Parent and Adolescent Attitudes Toward a Virtual Nutrition Intervention for Adolescents with Autism Spectrum Disorder

Acadia W. Buro1 · Heewon L. Gray2 · Russell S. Kirby2 · Jennifer Marshall2 · LaShae Rolle2 · Jamie Holloway3

Accepted: 9 September 2022 / Published online: 17 September 2022
© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2022

Abstract

Objectives This qualitative study examined acceptability, perceived benefits, and unintended consequences of a virtual implementation of an 8-week theory-driven nutrition intervention (BALANCE) for adolescents with autism spectrum disorder (ASD).

Methods Twenty-one parent interviews and six adolescent focus groups or interviews (n = 12; group size ranged 1–5) were conducted. Data were collected virtually via Microsoft Teams and analyzed for a priori and emergent themes.

Results The intervention was generally acceptable. Adolescents and parents reported that they were comfortable with the virtual format and the interactive group setting. Parents of adolescents 15 years and older emphasized the importance of autonomy/independence. Participants reported changes in adolescents’ psychosocial determinants of dietary intake, including knowledge and self-efficacy, as well as diet changes (e.g., self-regulation).

Conclusions The virtual implementation of BALANCE was acceptable according to adolescents with ASD and their parents based on their reported perceptions and feelings about the intervention. The findings suggest that many adolescents with ASD may benefit from virtual group interventions. Quantitative research is needed to examine behavioral outcomes of the BALANCE intervention.

Keywords Nutrition · Telehealth · Adolescents · Autism · Qualitative research

Adolescents with autism spectrum disorder (ASD), a developmental disability characterized by social communication challenges and restrictive and repetitive behaviors (American Psychiatric Association, 2013), have a greater risk of obesity compared to typically developing adolescents (Kahathuduwa et al., 2019; Must et al., 2017). In addition to usual risks associated with obesity, including hypertension (Friedemann et al., 2012) and type 2 diabetes (Goran et al., 2003), those with ASD may face unique threats to independent living and well-being due to lifestyle behavior challenges and social and behavioral impairments (Curtin et al., 2014). As youth with ASD may exhibit problematic eating behaviors, such as food selectivity (Bandini et al., 2010; Mari-Bauset et al., 2014), and consume more energy-dense foods and fewer fruits and vegetables than typically developing youth (Sharp et al., 2013), nutrition represents a modifiable risk factor for unhealthy weight gain in this population (Dhaliwal et al., 2019).

Although remote-based delivery has been identified as a feasible and acceptable intervention format for youth with ASD (de Nocker & Toolan, 2021; Sam et al., 2020), most nutrition interventions have been conducted in typically developing youth (Ajie & Chapman-Novakofski, 2014; Domínguez Rodríguez et al., 2016). Telehealth interventions for youth with ASD have largely been limited to diagnostic assessments, early intervention, and therapy (e.g., Applied Behavior Analysis) (Ellison et al., 2021; Matthews et al., 2021; Sutherland et al., 2018). However, children, adolescents, and young adults have exhibited changes in eating behaviors and physical activity, as well as weight gain, due to COVID-19 restrictions (Stavridou et al., 2021), and youth with ASD have behavioral obesity risk factors that may be worsened by the COVID-19 pandemic.
Groups were determined based on participants’ weekly (six groups of 2–7) participated in an 8-week intervention. Parents of adolescent participants were eligible to participate in an interview. The mean age of adolescents (n = 12) was 15 years (ranged 12–19 years), and 83% were male. Adolescents were 50% White, 17% Hispanic or Latino, 8% Asian, 8% Black or African American, and 17% Other (Asian and White). The mean age of parents was 48 years, 100% were female, and 65% identified as White. Most (83%) reported that they did not experience food insecurity. Participant demographic characteristics are summarized in Table 1. The study was approved by the University of South Florida Institutional Review Board, and informed consent/assent was obtained from all participants.

Methods

Participants

This qualitative study included adolescent focus groups or interviews and parent interviews. Adolescents with ASD aged 12–21 years and their parents were recruited through partnership with the Center for Autism and Related Disabilities at the University of South Florida. Adolescent inclusion criteria included parent-reported clinical diagnosis of ASD and age 12–21 years. Exclusion criteria included concurrent participation in another nutrition-related intervention, below third-grade reading level per parent report, eating disorder or feeding disorder diagnosis per parent report (as such conditions should be treated with therapy and/or medical attention), or being non-English speaking. English-speaking parents of adolescent participants were eligible to participate in an interview.

Twenty-seven adolescents with ASD aged 12–21 years (six groups of 2–7) participated in an 8-week intervention. Groups were determined based on participants’ weekly availability. Parents completed a household demographic questionnaire via the online survey platform Qualtrics at baseline. Post-intervention, adolescents were invited to participate in focus groups, and one parent of each adolescent was invited to participate in an interview. The mean age of adolescents (n = 12) was 15 years (ranged 12–19 years), and 83% were male. Adolescents were 50% White, 17% Hispanic or Latino, 8% Asian, 8% Black or African American, and 17% Other (Asian and White). The mean age of parents was 48 years, 100% were female, and 65% identified as White. Most (83%) reported that they did not experience food insecurity. Participant demographic characteristics are summarized in Table 1. The study was approved by the University of South Florida Institutional Review Board, and informed consent/assent was obtained from all participants.

Procedure

Intervention The conceptual framework for BALANCE (Buro et al., 2021) incorporates SCT constructs and ASD-specific challenges, including sensory differences (Hazen et al., 2014) and cognitive rigidity (Polfuss et al., 2016), to promote positive dietary behavior change. The virtual implementation included eight weekly 30–45-min lessons delivered via Microsoft Teams (exploring taste, flavor, and texture; mealtimes and rules; food groups and nutrients; moderation; beverages; cooking; well-being; and sustaining healthy eating habits), as well as weekly homework assignments, weekly parent email handouts, and three parent webinars. Adolescents participated in the 8-week intervention on their own, but parents were given the option to sit in or stay nearby during the lessons if their children needed support. Parent webinars, which occurred at baseline, after Lesson 4, and after Lesson 8, reviewed lesson activities and provided suggestions for empowering and encouraging their children to make positive dietary choices.

