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The feasibility of using the application developed to operationalize the Global Diet Quality Score in Ethiopia

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Abstract

Background The Global Diet Quality Score (GDQS) application is an electronic data collection tool developed to provide a standard, easy-to-use method for collecting low-cost, time-relevant data on diet quality.

Objective To assess the feasibility and ease-of-use of the GDQS application and associated set of 3D cubes used as visual aids to assist the respondent with estimating amounts consumed at the food group level.

Methods The study was conducted in August 2021 in two regions of Ethiopia with varied dietary practices. Face-to-face interviews were conducted in Amharic and Somali by 10 enumerators among 120 women to collect dietary data using the GDQS application. Feedback on each completed interview was collected from both the respondent and enumerator. Enumerators also participated in focus group discussions.

Results Enumerators rated the GDQS application as easy to use after 85.8% of the interviews completed. They identified the automatic provision of food-specific probes to guide the interview, the automatic classification of reported foods, beverages, and ingredients into the corresponding GDQS food groups, and the ability to work offline as the main advantages of the application. Most respondents (78.3%) did not find it difficult to choose the cube that corresponded to the amount of each food group they reported consuming. Respondents' feedback on the open recall of all foods, beverages and mixed dishes consumed the previous day and the use of 3D cubes was mostly positive.

Conclusion The results suggest that the GDQS application and cubes were easy to use and feasible for collecting data on diet quality in a low-income country setting.

Keywords Diet quality, Global Diet Quality Score application, Feasibility study, Ethiopia

Introduction

Poor diet quality is a direct cause of undernutrition, a risk factor for noncommunicable disease (NCD), and responsible for approximately 20% of preventable mortalities worldwide [1]. Nevertheless, until recently there were no simple, standard, and validated metrics for monitoring diet quality across populations [2, 3]. In 2021, a team of international investigators and collaborators developed the Global Diet Quality Score (GDQS), a novel metric of diet quality [4].

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Unlike most existing metrics, the GDQS was designed to be sensitive to diet-related outcomes associated with undernutrition and overnutrition. The GDQS is an entirely food-based metric and therefore does not require the use of a food composition table for analysis. Quantity of consumption data at the food group level is used in the scoring of the metric, which is an innovation from other simple metrics used for dietary assessment that helps to improve the performance of the metric [4]. The GDQS is appropriate for use globally and has been validated among non-pregnant and non-lactating women and men 15 years and older [5–13] and among children 2–14 years of age [14]. Research to validate the GDQS for pregnant and lactating women is currently underway.

The GDQS application was developed by *Intake* – Center for Dietary Assessment at FHI 360 to provide a simple tool for collecting the dietary data needed to tabulate the GDQS [15]. The GDQS application has been designed to overcome known operational challenges associated with collecting high-quality population-based dietary data. It provides a standard, easy-to-use method for collecting low-cost, time-relevant data on diet-related metrics across different countries and contexts.

The GDQS application uses an open recall method to capture all foods, beverages and mixed dishes consumed by the respondent during the 24-hour reference period. It eliminates food group classification burden and error by incorporating into the application an extensive database of foods and ingredients consumed globally, pre-classified into their corresponding GDQS food groups. The GDQS application is used in conjunction with a set of 10 3D plastic cubes used as visual aids to assist the respondent with estimating the total quantity (i.e., volume) consumed at the food group level during the 24-hour period of reference for the interview. Each of these cubes has been pre-determined in size to reflect the volume that corresponds to a quantity of consumption cut-off (in grams) that is used for a food group to tabulate the GDQS [15].

At the time of the study, the GDQS application had not yet been empirically tested or used in a field setting. Conducting a feasibility study for the new application and the 3D cubes before deploying them more widely is critical to ensuring that both tools not only meet the GDQS data collection needs but are also easy to use and well understood by both enumerators and respondents. This study, carried out in August 2021, aimed to assess the feasibility and ease of using the GDQS application and the 3D cubes in a field setting in Ethiopia and to inform potential areas of improvement for the GDQS application for global use.

Methods

Study setting and participants

This study was conducted in two regions of Ethiopia with diverse dietary practices, namely the Southern Nations, Nationalities and Peoples' Region (SNNPR), which is a primarily agrarian region, and the Somali region, which has a high population of pastoralists. Seven woredas (districts) where Alive & Thrive (A&T) was supporting health facilities to improve the service delivery and quality of maternal nutrition counselling were selected for the study in both regions.

