression analysis and analysis of covariance (ANCOVA) was also used to determine differences between instrument versions while controlling for differences related to participant.

Results

Initial ANOVA comparisons for the paper-based and web-based dietary questionnaires indicated statistically significant differences between the two for the food groupings as shown in Table 1. However, this comparison did not take into account possible real differences in eating patterns between students in different schools. Indeed, when the responses of the participants from the two schools in which both questionnaire versions were administered were compared using ANOVA analysis, no significant differences were found in the reported intakes between the two versions. Because the choice of instrument type was necessarily associated with school for the ma-

Table 1: ANOVA comparison of the paper dietary and the Web-questionnaire

Food grouping	Mean Paper (SD)	Mean Computer (SD)	F	p-value
Fruits	18.04(12.52)	22.27 (13.85)	25.49	0.000
Juices	9.26 (5.63)	11.02 (5.91)	22.47	0.000
vegetables	16.12 (13.22)	18.86 (14.75)	9.63	0.002
High fat foods	54.43 (23.39)	52.12 (24.69)	19.24	0.000

jority of the participants, further analysis was required to avoid confounding due to these school effects.

For certain that differences did exist between schools, an ANOVA was conducted with the schools as the grouping factor and each of the food groups as the Dependent variable. Significant differences between school groupings were found for all four food groups: fruits ($F=3.2$; $p\text{-value}=0.00$); juices ($F=3.18$; $p\text{-value}=0.00$); vegetables ($F=1.83$; $p\text{-value}=0.01$); and high fat foods ($F=3.43$; $p\text{-value}=0.00$). With evidence of significant differences between schools, the next step in the analysis was to statistically control for these differences through analysis of covariance (ANCOVA) and multiple regression analysis.

Variables to represent participation were created and included as covariates to account for any paper and web differences. The questionnaire version and these dummy variables were the independent variables in the analysis. The food grouping (fruits, juices, vegetables, or high-fat foods) was the dependent variable. Multiple Regression analysis was used to compute estimates of mean dietary intakes for each instrument were taken into account. The results of the multiple regression analysis are shown in Table 2. The adjusted mean intakes are reported intake for the seven days (previous week) for the reference school (between schools differences are not reported in this table). None of the p -values for the difference between instruments reached statistical significance, which indicated that the version

of Instrument utilized was not a significant predictor of reported intake for any of the food Groupings. The mean weekly reported servings did not vary significantly between the two paper dietary questionnaires and web-based dietary questionnaire of the questionnaire. However, the web-based questionnaire produced lower intake estimates (after adjustment for between-school differences) for all of the food groupings.

Discussion

In the initial comparison using ANOVA, it appeared that for all food categories, the mean intake as reported on the web-based questionnaire was higher than for the paper-based questionnaire. This design necessitated controlling for participating through the use of ANCOVA and multiple regression analysis. Since two schools used only one version of the instrument, the bivariate mean differences in Table 1 could be confounded by between-school differences.

The multiple regression analysis yielded lower mean weekly serving estimates when the effects of schools were controlled. In the multiple regression analysis, the web-based instrument yielded mean intakes that were lower than the paper-based instrument by 1.06 to 4.12 servings for each food category. Estimated daily intakes of these participants could be calculated as 2.3 to 2.7 servings of fruits, 1.3 to 1.4 servings of juice, 2.1 to 2.6 servings of vegetables, and 5.4 to 6.2 servings

Table 2: Multiple regression results of paper based and web based dietary comparison with students as covariates

Food grouping	Mean Paper (SD)	Mean Computer (SD)	F	p-value
Fruits	17.94	15.58	-1.07	0.29
juices	8.55	7.51	-1.09	0.27
vegetables	18.44	14.24	-1.81	0.07
High fat foods	41.68	38.04	-0.92	0.38

of high fat foods. It is not known if these amounts reflect actual intake, it appears some degree of over-reporting exists. Over-reporting with the food frequency questionnaire has been reported in this age group [3].

Despite the mean reported differences between versions, these differences were not statistically significant when the variation between schools was controlled. It

could be theorized that different schools represented variations in income levels which could influence food intakes. While the majority of the students were African-American for two of the schools, some of the schools also included Caucasian students. Thus, these ethnic differences may have contributed an additional source of variability between the schools. The variation in income as indicated by the free and reduced lunch

program participation as well as the mobility index also varied greatly between schools. These demographic factors provide some possible answers for reasons as to how the participants varied between schools.

Both questionnaires included color digital photographs of actual food items. While the children enthusiasm for the photographs, no comparisons were made with questionnaires that did not include photographs. Both questionnaires included color digital photographs of actual food items. While the children enthusiasm for the photographs, no comparisons were made with questionnaires that did not include photographs. In this age group found no differences in reporting accuracy with and without the use of food pictures [6,7]. While food photographs may have served as a memory aid and were enjoyed by the children, the food photographs may also have caused over identification with preferred food items. It could be hypothesized that the quantities of reported high fat foods are a result of children over-identifying with preferred food item photographs.

The limitations of this study include that between-instrument comparison in the study was not planned in advance and therefore not incorporated into the design. Since different schools participated on different days, two schools completed either the paper-based questionnaire or the web-based questionnaire. Thus, schools were a confounding factor in the original analysis of the two instruments. While statistical approaches were used to control for this confounding, a preferred research design would have been to randomize the children to the two versions of the instrument and compare any reporting differences. Another option would have been to have each child to complete both versions of the instrument. However, this design would have required more time and resources and would have likely resulted in respondent fatigue.

Conclusion

Technology offers additional options for the field of dietary assessment research. Traditional methods can be offered in a new medium. New methods may be developed. It remains to be seen how changes in the medium of traditional methods can impact dietary

assessment. This research indicates that differences in children's dietary assessment instrument are not related to the version of the paper dietary questionnaire employed. Over-reporting was evident with both versions of the instrument. The degree of over-reporting was lessened with the web-based food frequency questionnaire. The web-based questionnaire was also more efficient in that the time needed to administer the questionnaire was reduced and the need for later data entry into the database was eliminated. In summary, while the use of technology did not resolve reporting issues that are well known with children and the paper dietary assessment instrument questionnaire method, the potential advantages offered by technology-based methods merit continued exploration in future studies.

Acknowledgments

This study was the sponsoring Institution of Arkansas State Agricultural Experiment Station.

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