Lesson content was adapted from a nutrition intervention for young children with ASD created that was created by the research team (Gray et al., 2022) and revised based on participant feedback from a school-based pilot study (Buro et al., 2022b). A manual was created to guide the intervention implementation, and a lesson booklet that included instructions, handouts, and a take-home activity for each lesson was created and sent to each participant. Each session included interactive discussion and activities and a tasting session or optional snack. Food suggestions were flexible to match participants’ preferences and accessibility. Participants could see and talk to each other and the lesson instructor during the lessons using web cameras, microphones, and the chat feature. Screen sharing was used to share handouts based on participants’ preferences. Make-up videos (approximately 15 min long) with the same content and format but without participant interaction were sent to participants if
they had to miss any lessons. The videos were not intended to replicate the intervention but rather to provide a feasible way to provide participants with the intervention content.

Lesson activities, summarized in Table 2, were aligned with SCT constructs. For example, the matching nutrients to their benefits activity in Lesson 3 addressed constructs of knowledge and outcome expectations. Application of SCT constructs to the activities was informed by the Child and Adolescent Trial for Cardiovascular Health (CATCH) intervention applications and strategies (Perry et al., 1997), and one activity was borrowed from the Laurie M. Tisch Center for Food, Education & Policy Food Day Curriculum (Koch & Contento, 2011).

Measure

Focus groups and interviews were conducted virtually via Microsoft Teams and video recorded. Each group of students was invited to participate in a focus group the week after their last lesson at the same day and time of their lessons. For example, Group 1 met on Thursdays at 5 pm, so all participants from Group 1 were invited to participate in a focus group the week after Lesson 8 on Thursday at 5 pm. All parents in the intervention group were invited to participate in an interview. Interviews were scheduled based on parent availability. Semi-structured focus group and interview guides were developed based on the study purpose to examine intervention acceptability, perceived benefits, and unintended consequences. Attendance per 15–40-min focus group ranged one to seven (n = 12 total). An interview was conducted instead of a focus group in two instances where only one adolescent attended the scheduled focus group. Reported reasons for missing focus groups included forgetting or being busy. Twenty-one parents participated in a 16–42-min interview.

Data Analyses

A codebook with a priori codes based on focus group and interview guides was created with domains for acceptability, perceived benefits, and unintended consequences. The definition of acceptability was adapted from previous research and includes the extent to which participants considered BALANCE to be appropriate based on their reported perceptions of and feelings about the intervention (Sekhon et al., 2017). Audio files were transcribed verbatim by an external source, and accuracy was assessed by research staff by cross-checking three transcripts with audio recordings. After an initial reading of the transcripts, emergent themes were added to the codebook. The final list of codes is depicted in Table 3.

The coding reliability approach to thematic analysis (Braun & Clarke, 2006; Braun et al., 2019) was conducted.
## Table 2 Application of social cognitive theory constructs to lesson activities for Bringing Adolescent Learners with Autism Nutrition and Culinary Education (BALANCE)

### Lesson 1: Exploring taste, flavor, and texture

| Minutes | Activities                                                                 | Constructs                                                                 |
|---------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 5       | Engage students in an interactive discussion of taste, flavor, and textures | Knowledge, self-efficacy                                                  |
| 30      | Have a tasting session for foods with different tastes and textures       | Self-efficacy, observational learning, outcome expectations, normative beliefs |
| 10      | Work with students to plan to overcome barriers to exploring a new taste, flavor, or texture | Outcome expectations, barriers and opportunities, intentions |

### Lesson 2: Mealtimes and rules

| Minutes | Activities                                                                 | Constructs                                                                 |
|---------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 10      | Discuss the benefits of having a regular mealtime schedule                | Knowledge, self-efficacy, outcome expectations                              |
| 10      | Discuss what the students’ mealtime environments look like and why         | Self-efficacy, outcome expectations, barriers and opportunities            |
| 25      | Make a healthy snack as a class and have each student set a goal for maintaining a regular mealtime schedule | Behavioral skills, intentions, social support |

### Lesson 3: Food groups and nutrients

| Minutes | Activities                                                                 | Constructs                                                                 |
|---------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 10      | Discuss the role of healthy eating in accomplishing personal goals        | Knowledge, outcome expectations, intentions                                |
| 15      | Play a matching game to match nutrients with their benefits               | Knowledge, outcome expectations                                            |
| 10      | Create a sample meal using USDA MyPlate                                   | Knowledge, self-efficacy, observational learning                           |
| 10      | Discuss snacks and their food groups and benefits                         | Knowledge, outcome expectations                                            |

### Lesson 4: Moderation

| Minutes | Activities                                                                 | Constructs                                                                 |
|---------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 5       | Review the lessons so far                                                 | Knowledge                                                                  |
| 10      | Play a matching game with foods and level of processing                  | Knowledge, self-efficacy                                                  |
| 10      | Review how to use the hand as a measurement guide                        | Behavioral skills, observational learning                                  |
| 15      | Practice writing down everything eaten for your last meal                 | Self-efficacy, behavioral skills                                           |
| 5       | Set a healthy eating goal                                                 | Intentions                                                                |

### Lesson 5: Beverages

| Minutes | Activities                                                                 | Constructs                                                                 |
|---------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 10      | Engage students in an interactive discussion on beverages                 | Knowledge                                                                  |
| 5       | Discuss how water and nutrient-dense beverages can meet the body’s needs | Knowledge, self-efficacy                                                  |
| 30      | Guess the sugar content of various beverages and practice finding the sugar content on a nutrition label | Observational learning, behavioral skills |

### Lesson 6: Cooking

| Minutes | Activities                                                                 | Constructs                                                                 |
|---------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 10      | Discuss current practices for preparing food at home                      | Self-efficacy, social support                                             |
| 20      | Practice making a healthy snack                                           | Behavioral skills, observational learning, collective efficacy            |
| 15      | Conduct a tasting session                                                 | Observational learning, self-efficacy, intentions                         |
using MAXQDA software (VERBI Software, 2019). One researcher (AWB) coded all transcripts, and a second coder (LR) separately coded seven (21%) of the transcripts. Discrepancies were resolved through discussion among the coders and a third member of the research team (HLG) during team meetings. Interrater reliability was determined by percent agreement (92%) and Cohen’s kappa (0.9) (Cohen, 1960). Segmented data were extracted to matrices, and coded segments were analyzed to examine intervention acceptability, perceived benefits, and unintended consequences, as well as context regarding diet history, family support, food environment, and COVID-19.

