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Brief Report

Digital photography improves estimates of dietary intake in adolescents with intellectual and developmental disabilities

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Abstract

Background: Dietary assessment of adolescents with intellectual and developmental disabilities (IDD) is challenging due to the limited cognitive abilities of this population.

Objective: The purpose of this study was to determine the feasibility of using of digital images to improve the estimates of energy and macronutrient intake from proxy-assisted 3-day food records in adolescents with IDD.

Method: Participants used a mobile device to take photos of all food and beverages consumed over a three-day period and simultaneously completed a standard parent-assisted 3-day food record at two separate time points. A registered dietitian reviewed and recorded the differences between the standard record and the images. The proxy-assisted records and the photo-assisted records were analyzed separately.

Results: One hundred and thirty eating occasions were entered (20 participants (age = 14.9 ± 2.2 yrs, 45.0% female)). Photo-assisted records captured significantly higher estimates of energy intake per eating occasion than regular proxy-assisted records ($P = 0.001$) as well as significantly greater grams of fat ($P = 0.011$), carbohydrates ($P = 0.003$), and protein ($P = 0.004$).

Conclusion: The use of photo-assisted diet records appears to be a feasible method to obtain substantial additional details about dietary intake that consequently may improve the overall estimates of energy and macronutrient intake when using proxy-assisted diet records in adolescents with IDD.

Keywords: Intellectual disabilities; Adolescents; Dietary assessment; Technology; Photo-assisted food record

Due to the complexity of nutrition and the numerous health risks that accompany poor diet quality and excessive energy intake, it is essential to have methods to assess dietary intake. Dietary assessments increase the effectiveness of both health interventions and policies at the individual as well as the population level. Overall, the high prevalence of obesity is a serious problem, and research shows that obese adolescents are up to four times more likely than their healthy weight peers to become obese adults and to develop chronic diseases, such as hypertension, type 2 diabetes, and metabolic syndrome.[1] Since obesity research in adolescents with intellectual and developmental disabilities (IDD) is limited, the need for valid dietary assessment is high: the prevalence of obesity in adolescents with IDD is approximately 2–3 times greater than in adolescents without IDD.[2–6] Researchers have not yet validated a method for dietary intake assessment in individuals with IDD due to significant barriers in collecting accurate and reliable data. These barriers include compromised cognitive functioning, poor memory, and a shortened attention span.[7,8]

One of the most common dietary assessments used in the general population is diet records. Diet records have the potential to provide accurate data for food consumed during the recording period. They allow respondents to record food and beverages as they are consumed, lessening the problem of omission and increasing the described detail of foods. For these reasons, diet records are often regarded as one of the best dietary assessment methods.[9] However, diet records, like all dietary assessments, are imperfect

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because they rely on self-report and a person's ability to correctly describe what was consumed.[10] Therefore, this method may not be appropriate in individuals with IDD.

As a result, the use of proxy-assisted diet records has been shown to provide more accurate dietary information in adults with IDD.[11,12] Proxy-assisted diet records are an assessment method in which a family member or support person assists a participant in completing a diet record. Proxy-assisted records are commonly used in populations with limited reporting capabilities, such as children and individuals with Alzheimer's.[13] While proxy-assisted diet records have been shown to work in adults with IDD, adolescents have different limitations than adults (school lunches, lack of responsibility for preparing their own meals, use of technology), and the feasibility of this method in adolescents has not been assessed.

In addition, photo-assisted dietary assessment is another method that has been validated in the general population[14–21] and has been determined feasible in adults with IDD.[22,23] Photo-assisted dietary assessment is a technique in which digital images are taken of all food and beverages consumed during the record period. The use of photo-assisted 24-h food recalls in adults with IDD resulted in a significantly greater energy intake being reported per eating occasion when compared to the standard recalls ($P = 0.002$) as well as a greater intake of fat ($P = 0.006$), protein ($P = 0.029$), and carbohydrates ($P = 0.003$).[24] The authors concluded that photo-assisted recalls have the potential to be a more accurate dietary assessment technique in individuals with IDD than 24-h recalls alone.[24]

While previous studies in adults with IDD have determined that both proxy-assisted diet records and photo-assisted recalls can provide accurate dietary assessments and that the photo-assisted recalls potentially improve the total energy and macronutrients reported, no information is available regarding the use these dietary assessments in adolescents with IDD or regarding whether digital photography can improve proxy-assisted food records. Therefore, the aim of this study was to determine if the collection of digital images is a feasible method to improve estimates of energy and macronutrient intake of proxy-assisted 3-day food records in adolescents with IDD.

Methods

Participants

This study was conducted with twenty adolescents with IDD. Each participant completed a proxy-assisted record and took pictures of the foods eaten during the record period to determine if they provided additional details about the type and amount of foods eaten. All individuals had to be 11–18 years of age with mild (IQ of 50–69) to moderate (IQ of 35–49) IDD, living at home with a parent or legal guardian, of sufficient cognitive ability to understand directions, and able to communicate through spoken language. This study was approved by the University of Kansas's Human Subjects Committee. Participants and their legal guardian met with a member of the research team who explained the study in detail and who read them a university-approved consent form. Both the participants and the legal guardians were given an opportunity to ask questions about the study. Participants were read an assent using plain language asking if they wanted to participate. If participant gave oral assent, their legal guardian was then asked to sign the consent form.

Collection of dietary assessments

All participants were given a mobile device with a built-in camera (iPad 2, Apple, Cupertino, CA, USA)[25] at the beginning of the study. The device's rear-facing camera (1280 × 720 pixels or 0.92 megapixel camera with autofocus) was used for the photo-assisted records. Before the assessment, each participant was instructed on basic mobile device functions, including how to operate the camera application. The study personnel observed the participant independently take satisfactory images.

Participants were instructed to complete hard copy, proxy-assisted diet records, with the help of a parent or legal guardian if needed, for three consecutive days (2 weekdays, 1 weekend day). The participants were instructed to also take before and after images, using the mobile device, of all food and beverages consumed at home during that 3-day period, without the help of the parent/guardian. A fiduciary marker (a 5 cm × 5 cm checked square) was included in all images to serve as a reference measure of portion size. To remind participants to comply with the photo/record protocol calendar, prompts were programmed into the mobile device.

After the record period was complete, a registered dietitian (RD) reviewed the written proxy-assisted 3-day diet record with the participant without the use of the images. Portion guides were used to help clarify portion size and provide better accuracy. The portion guides used in the interviews were 3-dimensional models consisting of a variety of items intended to provide a reference (i.e., glasses, mugs, bowls, circles, thickness sticks, chip bags, drink bottles, a 12-inch ruler, measuring cups and spoons, a grid, wedges, geometric shapes, and diagrams of chicken pieces).[26] Following the review of the proxy-assisted diet record, the RD separately reviewed the date and time stamped images using methods previously published by Ptomey et al[24] to obtain additional information about the foods eaten. Each photographed eating occasion or food item was discussed with the participant in order to identify additional details possibly left out of the initial dietary record regarding the food type, portion size, and other characteristics (e.g., drinks, side dishes, ingredients, condiments, etc.). Food items, portion size, and specific details