



Brief Report: Feasibility and Acceptability of a Remote-Based Nutrition Education Program for Adolescents with Autism Spectrum Disorder: A COVID-19 Pilot Study

Riley H. Shurack¹ · Jeanette M. Garcia¹ · Keith Brazendale¹ · Eunkyung Lee¹

Accepted: 20 September 2021 / Published online: 5 October 2021

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Abstract

To examine the feasibility and acceptability of a remote-based nutrition education program during COVID-19 for adolescents with autism spectrum disorder (ASD). Ten adolescents with ASD participated in a 4-week nutrition education program utilizing Zoom software during COVID-19. Topics included shopping for healthy food, and food preparation safety measures. Attendance was collected for each session. Participants, parents, and the classroom teacher completed post-program surveys and interviews. The course attendance rate was 97%. Every adolescent reported they would participate in similar future programs, and the teacher/parents felt the program was a positive experience for the participants. The remote-based nutrition education program appeared to be feasible and acceptable to participants. Future research should focus on program efficacy.

Keywords Autism spectrum disorder (ASD) · Nutrition · Remote-based learning · COVID-19

Introduction

Individuals diagnosed with autism spectrum disorder (ASD) often have nutritional deficiencies due to food selectivity and preferences for calorically dense foods with little nutritional value (Gephart & Loman, 2013; Hyman et al., 2012). Compared to their neurotypical (NT) counterparts, youth with ASD are more likely to suffer from chronic diseases such as obesity, cardiovascular disease, and metabolic syndrome partly due to such unhealthy eating patterns found in this population (Dreyer Gillette et al., 2015; Flygare Wallén et al., 2018; McCoy & Morgan, 2020). Interventions for nutrition education in ASD individuals are crucial to promoting health-related behaviors that can be adopted and sustained throughout adulthood.

The COVID-19 pandemic began in March 2020 and resulted in the closure of most businesses and schools, and a cancellation of nearly all in-person programs in the United States. As youth with ASD tend to prefer routine, the

disruption to their daily schedule may cause them to experience additional anxiety, resulting from both the uncertainty of the pandemic and adjusting to a new routine, has been linked to a decline in healthy lifestyle habits in individuals with ASD (Garcia et al., 2020). Recent studies have emphasized the importance of making healthy choices during the pandemic to combat the increasing anxiety, depression, and weight gain that has been reported in this population (Bal et al., 2021).

A remote-based delivery format has been identified as an evidence-based treatment for youth with ASD (Sam et al., 2020). Although previous research provides support for the use of remote-based technology in this population, no studies to date have examined the use of a remote-based nutrition education program for older adolescents with ASD. Given the negative effects of the pandemic on physical and psychosocial health in adolescents with ASD, it is imperative that health promotion programs continue to be offered to this population. Therefore, the purpose of this study was to examine the feasibility and acceptability of a remote-based nutrition education pilot program for adolescents with ASD during the COVID-19 pandemic.

✉ Jeanette M. Garcia
Jeanette.garcia@ucf.edu

¹ College of Health Professions & Sciences, University of Central Florida, 12805 Pegasus Drive, Orlando, FL 32816, USA

Methods

Sample and Setting

The current sample was comprised of adolescents with ASD, aged 15–19 years, who had previously participated in an 8-week, in-person nutrition education program with an additional culinary component. All participants attended a private school in Central Florida that enrolls youth with a prior physician-based diagnosis of Level 1 (high-functioning) ASD, defined in the DSM-5 (2013) as needing minimal support during the school day. All children and adolescents enrolled at the school were free of any serious psychiatric conditions or severe intellectual disabilities that would require one-on-one care. The eleven adolescents who completed the original, in-person program were eligible to participate in the remote-based nutrition education program. To be eligible for the in-person program, adolescents had to be a full-time high school student at the school, and be free of any behaviors that would pose a danger to themselves or other participants. Adolescents with other comorbidities were eligible to participate in the program, as long as they had a primary diagnosis of ASD. Finally, any adolescents with severe food allergies were excluded from the study. An additional requirement that was added to the remote-based pilot study was having a functional computer and access to the Zoom application. All procedures for the current pilot study were approved by the University of Central Florida Institutional Review Board.

Investigative Team

As the program was multidisciplinary in nature, the investigative team consisted of faculty and student research assistants from Health Sciences, Special Education, Psychology, Kinesiology, and Social Work. Additionally, a Registered Dietician (RD) on the team reviewed and approved of all nutrition education curriculum for both the in-person and remote-based sessions.