Results

Virtual Format

All participants reported that the intervention format was acceptable, although one missed four lessons due to trouble accessing Microsoft Teams on a Chromebook. Parents and adolescents reported that the virtual format was convenient and comfortable, especially during the COVID-19 pandemic. An 18-year-old male said, “It’s good since I’m used to it with my other group.” A parent of a 15-year-old male said the virtual format saved time: “I think that kids have gotten more used to it, and we’re all more comfortable in it. And that you can do a 45-min session. It’s really only 45 min. It’s not an hour and a half.” Another parent mentioned that the virtual format was the reason she participated. She described how nutrition gets pushed aside when there are competing priorities:

I think I participated because it was online…we have so many therapies and so many things going on that it’s not that nutrition is not a priority but in the list of the things that you need to do, that you got to have a behavior analyst, you got to have the neurologist, the psychiatrist, the occupation therapist, the physical therapy. So, nutrition… you balance that, you say, “That can wait. That can wait.” – Parent of a 12-year-old male

Parents also described that the virtual format allowed them to have a sense of control over their children’s behavior. As one parent of a 16-year-old male described, “It is
beneficial because I am very comfortable with whether his behavior needs to be controlled or not, I’m right here…I don’t have to worry about him being in a situation that I have to go fix later.”

Dislikes regarding the virtual format included excess screen time, mentioned by one parent, and technical barriers regarding Microsoft Teams, mentioned by one adolescent and his parent. One parent expressed concern with her son being “on overload” with screen time:

If things were normal, he’d be going to school every day and then he’d have this when he got home. So, I think some days, it’s just he’s on overload and just over it, but he made it through quite few of them till the end. – Parent of a 12-year-old male

**Group Setting**

Many parents reported that the group setting allowed their children to see other students’ role modeling healthy behaviors, which aligns with the SCT construct of observational learning, or learning through observing others’ behaviors and their consequences (Glanz et al., 2015). In particular, parents mentioned seeing other students try new foods and talk about healthy eating. One parent described beneficial “peer pressure”:

Like if I tell him to try something, you know, “It is mom telling me to try something,” whereas if he is going to a class, and the other kids are all trying it. I think the peer pressure, but in a good way, I think it is helpful, which is one of the reasons I signed him up for the class, to see other kids are trying things, they try, you know, to eat different things. – Parent of a 14-year-old male

A parent of a 16-year-old male mentioned that students might feel isolated when they can’t see each other: “I think they also like to see each other. Like, ‘I don’t like this,’ or ‘It doesn’t feel like that,’ and ‘They have tried this.’ They don’t feel so isolated and unique sometimes.”

**Autonomy/Independence**

Parents mentioned that the intervention fostered independence and provided opportunities for their children to develop autonomy related to healthy eating behaviors. This finding was especially prevalent in parents of adolescents aged 15 and older. A parent of a 16-year-old male described, “I feel like [he] was really happy. At that time, I have classes scheduled at the same time, and I cannot be with him or prompting him to join all the time. He was in his own accord joining.” A parent of a 19-year-old female mentioned that her daughter was able to maintain independence and participate in the lessons on her own: “She was more independent. And again, that’s why I liked the online version because it did allow her to have that bit of independence, which we are really striving for her adult life.”

**Sensory Components**

Adolescents and parents mentioned sensory components as a positive aspect of the intervention, including visual supports and food exposure. The guacamole-making activity in Lesson 6 was described as a positive hands-on experience. One parent described:

The avocado, guacamole, he was so proud of himself when he was done making it. And he loved that, so that was something I had not expected him to be that excited about… I cut the tomato for him because he was a little scared to cut, but he did everything else himself, and he was he was very proud of that. – Parent of a 14-year-old male

Adolescents and parents also reported that they liked the images and colors in the lesson booklet that was mailed for use throughout the intervention. A 13-year-old male said, “the booklet made it interacting.”

Parents described how the visual supports could be improved by including cards or a poster in addition to the lesson booklet. A parent of a 16-year-old male described, “Taking the pages out and cutting them up into little cards. That would be a very nice, you know, tactile, visual reinforcer for him.” A parent of a 13-year-old male said, “I really would’ve liked like some kind of poster… where maybe I could put in my kitchen and write some of the snacks from the cabinet that fall into the different categories to kind of help him make a better choice.”

**Interaction**

Adolescents and parents mentioned that the intervention offered opportunities for interaction and socialization. As one parent of a 16-year-old male described, “I was really happy because he even took it like a time for socializing with other children. That was something that I was not anticipating and was totally unexpected and really beneficial for them.” One adolescent and two parents and reported that they would have liked more interaction. One adolescent said:

One thing that I was hoping to get in here was to interact, and, which I sort of kind of got it. That’s sort of what we did. I’d rather do that than get COVID, for me, anyway. I just don’t feel like I, we did enough of it, in my opinion. – 14-year-old male

**Reinforcement**

Parents discussed reinforcement, a SCT construct referring to provision or removal of rewards or punishments to
increase or attenuate a behavior (Glanz et al., 2015), with
to homework. One parent of a 14-year-old male described, “I think it made them more invested and com-
mittet. And for us anyway, it allowed him to think inde-
pendedly and applied some of the knowledge in refreshers 
that he had into everyday life.” While the homework was 
described as reinforcing by most parents, two parents of 
12-year-olds mentioned that homework was a burden. One 
parent described, “You need to realize that it is not home-
work for the kids, that it is homework for mom.”

Parent Component

While most parents had positive feedback about the parent 
handouts, webinar feedback was mixed. Parents reported that 
the weekly handouts allowed them to stay updated on what 
was covered in the lessons. One parent described:

I did look at them all, and I thought they were benefi-
cial because since [he] was taking the iPad out of the 
room, I wasn’t participating in the class, except for the 
one time when I helped with food. But I think those 
were good because it gave us an update on what was 
covered and everything. – Parent of a 12-year-old male

Some parents mentioned that shorter and/or asynchro-
nous parent sessions would be better than webinars. Two 
parents recommended that parents join the virtual platform 
for 10–15 min after each lesson to review and plan for the 
following week. Two other parents suggested having pre-
recorded sessions for parents to watch at their convenience. 
A parent of a 17-year-old female said, “A little bit more 
asynchronous as opposed to live will probably be helpful. 
It will at least allow me to budget my time and be there at 
whatever time I can jump into it.”