The study design was not intended to generate statistically representative data as we had determined that this was not a necessary condition to obtain the information needed to achieve the overall objective of the study. Twelve enumerators collected data from 120 pregnant women in Amharic and Somali at the local health facilities. Each enumerator collected data from 10 respondents. This allocation of the sample size to enumerators was deemed sufficient to allow for each enumerator to gain enough experience in collecting data using the GDQS application and report back on their experience as users of the application. Respondents were selected purposively. The inclusion criteria for respondents to participate in the study were: currently pregnant, aged 18 years and older, not ill on the day of data collection, not exposed to COVID-19 within the previous two weeks, and not having fasted the day before data collection.

Adaptation of the GDQS application to the local context

To conduct the study in local languages, the GDQS application user interface and database of foods and ingredients integrated into the GDQS application were translated from English into Amharic and Somali languages by a professional translation firm and reviewed by A&T experts.

Data Collection procedures

The GDQS application was administered in face-to-face interviews in Amharic and Somali. After each completed interview, enumerators and respondents completed a feedback questionnaire. At the end of data collection, all enumerators participated in focus group discussions led by *Intake* staff. Data were collected by A&T staff who participated in a four-day virtual training provided by *Intake* staff. The data collection procedures are described in detail below.

The GDQS application administered to respondents

The GDQS application was administered to collect the dietary data needed to tabulate the GDQS. Enumerators used open recalls to collect information on all foods, beverages and mixed dishes consumed the previous day

and night, from the time the respondents woke up to the time they went to bed and did not eat or drink anything more. Enumerators recorded the food, beverage, and ingredient in the application, and the application classified each food, beverage, or ingredient consumed into the corresponding food group automatically using a built-in food database pre-classified into the GDQS food groups. Foods, beverages, and ingredients reported as consumed by the respondent that were missing from the GDQS database were entered by the enumerator and classified manually into the corresponding GDQS food group.

Information about the respondent's quantity of consumption of each GDQS food group was collected using a set of 10 hollow 3D cubes in a range of predetermined sizes. Enumerators physically showed the 3D cubes to the respondent, read back the foods, beverages and ingredients the respondent reported consuming within a given GDQS food group and asked the respondent to estimate the quantity consumed by pointing to the cube that came closest in size to the amount of all foods and beverages combined belonging to the same group. This same procedure was repeated separately for each food group reported as consumed by the respondent (see additional file 1). Details of the GDQS application's procedure for collecting the GDQS data are described elsewhere [15].

Feedback tool administered to respondents

Immediately after completion of data collection using the GDQS application, respondents were asked to provide feedback on the GDQS data collection process. The feedback interviews with the respondents focused on the respondent's individual experience in responding to the GDQS application interview questions, including the respondent's perception of how easy or difficult it was to remember and report all foods, beverages, and mixed dishes that were consumed the previous day and to indicate which cube was the closest in size to the total amount (volume) of all different foods, beverages, and ingredients consumed within each food group (see details in additional file 2).

Feedback tool self-administered to enumerators

After completing the GDQS application and feedback interview with each respondent, enumerators completed a self-administered questionnaire, in which they were asked to describe the ease or difficulty of administering the GDQS application for the interview that had just been completed. As part of this self-administered questionnaire, enumerators were also asked to answer questions related to their perception of the quality of data provided by the respondent in the interview just completed (see additional file 3).

Focus group discussion with enumerators

Two remote focus group discussions (FGDs) were conducted with enumerators via Microsoft Teams following the completion of the data collection in the field. Each FGD involved half of the enumerators ($n=6$) and was facilitated by *Intake* staff. Enumerators were randomly assigned to one of the two focus group sessions. The objective of the FGDs was to obtain enumerators' feedback on their experience of using the GDQS application with respondents. The discussions focused on the enumerators' experience regarding the clarity of enumerator instructions provided in the application, their perception of respondents' understanding of the questions they were asked to respond to through the GDQS application, any challenges that the enumerators observed when the respondents estimated the amount of all foods, beverages and ingredients consumed within a food group, enumerators' feedback on the use of the GDQS application for data collection, and any suggestions for how to improve the GDQS application and the use of the set of 10 cubes for respondent estimation of the amount of each GDQS food group consumed. (see FGD guide in Additional file 4) .