Program Description

In-Person Nutrition Education Program

The original in-person nutrition education was conducted between January and mid-March of 2020, before the COVID-19 pandemic. In this study, participants met twice a week for an hour over the course of eight weeks. This program consisted of both a nutrition education and culinary component. A description of these activities is found in Table 1 (Garcia et al., 2021).

COVID-19-Adapted Remote-Based Nutrition Education Program

The COVID-19 pilot study was adapted from the original study following the mandatory stay-at-home order in Florida on April 1st, 2020. A 2-week transition period between the discontinuation of the original in-person study was implemented to allow the investigative team time to discuss adaptations to the curriculum with the partner school.

Table 1 Overview of 8-week nutrition session (in-person)

Week	Education topic: tuesday session	Culinary tutorial: thursday session
1 1/21–23	Introduction & Baseline Knowledge Inquiry	Nutritional Trail Mix
2 1/28–30	MyPlate & Food Groups	Frozen Fruit Smoothies
3 2/4–6	Optimal Nutrition: Nutrient vs Caloric Density & Portion vs Serving Size	Fresh Guacamole
4 2/11	Food is Fuel: Energy Sustaining Foods	Acai Bowls
5 2/18–20	Diet Nutrient Gaps: Micronutrients (Vitamins and Minerals)	Homemade Pizza
6 2/25–27	Reading Nutrition Labels	Turkey Tacos
7 3/3–5	Grocery Shopping: Navigation & Selection At a Mobile Farmer's Market	Hummus Platters with Vegetables and Fruit from the Mobile Farmer's Market
8 3/10–12	The Importance of Healthy Snacks	No-Bake Oatmeal Energy Balls

A 1-h session was held over Zoom software once a week over the course of 4 weeks with the program instructors, participants, and the participants' classroom teacher. The participants and their teacher were asked to join into the meeting at a pre-scheduled time via a designated URL organized by the overseer. The instructors were able to utilize the "Share Screen" feature in Zoom to share their respective computer screens to the participants, such as sharing the Walmart.com homepage for online grocery shopping. Participants were required to turn on their webcams to show their faces and keep their microphones off unless if asked a question. They also had the option to utilize the Chat component of Zoom to exchange messages publicly to their peers or privately to the instructors. The first session served as a follow-up to the original in-person study to check in on the participants during the stay-at-home-order, and the three sessions thereafter consisted of teaching participants lessons based on topics agreed upon between the investigative team and partnering school for the pilot study. Table 2 displays the curriculum for each session of the 4-week program. A research assistant took notes during each session, and a debriefing was held after each session among the investigative team members to discuss any issues, concerns, or suggestions related to the program.

Demographic Assessment Measures

Prior to the start of the original in-person program, parents completed a demographic survey that asked about their child's age, sex, race/ethnicity, estimated height/weight, presence of other health conditions, and any current medications. Body mass index (BMI) was calculated using parent-estimated height and weight values for their child, which was then converted into BMI percentiles based on age and gender-specific criteria. BMI percentiles $\geq 85\%$ were classified as "overweight", while BMI percentiles $< 85\%$ were classified as "normal weight" (Kuczmarski et al., 2002).

Feasibility and Acceptability Measures

Participant Attendance

Attendance for each session was recorded by a research assistant. Participants who entered the Zoom meeting late were still marked as present; however, the reason for their lateness was noted in the session observations. If a participant was not present in the first 5 min of the meeting, the teacher made a phone call to the participant's residence to remind them of the meeting.

Participant Survey

Close-Ended Questions Following the final remote-based session, participants were asked to complete an 11-item close-ended survey regarding their experience with the remote-based sessions and their perceptions of remote-based learning using response options of "Agree," "Disagree," and "Neutral" (e.g., "I had adequate opportunity to ask questions of the instructors throughout the semester during the remote-based session.") (Porter et al, 2014).

Open-Ended Questions Two open-ended questions about participant likes and dislikes of the remote-based method of learning were also asked (e.g., "What did you like/dislike about the remote-based sessions?").

Parent/Caregiver Interviews

Parents and caregivers of participants were also asked to take part in individualized discussions regarding their perceptions of the program. The interviews were conducted with each parent or caregiver via Zoom; questions were based on their perceptions of feasibility and acceptability of the remote-based nutrition education program for the participants, as well as suggestions for improving the program if it were to be offered again in the future. Each session lasted approximately 10 min with each parent or caregiver. To reduce the possibility of information bias, an experienced interviewer who had not been directly involved in the nutrition education

Table 2 Overview of 4-week nutrition session (remote-based)

Week	Education Topic: Tuesday Session
1 4/7	Welcome Back: Review of Knowledge Inquiry (Post-COVID-19 Stay-at-Home Order)
2 4/14	Shopping Healthily on a Budget during COVID-19: Utilizing Online Grocery Store Websites
3 4/21	Utilizing the USDA MyPlate Mobile Application
4 4/28	Shopping Healthily on a Budget during COVID-19: Reviewing Inexpensive Healthy Foods & Recipes

sessions led each interview, while a research assistant not directly affiliated with the nutrition program was present to take descriptive notes.