Diet Changes

Self-regulation was an emergent theme regarding diet 
changes after participating in BALANCE. An 18-year-old 
male mentioned that he had been eating less since particip-
ing in BALANCE. He said, “I’ve been eating less. I was 
eating a whole lot more before joining this.” Parents also 
reported that their children were eating smaller portions or 
talking about balancing out energy-dense food choices with 
nutrient-dense choices. As a parent of a 17-year-old female 
mentioned, “She’s had more of a feel for leaving stuff on her 
plate when she was done and not overstuffing herself and 
even saying no to some things.” Another parent mentioned 
that she noticed several changes in her son’s eating habits:

Instead of reaching for the four slices of pizza, he’s 
only reaching for two, so that’s a pretty drastic change 
for him… If he drinks a sugary drink, he won’t ask for 
dessert later in the day, which is really like a big thing 
for him because usually he’s like – because we don’t 
really do a lot of – it’s all water here, but every now and 
then, we’ll go to the store, and he’ll want one of those 
Arizona Mango cans… if he drinks that, he won’t ask 
for a dessert or cookie… he’s like, “No, I had my tea 
today.” – Parent of a 13-year-old male

Adolescents and parents also discussed an increased will-
ingness to try new foods. A 19-year-old male said, “I tried 
different things. I tried to make this pasta salad.” Some par-
ents mentioned daily changes in fruit or vegetable intake. 
One parent described:

He seems like to eat two apples a day or sometimes 
even more. He didn’t like the texture before, but now, 
I don’t know what happened. It seems like he doesn’t 
mind to eat apples. Just about four weeks ago. And 
every day he eats [apples], so I have to keep buying a 
lot of apples. – Parent of a 17-year-old male

Parents of the youngest adolescents discussed how they 
noticed more subtle changes. For example, one parent said 
that her son seems more willing to try vegetables at dinner:

When I make dinner, I’ll put just a very small bit of 
vegetables on his plate that we’re eating like, a table-
spoon or something, even if I know it’s something he 
doesn’t normally eat. And a lot of times he just doesn’t 
touch it, but since he started this class, he’ll like try 
one bite. And that was without me prompting him. – 
Parent of a 12-year-old male

Knowledge/Awareness

Adolescents and parents reported knowledge and/or aware-
ness related to healthy eating as a benefit of participating 
in BALANCE. Knowledge was the most common benefit 
reported by adolescents. As an 18-year-old male summa-
rized, “It gave me some big brain knowledge about certain 
foods. Big brain knowledge.” One parent described aware-
ness related to mealtimes schedules and environments, which 
were both discussed in Lesson 2:

He’s more aware. At least he comes out and make 
some popcorn or takes a little bit of fruit. He is more 
receptive to the timing when I said, “It’s time to eat.” 
He’s more aware now that he has to eat, while he eats, 
not doing something else and going around here to sit 
with us and eat, and we’re trying to make it the family 
kind of situation, putting the social component and 
enjoying of the meal. – Parent of a 16-year-old male

Parents also discussed knowledge related to portion sizes, 
which was covered in Lesson 4. One parent of a 12-year-old 
male described, “The portion size thing. I forget. One day
he was going like this [making a fist]. We were talking about something and he’s like, ‘This much.’”

**Behavioral Strategies**

Parents discussed an increase in their children’s food preparation skills, which aligns with the SCT construct of behavioral skills (Glanz et al., 2015). Some parents mentioned that their children continued to make guacamole after the activity in Lesson 6. For example, one parent said:

[My daughter] asked me to buy avocado and tomatoes to make – I forgot what it’s called that – guacamole – because I wasn’t making it before…And she makes it herself. She loves it… I would have never thought my daughter would like to eat avocado because she never like to try it before. But since she made it, then it inspired her to taste. And then she liked it, and now she makes it all the time. – Parent of a 14-year-old female

Some parents also mentioned that their children asked to learn new food preparation skills after BALANCE. For example, a parent of a 16-year-old male described, “Because of the program, he asks me sometimes like, ‘How can I cook this? How can I do this?’”.

**Self-efficacy**

When discussing their perceived benefits of BALANCE, adolescents and parents discussed greater confidence related to healthy food choices or food preparation, which aligns with the SCT construct of self-efficacy (Glanz et al., 2015). A 20-year-old male said, “Making guacamole is easy.” A parent of a 17-year-old male said, “I like that he has confidence for his own initiatives, as tonight, ‘I’m going to make dinner.’” Another parent said:

I think that was beneficial, like when you did the little trail mix things or the guacamole, like all those things that are beneficial for her to realize like, ‘Hey, I can throw something together even with a few steps.’” – Parent of a 12-year-old female

**Outcome Expectations**

Outcome expectations (Glanz et al., 2008) were an emergent theme mentioned by some parents in the context of increased importance of healthy eating, as illustrated by the following example:

He seems to be talking more about it and understanding more about, “Maybe I need to make better choices,” not that he does, but I think talking about all of this. He’s on a different mindset, and hopefully, it’ll get better and better. – Parent of a 19-year-old male

**Healthy Weight**

Some parents mentioned weight as a concern, and two parents said that they noticed an improvement in their children’s weight since participating in BALANCE. A parent of a 20-year-old male said, “He looks like he lost weight since the beginning. I don’t know if that’s from the biking or if he’s just watching stuff better.” A parent of a 13-year-old male said, “I think he’s like he lost like three pounds in eight weeks or something like that.”

**Other Lifestyle Changes**

Parents mentioned other lifestyle changes in addition to diet-related changes, including increased physical activity, water intake, and family style meals. One parent described a substantial increase in her son’s physical activity:

He’d just be locked in the video game all day, but he takes lots of breaks now and he spends more time outside on the scooter than he does in his room… [BALANCE is] the only thing I can attribute it to. – Parent of a 13-year-old male

Some parents mentioned that their children have been more focused on staying hydrated, and a parent of a 12-year-old male mentioned that she has been serving more family style meals since her son participated in BALANCE. She said, “Your class made me decide to serve more of our meals family style at the dining table because I usually just fill up the plates myself and hand them out without really thinking about it.”

**Anxiety/Discomfort**

Two parents reported anxiety or discomfort during BALANCE lessons. One parent reported that her son’s discomfort caused him to engage in hair-pulling. He often turned off his webcam to feel more comfortable. His parent described:
Towards the end and maybe say like the last four lessons, he was just, he’d had a lot of like SIB [self-injurious behaviors] where he would kind of like pull his hair or the normal things that we would see during schoolwork. – Parent of a 13-year-old male

A parent of a 12-year-old male mentioned that her son was sometimes too tired to participate. She said, “It was more in the moment, like he’s just too tired, or he had a difficult day, and it’s kind of not over yet and that kind of thing.” Her son left two lessons early because he was stressed. During one lesson, he asked to take a break. When he came back, he said, “Is it okay if I leave early? I’m just not into it today…I just feel too stressed today.”