Results

Participants

A total of 120 pregnant women with an average age of 25 years (range 18 to 40 years) were interviewed. Two-thirds (66.9%) were from SNNPR (agrarian region) and the remaining 33.1% from Somali region (pastoral region). Two-thirds of the women (65.8%) did not complete primary school and three-quarters (75.0%) were housewives. Two-thirds of the women (65.8%) had at least one child living in their household.

Diet context

Most women (87.5%) reported that their food consumption the day before the interview was usual in terms of the types and amounts of foods consumed. Only 15 women reported having consumed an unusual diet; reasons included the fasting period just having ended, the previous day being a holiday, and having eaten with friends or relatives. Most respondents (83.3%) prepared their food at their own homes; only 16 reported that someone else in the household prepared their food and four reported that most of their food was prepared at someone else's home.

The results from the feedback interviews with respondents, enumerators' feedback, and FGDs with enumerators were grouped into three themes for reporting study results: feasibility and ease of use of the GDQS application, ease of remembering all the foods, beverages, and

mixed dishes consumed the previous day during the open recall, and feasibility and ease of use of the set of 10 cubes to estimate quantities consumed at the food group level.

Feasibility and ease of use of the GDQS application (enumerator perspective)

Most respondent interviews were reported by enumerators as " easy" or " very easy" (85.8%) to collect data with the GDQS application, only eight interviews (6.7%) were reported as being "difficult " to collect, and none were reported as being "very difficult" (Fig. 1).

Regardless of the rating of the ease of use of the GDQS application, all enumerators were asked to report the most difficult aspect of data collection using the GDQS application (Table 1). Even after probing, across all interviews completed, there were less than 50% of interviews (48.3%) for which no difficulties were reported by enumerators as occurring during the interview. The most reported difficulty by enumerators across the interviews completed was the respondent estimation of amounts consumed using the 3D cubes (24.2%). Some difficulties reported across interviews related directly to the functionality of the GDQS application (5.8%), language translation issues (2.5%), and the process of manually classifying foods, beverages, and ingredients not included in the GDQS database into the corresponding GDQS food group (1.7%). Enumerators reported that their perception of the respondents' understanding of the interview questions was poor in only 3.3% of the total number of interviews completed.

When asked to rate their perception of the quality of the dietary data collected from the respondent using the GDQS application, three-quarters (73.9%) of the completed interviews were reported by enumerators to be of "good" or "excellent" quality. There were only three completed interviews for which enumerators considered the perceived data quality to be "poor" or "very poor" (Fig. 2).

During the FGDs, enumerators described the GDQS application interface as being user-friendly and intuitive. They mentioned several advantages of the GDQS

Fig. 1 Reported ease or difficulty of using the GDQS application for dietary data collection from the perspective of enumerators after each interview (n = 120)

Table 1 Difficulties identified in using the GDQS application to collect data after each interview (enumerator perspective)

	*N**	%
No difficulties were encountered	58	48.3
The use of cubes to estimate amounts	29	24.2
Estimating amounts consumed (unrelated to the use of the cubes)	8	6.7
Issues with the GDQS application functionality	7	5.8
Recalling all foods, beverages, and mixed dishes consumed the previous day (completing the open recall)	5	4.2
Estimating amounts of foods and mixed dishes consumed from shared plates	4	3.3
Respondents' understanding of the interview questions	4	3.3
Language translation issues	3	2.5
Manually classifying food not included in the GDQS database	2	1.7

*Enumerators were allowed to provide more than one answer

Fig. 2 Perceived quality of the dietary data collected from the perspective of enumerators after each interview (n = 120)

application including the ease of the GDQS application installation, its ability to function offline, and fast submission of data when an internet connection was available. Enumerators appreciated that the application provided the necessary probes, which simplified obtaining the necessary details for each food, beverage, and ingredient consumed. Enumerators also appreciated that there was no data entry requirement after the completion of the fieldwork. Other benefits the enumerators mentioned included that there was no need to classify foods, beverages, and ingredients reported into the corresponding GDQS food group and that respondents did not need to understand the GDQS food groups to respond meaningfully to the interview questions. Enumerators appreciated the opportunity to add missing foods and beverages to the GDQS database during data collection and also reported that they were progressively able to collect data faster after gaining experience in collecting data with the GDQS application.