Classroom Teacher Interview

The classroom teacher was asked to participate in a 1-h semi-structured interview with a trained research assistant not directly affiliated with the nutrition program. The research assistant inquired about the following topics related to feasibility and acceptability: (1) Perception of the remote-based sessions (i.e., benefits, limitations, etc.); (2) feasibility of the remote-based program for future classes; and (3) suggestions for improvement. The interview was audio-recorded, and later transcribed verbatim.

Statistical Analysis

Means and frequencies were calculated to describe participant characteristics, participant attendance, and the participant close-ended surveys. Two research assistants independently viewed the open-ended participant responses, parent interviews, and the classroom teacher interview. The research assistants coded the data and extracted relevant themes. The research assistants compared their list of themes, and discussed any discrepancies. The relevant themes were then quantified based on the frequency of each theme identified in the data. All quantitative data was analyzed in SAS version 9.4.

Results

Participant Characteristics and Attendance Rate

Out of the 11 participants who completed the remote-based program, one participant failed to complete the survey measures. Therefore, a total of 10 participants were included in the final analysis. The average age of the participants was 16.2 ± 2.1 years old, and 60% of them were overweight (85th percentile \leq body mass index), as indicated in Table 3. Only 1 of the 10 participants was absent from any of the sessions, indicating a 97% attendance rate for the four Zoom sessions overall.

Quantitative Analysis

Participant Close-Ended Responses

Overall, 90% of participants felt that the remote-based nutrition education program was effective in improving their ability to eat healthier and shop more efficiently during the pandemic, and were interested in taking a similar class if

Table 3 Participant characteristics (n = 10)

Variables	N (%)	Mean (SD)
Males	7 (70%)	
Females	3 (30%)	
Age (years)		16.2 (2.1)
White	8 (80%)	
Multiple Health Conditions ^a	7 (70%)	
Currently on Medications	6 (60%)	
Overweight	6 (60%)	
Attended at least 95% of sessions	5 (50%)	

^aConditions besides ASD included attention deficit hyperactivity disorder; sensory processing disorder; anxiety disorders; & mood disorders

Table 4 Participants' close-ended responses evaluating the acceptability of the remote-based nutrition education sessions

Topic	% Agreement
Improve knowledge	100
Enjoyment	100
Expectations met	80
Flexibility	80
Interest in future	90
Impact on eating habits	80
Effectiveness	90
Opportunities for questions	80

offered in the future. When asked if the inclusion of the remote-based nutrition program positively impacted their eating patterns and choices, 80% said yes. Eighty percent also claimed that it met their expectations of being able to learn new material on a different teaching platform, felt that there were adequate opportunities to ask questions, and that the remote-based format was flexible with their schedule. More notably, 100% of the participants agreed that the remote-based sessions helped them learn, and they enjoyed utilizing the alternative format. Table 4 depicts main themes extracted from the close-ended responses, demonstrating the participants' acceptability of the remote-based program.

Qualitative Analysis

Participant Open-Ended Responses

Eight of the ten participants agreed that the inclusion of the Zoom nutrition education classes affected their eating patterns or choices. Seven of the participants explained that they became more mindful of both their food choices and portion sizes, while one participant noted that he learned how to shop more effectively while maintaining limited

contact with others during the pandemic. One participant stated, “[I] drink more water, [and I] think about what I’m eating.” Participants also added that the Zoom sessions helped with meal structure, with one participant claiming it aided his weight loss efforts. When asked to describe their likeability for Zoom, some quotes coined by the participants included, “I could still learn as much over Zoom as when I was in school,” and “[I still had] the ability to keep learning the course and keep practicing skills.”

Parent Interviews

Nine of the 10 parents/caregivers participated in semi-structured interviews with a research assistant unfamiliar with the program. One parent was unable to participate in the interviews due to her work schedule, and declined rescheduling the interview.

Five out of the nine participants’ parents/caregivers who participated in the interviews reported that the new pandemic restrictions affected the eating and exercise habits of the participants. Specifically, some witnessed their child eat significantly more or less food than before the pandemic, and also noted higher levels of stress, decreased exercise levels, and poorer sleep patterns. As the participants attended the remote sessions, parents/caregivers witnessed a substantially increased interest in nutrition and cooking healthier foods. Parents/caregivers claimed that there was more interaction and communication between themselves and the participants while the Zoom sessions were taking place; one parent commented, “Our child liked Zoom because she was more involved.” Parents/caregivers noted that the participants were more receptive to trying new foods and were more mindful of the food they ate. This enabled the parents/caregivers to comment more favorably on the Zoom sessions since they had a better idea of what the participants were doing; one parent explained “[We] wished we could have been more involved with the in-person study but happy they learned more during COVID.”