**Diet History**

Emergent themes regarding children’s diet history included limited diet variety, sensory challenges, and routines and rituals. Some said that their children basically eat the same foods every day. A parent of a 16-year-old male discussed how he allows her son to stick to his limited list of foods because it’s convenient: “[He] has found a very limited list of foods that he will reliably eat and feel like he’s getting something good to eat, and I allow him to continue to have that limited diet because it’s easier for me.”

Parents also discussed their children’s sensory challenges related to food. A parent of a 12-year-old male mentioned how her son goes into a different room when the family orders takeout to avoid smelling the food: “If we get takeout… [he] wants nothing to do with it. He goes in a different room. He doesn’t want to smell it. He doesn’t want to see it.” Parents described challenges related to food textures as well. A parent of a 13-year-old male said, “He has a lot of issues with textures… a lot of times it’s really hard for him to try new food.”

Additionally, parents described their children’s routines and rituals involving food. One parent described how her son likes to have his pizza cut a certain way:

> I will make sure like he has his pizza. He likes it chopped into 16 pieces, and then we will place it on the table for him, make sure he’s got a fork and a napkin, and if he asks to have a drink, he’s got to get his own drink. – Parent of a 16-year-old male

**Food Environment**

The most common theme regarding the food environment was parent control, including parents restricting or allowing access to certain foods. A parent of an 18-year-old male reported that she locks away her son’s preferred foods so that they are not readily accessible. She said, “I have all the snacky stuff locked in my closet, so there’s nothing out for him to get.” Parents also described how they only keep certain types of foods and beverages in the home, such as organic options. As one parent of a 19-year-old female described, “We don’t do soda. We don’t do colors in our foods. We don’t do artificial sweeteners…there’s not a lot of other things present in our household because we just don’t eat that way.”

Cost and lack of time were reported as barriers to maintaining a healthy food environment. When describing the home food environment, a parent of a 16-year-old male said that she limits her son’s fruit intake due to cost. She said, “He does love fruit. He will eat three apples a day if we let him, but then apples get expensive when you’re eating three a day, so he gets in trouble for eating all the apples.”

Regarding lack of time, several parents discussed how ordering pizza was part of their routine because it was convenient. As one parent described:

> We order very often, especially since, because I work. When I work, I work 24 hours, so I’m not here for an entire day, so especially then it’s super easy for my husband to just order pizza, you know what I mean? – Parent of an 18-year-old male

Most adolescents and parents reported eating most of their food at home due to COVID-19 restrictions, but some parents discussed the out-of-home food environment as a hindrance to healthy eating. A parent of a 16-year-old male discussed how the community food environment offers similar challenges: “He goes outside and walks the dog, and neighbors are like, ‘Hey, we had a party, you want six Pepsis?’ So just, how do I curtail that?” A parent of a 17-year-old female reported that his daughter had been making worse food choices when she was attending school in person: “She wasn’t making the best choices… I would think that there can be a little bit more control over that, but there isn’t. She’s getting the Rice Krispies bar every day and anything fried stuff for lunch.”

**Family Support**

Family support was another emergent theme regarding children’s eating habits. Some parents reported teaching their children how to prepare food. One parent discussed how she encourages her son to take on food preparation tasks to help him build independence:

> We’re trying to get him more independent. A lot of times I try to stop myself and say, “Okay, well, he can do this,” or, “Here, [son], here, use… whatever it is.” A lot of times, it’s a frozen something. “You know how to use the oven. You go ahead.” And I’ll help him put it to 350…So probably two-thirds of the time, we’re
making it for him, but then one-third, he does himself.
– Parent of an 18-year-old male

Some parents described family members as positive or negative role models for their children. A parent of a 17-year-old female said, “Her sister’s like an athlete. She eats very healthy food, so she sets a really good example.” On the other hand, some parents mentioned that they were interested in BALANCE because they felt that they were not positive role models or did not have the knowledge to support their children’s eating habits. One parent said:

I wanted him to learn something about nutrition because I’m not a great role model. So, I was hoping maybe he can, and I can learn too, and we can learn together, and he can…want to do a little more, be a little out there because he would ask stuff and sometimes I didn’t have an answer for him. – Parent of a 12-year-old male

Changes Due to COVID-19

Adolescents and parents described eating more food at home due to the COVID-19 pandemic, including snacks, homemade meals, and takeout or delivery. Many adolescents reported not going out to eat due to COVID-19. An 18-year-old male explained, “I don’t really go out with my parents, because again, virus detected.” Parents also mentioned increased problematic eating behaviors. A parent of a 19-year-old male said, “At school, he would have options to various foods to look at, and he would seem to maybe try something, where at home, he’s not eager to do that…Now, maybe we’ve taken a few back steps since COVID.”

Regarding the family’s eating habits, parents reported increased attention to healthy eating. While some participants mentioned getting takeout and/or fast food more often, many reported making more food at home. A parent of a 19-year-old male said, “Maybe two days a week, it would be something from home, and the rest something out.” In contrast, a parent of a 15-year-old male reported that her family increased home cooking:

We’ve just made healthier choices overall as a family and trying to also be able to sit down and have a family meal, where before the pandemic, we were running like, soccer game, food, and all of this kind of stuff.
– Parent of a 15-year-old female

Parents also reported that their children’s physical activity habits changed due to the pandemic. Many adolescents and parents expressed frustration or unhappiness over structured physical activity opportunities being canceled. One parent mentioned:

We already led an isolated lifestyle, but we did count on those outside activities occasionally to be things that would kind of keep us going. At first, through-out the summer, for example, he was taking a karate class and that of course, got canceled, and then they were doing the karate online. We learned how to do it online, and that that kind of worked out okay, but definitely, he vocalized a lot of, I wouldn’t say frustration, but just unhappiness about it. – Parent of a 16-year-old male

Some adolescents and parents reported an increase in outdoor physical activity. A parent of a 16-year-old male described, “We have been more consciously making an effort to go outside and go for that walk, and he’s willing to do that because it allows him to get out and see what’s going on.” One 19-year-old female said, “I like to go see wild pigs in my neighborhood.”

Parents also reported that their children increased their screen time for school, appointments, socialization, and entertainment as a result of the pandemic. One parent described:

He is constantly on screens. Part of it is because of school, so he does not get the break for school since he is in online school, so he is literally from the time he wakes up – and he does not sleep well, never has – until probably nine o’clock at night he is somehow in some way on a screen. – Parent of a 14-year-old male

Additionally, parents reported that part of their children’s increased screen time has been due to gaming, instant messaging, and video conferencing for socialization. For example, a parent of a 14-year-old male described, “screen time has definitely increased, obviously due to schooling online, but also video game time substantially just because he has no other contact with his peers other than online gaming.”