Enumerators noted, however, that the GDQS application had several bugs at the beginning of the data collection, all of which were subsequently fixed. They stressed that the GDQS application lacks a feature for saving foods, beverages, and mixed dishes encountered during data collection to the GDQS database for subsequent interviews. Some challenges were also encountered using the GDQS application in Somali and Amharic due to a lack of enumerator experience in typing these languages using a tablet keyboard. Additionally, in the Amharic version of the application, the list of food types did not appear in alphabetical order.

Enumerators' recommendations for how to improve the GDQS application included extending the GDQS database to be even more comprehensive so more foods, beverages, and ingredients could benefit from automated classification into the correct GDQS food group, listing foods alphabetically in the Amharic version of the GDQS application, and simplifying the interview for rural communities. Enumerators also recommended developing a more extensive job aid with a description of the GDQS food groups and examples to help classify foods, beverages, and ingredients missing from the GDQS database.

Ease of remembering all foods consumed the previous day (respondent perspective)

When asked how easy or difficult it was to remember the foods, beverages, and ingredients consumed the previous day, most respondents (88.3%) reported that they found it "easy" or "very easy". Only three respondents found it "difficult" or "very difficult" to remember all that they consumed the previous day (Fig. 3).

All respondents were asked to report what was easy and difficult to report during the open recall. The following reasons were reported for why it was easy to report foods, beverages, and ingredients consumed: 34 respondents (28.3%) always ate the same foods, 13 (10.8%) ate foods prepared at home, seven (5.8%) found the interview structure helpful, four (3.3%) only ate a few foods, and 62 (51.6%) considered the open recall "simple" (no reason provided). Only six respondents (5%) reported that there was anything difficult about reporting the foods consumed yesterday. When asked what was difficult, two respondents (1.7%) reported that they struggled to remember what they ate, two respondents (1.7%) found it difficult to estimate the amount consumed, one respondent (0.8%) mentioned that the food was prepared as a mixed dish, and one respondent (0.8%) mentioned that she consumed purchased foods.

Ease of remembering the foods, beverages, and ingredients consumed the previous day (enumerator perspective)

Enumerators discussed their experiences using the open recall during the FGDs. They reported that they had not encountered specific difficulties collecting data during the open recall portion of the interview. They commented that their sense was that respondents were able to report everything consumed the previous day. They also mentioned that asking respondents to recall foods consumed by mealtime, as prompted by the GDQS application, was helpful.

Ease or difficulty of using the cubes to estimate amounts consumed (respondent perspective)

More than half of respondents (55%) said it was "very easy" or "easy" to choose the cube that corresponded to the total amount (volume) of foods, beverages, and

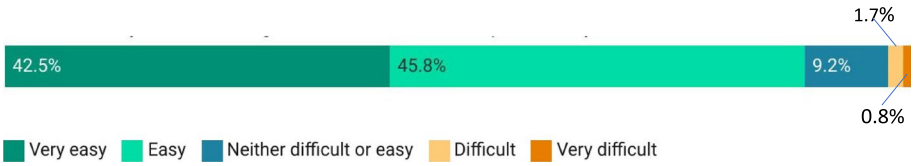

Fig. 3 Ease or difficulty of remembering all foods, beverages, and ingredients consumed the previous day from the perspective of the respondents (n = 120)

ingredients consumed for each GDQS food group. About one-fourth of respondents (23.3%) stated that it was "neither easy nor difficult", while the remaining respondents (21.6%) said it was "difficult" or "very difficult" (Fig. 4).