Classroom Teachers Interviews

The classroom teacher reported that the Zoom sessions were beneficial to participants and their families, noting that many of them now have tighter financial budgets due to the economic burden of the COVID-19 outbreak. The teacher reported that the logistics of the program appeared to encourage participants to be more responsible for their nutrition, as “It felt more like a team when we were all doing it [in-person] together.” Lastly, regarding the possibility of utilizing the remote-based program for students with ASD who may have more difficulty with social interactions, the teacher stated, “There are a few who I think were a little more quiet in-person who appeared more engaged during

the sessions. I think some of them have difficulty with social interaction to a greater extent than some of the others and this was a more comfortable platform for them. Maybe some of the students with more social difficulties would benefit more from Zoom.”

Discussion

The goal of this pilot study was to assess feasibility and acceptability of a remote-based nutrition education program during the COVID-19 pandemic in adolescents with ASD. The results from this study suggest that the remote-based nutrition education program was feasible and acceptable for the participants, their parents, and the participants’ classroom teacher.

While several studies have tested nutrition interventions in young children and adults with ASD, the literature on nutrition education interventions in older adolescents is scarce (Garcia et al., 2020; Goldschmidt & Song, 2016; Hubbard et al., 2014; Kim & Kang, 2020). As older adolescents with ASD begin to transition into adulthood, a nutrition education program which assists adolescents in making healthy food choices has potential to improve dietary patterns, as well as foster autonomy and independence in this population.

An unexpected finding was the request for further involvement in the Zoom sessions from parents/caregivers. Parents/caregivers suggested they could play a role in this program by encouraging their children to practice the skills they’ve learned at each session, such as having their child create a family grocery list or assisting with selecting fruits and vegetables at the grocery store. Future studies should consider including family participation in nutrition education sessions as prior research has found that greater family involvement may increase the effectiveness of therapies and education programs for adolescents with ASD (Solomon et al., 2007).

The demonstrated feasibility of Zoom in the current study expands our knowledge and application of remote-based delivery, including additional platforms such as Zoom that offer real-time, interactive instruction to individuals with ASD. As previously mentioned, a high rate of participant attendance was found in the remote-based version of the nutrition program due to more availability during COVID-19, which indicates easy access to the materials. Additionally, Zoom offers many features to improve remote-based learning; these include screen sharing, a chat box, and reactions such as raising a hand to ask a question, giving a thumbs up/down, or requesting the host of the meeting to go faster or slower in the lecture. The classroom teacher and parents suggested that recording the Zoom lessons for adolescents with ASD and their parents to review after the initial sessions would encourage more parent involvement,

and reinforce the instructions discussed during the live session. This option would combine several evidence based techniques, such as video direction and modeling, used to promote positive behavior change in youth with ASD (Bellini & Akullian, 2007; Galligan et al., 2020). Future studies should further explore the capabilities of the Zoom platform, and how it could be utilized to benefit this population.

The current pilot study had several limitations that should be noted. The small sample size and short duration of the study was a limitation. Future studies should include a larger sample over a longer duration of time. Additionally, direct comparisons between the in-person and remote-based formats would have been biased, as the remote-based format was developed to continue the nutrition education program during the pandemic. Specifically, the curriculum had to be modified to accommodate the remote format, and consider new concerns of the participants as a result of the pandemic. The remote-based program was limited to a four-week period compared to eight weeks for the in-person program. Future research should focus on examining how the two formats may compare and potentially complement each other in this population.

Conclusion

Preliminary results of the current study indicate that a remote-based nutrition education intervention appears feasible and well-accepted by older adolescents with ASD. Additionally, the study findings support the future addition of a family component to the remote-based program, where parents can access nutrition education content and participate in meal preparation together with their child. Despite the challenges resulting from the unplanned nature of the COVID-19 pandemic, the transition to remote-based learning enabled the research team to develop a viable alternative to in-person health promotion programs for adolescents with ASD.

Acknowledgments This Grant is supported by HRSA/MCHB Healthy Weight Research Network UA3MC25735-01-00.

Author Contributions All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by RHS and JMG. The first draft of the manuscript was written by RHS, with guidance from JMG, KB, and EL. All authors commented on previous versions of the manuscript, and all authors approved the final manuscript.

Declarations

Conflict of interest The authors declare that there is no conflict of interest.

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