Some parents discussed mental health implications of the pandemic. Two mentioned that their children had anxiety about potential exposure to COVID-19. One parent of a 12-year-old male summarized, “He just doesn’t want to go places because of COVID where he could be exposed.” Parents also expressed concern over canceled social opportunities and jobs. One parent discussed how her son lost his job because of the pandemic:

He had a job at a restaurant and unfortunately due to COVID, not once but two jobs, they could not keep him right now… He wants to get a job, and [he] likes to be busy, and he likes to be around people. We’re just waiting. – Parent of a 19-year-old male

In contrast, one parent reported that staying home due to COVID-19 restrictions has improved her daughter’s emotional regulation:

The pandemic has really helped because it calmed all of our lives… I have four kids, so it calms our life down, and her, what I saw from her, was just that calmness
helped her better be able to regulate her emotions and be able to get her behaviors under control better because she didn’t have all these competing forces and having to constantly switch. – Parent of a 15-year-old female

**Similarities and Differences Among Parents and Adolescents**

Parents and adolescents described that the virtual setting was convenient and comfortable and cited the interactive setting and sensory components as favorable aspects of the intervention. Parents also discussed autonomy and reinforcement when describing what they liked about the intervention. Although few participants mentioned negative aspects of the virtual setting, technical barriers and/or anxiety/discomfort were mentioned by parents (n = 3) and adolescents (n = 2). Parents and adolescents discussed the same SCT-related constructs (e.g., self-efficacy, knowledge/awareness) when discussing perceived benefits of the intervention, but parents gave more detail regarding behavioral strategies, outcome expectations, and outcome expectancies. Parents and adolescents discussed diet changes, while parents expanded on other lifestyle changes and healthy body weight. Although parents provided more context on diet history, food environment, family support, and changes due to COVID-19, these contextual themes were highlighted by adolescents as well.

**Discussion**

Many elements of BALANCE are appropriate according to adolescents and their parents and may be incorporated into future virtual programs and services for this population. Participants reported that they were comfortable with the virtual format and the interactive group setting. These findings are consistent with previous research suggesting that telehealth service delivery is equivalent or better to face-to-face delivery for youth with ASD (Ellison et al., 2021; Sutherland et al., 2018). Another recent virtual nutrition intervention for adolescents with ASD also indicated that participants enjoyed the virtual format (Shurack et al., 2021). The inclusion of multiple reinforcing components (e.g., weekly lessons, parent handouts and webinars, and homework activities) was perceived favorably. Prior research has indicated that successful nutrition education interventions for youth include multicomponent, age-appropriate approaches (Murimi et al., 2018). Parents of adolescents 15 years and older emphasized the importance of autonomy/independence. Additional activities for older adolescents may focus on food preparation and safety, grocery shopping, and meal ideas. As parents of 12-year-olds reported that homework was a burden, the homework may be simplified or eliminated for younger adolescents. The parent component may also be further developed based on parents’ feedback. Parents suggested having more visual reinforcers and shorter and/or asynchronous parent videos.

Many adolescents and parents mentioned diet changes and several themes that align with SCT constructs, including knowledge/awareness, behavioral strategies, self-efficacy, outcome expectations, and outcome expectancies, as perceived benefits of BALANCE. As youth with ASD exhibit food selectivity, or consumption of a narrow range of foods (Bandini et al., 2010; Cermak et al., 2010; Mari-Bauset et al., 2014; Schreck et al., 2004; Sharp et al., 2018), willingness to try new foods is an especially important factor in improving healthy eating behaviors for this population. Parents in our study noted that their children exhibited an increased willingness to try fruit and vegetables in particular after participating in BALANCE. Many parents reported that their children were making changes on their own, while one parent reported that her son might be more willing to try new foods if prompted rather than on his own. Although participants were not asked specifically about SCT constructs, adolescents and parents mentioned knowledge/awareness, behavioral strategies, self-efficacy, outcome expectations, and outcome expectancies. These qualitative findings confirmed the significant pre-/post-intervention mean differences detected for behavioral strategies (p = 0.010), self-efficacy (p < 0.001), and outcome expectations (p = 0.009) in our quantitative assessment (Buro et al., 2021) and indicated that BALANCE shows promise at improving some psychosocial determinants of dietary intake. These results are also consistent with findings of the other recent virtual nutrition education intervention for adolescents with ASD; parents reported via close-ended survey responses that the intervention improved their children’s knowledge and eating habits (Shurack et al., 2021).

Findings also pointed to environmental factors that warrant further investigation and consideration in nutrition interventions for this population. The home food environment is a key factor in driving children’s dietary behaviors and weight status (Rosenkranz & Dzewaltowski, 2008), and our findings indicated that many families are eating more food at home during the pandemic. Parent control regarding food access or restriction was commonly discussed. Although the BALANCE intervention focuses on adolescents as agents of change, parenting practices can influence eating behaviors, particularly among younger adolescents (aged 10–14 years) (Reicks et al., 2015), and parents may exhibit increased use of restriction, pressure to eat, and monitoring during the COVID-19 pandemic (Adams et al., 2020). Family support should be further operationalized and measured. Some parents felt ill-equipped to support their children, suggesting a need for nutrition education and guidelines for parents of adolescents with ASD. Future research may investigate parent, sibling, and whole family support for healthy eating behaviors among adolescents with ASD, and professionals...
who work with youth with ASD may want to ensure that parents and families play an appropriate role in service delivery to encourage positive dietary behaviors for their children.

Limitations and Future Research

This study was limited by its sample composition, low attendance for focus groups, and data collection methodology. The data collection methods pose potential for social desirability bias, as interviews and focus groups were conducted by the individual who implemented the intervention. However, neutral phrases were used in an effort to reduce bias, and intrarater reliability was determined with a research assistant who was not involved in implementation. The low attendance of adolescent focus groups is also a limitation. In-depth interviews or exit surveys may be helpful in future research to gather richer data from adolescents. The study was further limited by the heterogeneous sample. Groups were determined based on participants’ weekly availability rather than age or ASD severity level. Although the live implementation allowed for personalized feedback and tailoring throughout the lessons, future studies may tailor the activities for more specific age groups, e.g., prioritizing topics and activities to encourage autonomy for adolescents aged 15 years and older. Intervention sessions may also be rescheduled rather than sending make-up videos to ensure that participants benefit from the interactive setting.

Acknowledgements We would like to thank all adolescents and parents who participated in this research.

Author Contribution AWB designed and executed the study, collected and analyzed data, and wrote the paper. HLG, RSK, JM, and JH collaborated with study design and reviewed the manuscript. HLG helped with study execution. LR analyzed data and reviewed the manuscript. All authors approved the final version of the manuscript for submission.

Funding This work was funded by the University of South Florida College of Public Health Internal Grant and the University of South Florida College of Public Health Student Research Scholarship. AWB is currently supported by the National Cancer Institute Behavioral Oncology Education and Career Development Grant (T32CA090314, MPis Vadaparambil/Brandon).

Declarations

Ethics Approval The study was conducted according to the criteria set by the Declaration of Helsinki and was approved by the University of South Florida Institutional Review Board.

Informed Consent Informed consent/assent was obtained from each participant following procedures approved by the University of South Florida Institutional Review Board.

Conflict of Interest The authors declare no competing interests.

References

Adams, E. L., Caccavale, L. J., Smith, D., & Bean, M. K. (2020). Food insecurity, the home food environment, and parent feeding practices in the era of COVID-19. Obesity, 28(11), 2056–2063. https://doi.org/10.1002/oby.22996

Ajie, W. N., & Chapman-Novakofski, K. M. (2014). Impact of computer-mediated, obesity-related nutrition education interventions for adolescents: A systematic review. Journal of Adolescent Health, 54(6), 631–645. https://doi.org/10.1016/j.jadohealth.2013.12.019

American Psychiatric Association. (2013). Diagnostic and Statistical Manual of Mental Disorders (5th ed.). American Psychiatric Publishing.

Bandini, L. G., Anderson, S. E., Curtin, C., Cermak, S., Evans, E. W., Scampini, R., Maslin, M., & Must, A. (2010). Food selectivity in children with autism spectrum disorders and typically developing children. The Journal of Pediatrics, 157(2), 259–264. https://doi.org/10.1016/j.jpeds.2010.02.013

Bandura, A. (1989). Human agency in social cognitive theory. American Psychologist, 44(9), 1175–1184. https://doi.org/10.1037/0003-066X.44.9.1175

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., Clarke, V., Hayfield, N., & Terry, G. (2019). Thematic analysis. In P. Lamping (Ed.), Handbook of Research Methods in Health Social Sciences (pp. 843–860). Springer.

Buro, A. W., Gray, H. L., Kirby, R. S., Marshall, J., Strange, M., Pang, T., Hasan, S., & Holloway, J. (2021). Feasibility of a virtual nutrition intervention for adolescents with autism spectrum disorder. Autism. https://doi.org/10.1177/13623633211051150

Buro, A. W., Gray, H. L., Kirby, R. S., Marshall, J., Strange, M., Hasan, S., & Holloway, J. (2022). Pilot study of a virtual nutrition intervention for adolescents and young adults with autism spectrum disorder. Journal of Nutrition Education and Behavior, 54(9), 853–862. https://doi.org/10.1016/j.jneb.2022.01.008

Buro, A. W., Gray, H. L., Kirby, R. S., Marshall, J., & Van Arsdale, W. (2022). The BALANCE nutrition education intervention for adolescents with ASD: A formative study in a school setting. Research in Autism Spectrum Disorders, 91, 101912. https://doi.org/10.1016/j.rasd.2021.101912

Cermak, S. A., Curtin, C., & Bandini, L. G. (2010). Food selectivity and sensory sensitivity in children with autism spectrum disorders. Journal of the American Dietetic Association, 110(2), 238–246. https://doi.org/10.1016/j.jada.2009.10.032

Cohen, J. (1960). A coefficient of agreement for nominal scales. Educational and Psychological Measurement, 20, 37–46. https://doi.org/10.1177/0016046600200104

Curtin, C., Joric, M., & Bandini, L. G. (2014). Obesity in children with autism spectrum disorder. Harvard Review of Psychiatry, 22(2), 93–103. https://doi.org/10.1097/HRP.000000000000031

de Nocker, Y. L., & Toulan, C. K. (2021). Using telehealth to provide interventions for children with ASD: a systematic review. Review Journal of Autism and Developmental Disorders, 1–31. https://doi.org/10.1007/s40489-021-00278-3

Dhalival, K. K., Orsso, C. E., Richard, C., Haqq, A. M., & Zwaigenbaum, L. (2019). Risk factors for unhealthy weight gain and obesity among children with autism spectrum disorder. International Journal of Molecular Sciences, 20(13), 3285. https://doi.org/10.3390/ijms20133285

Domínguez Rodríguez, A., Cebolla Marti, A. J., Oliver-Gasch, E., & Baños-Rivera, R. M. (2016). Online platforms to teach nutrition education to children: a non-systematic review. Nutricion Hospitalaria, 33(6), 1444–1451. https://doi.org/10.20960/nh.808
Ellison, K. S., Guidry, J., Picou, P., Adenuga, P., & Davis, T. E. (2021). Telehealth and autism prior to and in the age of COVID-19: A systematic and critical review of the last decade. Clinical Child and Family Psychology Review, 24(3), 599–630. https://doi.org/10.1007/s10567-021-00358-0

Friedemann, C., Heneghan, C., Mahtani, K., Thompson, M., Perera, R., & Ward, A. M. (2012). Cardiovascular disease risk in healthy children and its association with body mass index: Systematic review and meta-analysis. BMJ, 345, e4759. https://doi.org/10.1136/bmj.e4759

Glanz, K., Rimer, B., & Viswanath, K. (2008). Health behavior and health education: Theory, research, and practice. John Wiley & Sons.

Glanz, K., Rimer, B., & Viswanath, K. (2015). Health behavior: Theory, research, and practice. John Wiley & Sons.

Goran, M. I., Ball, G. D. C., & Cruz, M. L. (2003). Obesity and risk of type 2 diabetes and cardiovascular disease in children and adolescents. The Journal of Clinical Endocrinology and Metabolism, 88(4), 1417–1427. https://doi.org/10.1210/jc.2002-01442

Gray, H. L., Pang, T., Agazzi, H., Shaffer-Hudkins, E., Kim, E., Miltenberger, R. G., Waters, K. A., Jimenez, C., Harris, M., & Stern, M. (2022). A nutrition education intervention to improve eating behaviors of children with autism spectrum disorder: Study protocol for a pilot randomized controlled trial. Contemporary Clinical Trials, 119, 106814. https://doi.org/10.1016/j.cct.2022.106814

Hazen, E. P., Stornelli, J. L., O’Rourke, J. A., Koesterer, K., & McDougle, C. J. (2014). Sensory symptoms in autism spectrum disorders. Harvard Review of Psychiatry, 22(2), 112–124. https://doi.org/10.1097/HRP.0000000000000143

Kahathudawa, C. N., West, B. D., Blume, J., Dharavath, N., Moustaid-Moussa, N., & Mastergeorge, A. (2019). The risk of overweight and obesity in children with autism spectrum disorders: A systematic review and meta-analysis. Obesity Review, 20(12), 1667–1679. https://doi.org/10.1111/obr.12933

Koch, P., & Contento, I. (2011). Food day school curriculum: classroom lessons to transform youth and their communities. Teachers College Columbia University, Program in Nutrition and Center for Food & Environment; https://d3n8aipro7vhm.cloudfront.net/foodday/pages/24/attachments/original/1341610970/Food_Day_School_Curriculum_2012_NO BRAND.pdf. Accessed January 21, 2022.

Mari-Bauset, S., Zazpe, I., Mari-Sanchis, A., Llopis-González, A., & Morales-Suárez-Varela, M. (2014). Food selectivity in autism spectrum disorders: A systematic review. Journal of Child Neurology, 29(11), 1554–1561. https://doi.org/10.1177/0883073813498821

Matthews, N. L., Skepnek, E., Mammen, M. A., James, J. S., Malligo, A., Lyon, A., Mitchell, M., Kiefner, S. L., & Smith, C. J. (2014). Feasibility and acceptability of a telehealth model for autism diagnostic evaluations in children, adolescents, and adults. Autism Research, 14(12), 2564–2579. https://doi.org/10.1002/aur.2591

Murimi, M. W., Moyeda-Carabaza, A. F., Nguyen, B., Saha, S., Amin, R., & Njike, V. (2018). Factors that contribute to effective nutrition education interventions in children: A systematic review. Nutrition Reviews, 76(8), 553–580. https://doi.org/10.1093/nuetr/nuy020

Must, A., Eliasziw, M., Phillips, S. M., Curtin, C., Kral, T. V. E., Segal, M., Sherwood, N. E., Sikich, L., Stanish, H. L., & Bandini, L. G. (2017). The effect of age on the prevalence of obesity among US youth with autism spectrum disorder. Childhood Obesity, 13(1), 25–35. https://doi.org/10.1089/chi.2016.0079

Perry, C. L., Sellers, D. E., Johnson, C., Pedersen, S., Bachman, K. J., Parcel, G. S., Stone, E. J., Luepker, R. V., Wu, M., Nader, P. R., & Cook, K. (1997). The Child and Adolescent Trial for Cardiovascular Health (CATCH): Intervention, implementation, and feasibility for elementary schools in the United States. Health Education and Behavior, 24(6), 716–735. https://doi.org/10.1177/109019819702400607

Polfuss, M., Johnson, N., Bonis, S. A., Hovis, S. L., Apollon, F., & Sawin, K. J. (2016). Autism spectrum disorder and the child’s weight-related behaviors: A parents’ perspective. Journal of Pediatric Nursing, 31(6), 598–607. https://doi.org/10.1016/j.pedin.2016.05.006

Reicks, M., Banna, J., Cluskey, M., Gunther, C., Hongu, N., Richards, R., Topham, G., & Wong, S. S. (2015). Influence of parenting practices on eating behaviors of early adolescents during independent eating occasions: Implications for obesity prevention. Nutrients, 7(10), 8783–8801. https://doi.org/10.3390/nu7105431

Rosenkranz, R. R., & Dzewaltowski, D. A. (2008). Model of the home food environment pertaining to childhood obesity. Nutrition Reviews, 66(3), 123–140. https://doi.org/10.1111/j.1753-4887.2008.00017.x

Sam, A. M., Cox, A. W., Savage, M. N., Waters, V., & Odom, S. L. (2020). Disseminating Information on evidence-based practices for children and youth with autism spectrum disorder: AFIRM. Journal of Autism and Developmental Disorders, 50(6), 1931–1940. https://doi.org/10.1007/s10803-019-03945-x

Schreck, K. A., Williams, K., & Smith, A. F. (2004). A comparison of eating behaviors between children with and without autism. Journal of Autism and Developmental Disorders, 34(4), 433–438. https://doi.org/10.1023/B:JADD.0000037419.78531.86

Sekhon, M., Cartwright, M., & Francis, J. J. (2017). Acceptability of healthcare interventions: An overview of reviews and development of a theoretical framework. BMC Health Services Research, 17(1), 88. https://doi.org/10.1186/s12913-017-2031-8

Sharp, W. G., Berry, R. C., McCracken, C., Nuhu, N. N., Marvel, E., Saulnier, C. A., Klin, A., Jones, W., & Jaquess, D. L. (2013). Feeding problems and nutrient intake in children with autism spectrum disorders: A meta-analysis and comprehensive review of the literature. Journal of Autism and Developmental Disorders, 43(9), 2159–2173. https://doi.org/10.1007/s10803-013-1771-5

Sharp, W. G., Postorino, V., McCracken, C. E., Berry, R. C., Criado, K. K., Burrell, T. L., & Scahill, L. (2018). Dietary intake, nutrient status, and growth parameters in children with autism spectrum disorder and severe food selectivity: An electronic medical record review. Journal of the Academy of Nutrition and Dietetics, 118(10), 1943–1950. https://doi.org/10.1016/j.jand.2018.05.005

Shurack, R. H., Garcia, J. M., Brazendale, K., & Lee, E. (2021). Brief report: Feasibility and acceptability of a remote-based nutrition education program for adolescents with autism spectrum disorder: A COVID-19 pilot study. Journal of Autism and Developmental Disorders, https://doi.org/10.1007/s10803-021-05301-4

Stavridou, A., Kapsali, E., Panagouli, E., Thirios, A., Polychronis, K., Bacopoulou, F., Psaltopoulou, T., Tsolia, M., Sergentanis, T. N., & Tsitsika, A. (2021). Obesity in children and adolescents during COVID-19 pandemic. Children, 8(2), 135. https://doi.org/10.3390/children8020135

Sutherland, R., Trembath, D., & Roberts, J. (2018). Telehealth and autism: A systematic search and review of the literature. International Journal of Speech-Language Pathology, 20(3), 324–336. https://doi.org/10.1080/17549507.2018.1465123

VERBI Software. (2019). MAXQDA 2019 [Computer software].

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor holds exclusive rights to this article under applicable law.