All respondents were asked to provide open-ended feedback on the ease or difficulty of using the cubes. When probed, most respondents (64.2%) identified one or more challenges with the use of the cubes (Table 2). One-fifth of respondents (20.3%) found it difficult to use certain cube sizes (e.g., the smaller cubes were too small, the size distinction between some cubes was not visible, and some respondents consumed an amount of food that was greater than the largest cubes). Twenty respondents (16.3%) reported that they struggled to use the cubes to estimate the amounts of foods they had consumed, without providing specific reasons. An additional 15 respondents (12.2%) reported that it was difficult to estimate the amounts of specific foods they had consumed. Twelve respondents (9.8%) noted difficulty estimating individual consumption when eating from a shared plate. Four respondents (3.3%) reported that the shapes of the cubes do not correspond to the shapes of foods consumed and/or the shape of utensils used at home. Three respondents (2.4%) mentioned that it was difficult to estimate the amount of ingredients consumed in a mixed dish and one respondent (0.8%) mentioned that it was difficult to estimate the amounts of food consumed outside the home.

When asked whether there was a food or a set of foods for which selecting the cube size was especially difficult, 51 (42.5%) of respondents replied that there was. When asked to describe the types of foods considered difficult to estimate, respondents highlighted foods eaten in large ($n=6$) or small amounts ($n=4$), foods eaten from shared plates ($n=5$), and ingredients of mixed dishes ($n=3$). Examples of foods identified as being difficult to estimate included injera ($n=13$), bread ($n=3$), rice ($n=3$), vegetables ($n=3$), milk ($n=2$), sauces ($n=2$), sugar ($n=2$), kocho ($n=2$), biscuits ($n=1$), and meat ($n=1$).

Almost all respondents were able to report a reason why the cubes were easy to use. Two-thirds of the respondents related the ease of the use of the cubes to a type of food (44.1%) or to a specific food (22.5%) (Table 3). Liquid foods such as milk, juice, and tea ($n=29$), foods eaten in large amounts ($n=8$), solid foods ($n=5$), foods prepared by the respondent herself ($n=3$), and foods eaten in small amounts ($n=1$) were considered easier to relate to a cube. Examples of foods considered easy to estimate included sugar, injera, eggs, rice, potatoes, and biscuits.

One-third of respondents (29.7%) related the ease of the use of the cubes to the property of the cubes; 15 respondents found the largest cubes were especially helpful, nine found it helpful that the cubes were each of a different size, and five mentioned that the cubes are like utensils used in their household.

Most respondents (80.0%) consumed food from a shared plate the previous day. Among the 96 respondents who consumed food from a shared plate, half (49.0%) reported that they found it more difficult to select the cube size for the foods eaten from a shared plate, one-third (34.4%) reported that the level of difficulty was similar as for foods not eaten from a shared plate, and 16.7% found it easier to select the cube size for foods eaten from

Fig. 4 Ease or difficulty of the use of the set of 10 cubes to estimate quantities consumed at the food group level from the perspective of the respondents (n = 120)

Table 2 Most difficult part about selecting the cube size for food group amount consumed (respondent perspective)

	*N**	%
No difficulties were encountered	43	35.0
Using certain cube sizes (e.g., smaller cubes were too small, some cubes were similar)	25	20.3
Using the cubes to estimate amounts consumed (in general)	20	16.3
Using the cubes to estimate amounts of specific foods (e.g., vegetables, injera)	15	12.2
Using the cubes to estimate amounts of foods consumed from shared plates	12	9.8
The cube shape (e.g., different from bowls used to serve foods)	4	3.3
Using the cubes to estimate the amounts of ingredients consumed	3	2.4
Using the cubes to estimate foods prepared outside the home	1	0.8

*Respondents were allowed to provide more than one answer

Table 3 Easiest part about selecting the cube size for food group amount consumed (respondent perspective)

		*N**	%
Nothing was easy		4	3.3
Easy for specific types of foods		**49**	**44.1**
	Liquid foods (e.g., milk, juice)	29	26.1
	Large amounts	8	7.2
	Solid foods	5	4.5
	Prepared own food	3	2.7
	Small amounts	1	0.9
	Other reasons	3	2.7
Easy for specific foods (e.g., sugar, injera, eggs, rice, potatoes, biscuits)		**25**	**22.5**
Easy for reasons related to the cubes		**33**	**29.7**
	Largest cube sizes are helpful	15	12.5
	Cubes have different sizes	9	7.5
	Cubes are similar to household utensils	5	4.2
	There are a limited number of cubes	2	1.8
	Cubes were clearly labelled	1	0.8
	Largest and smallest cube sizes are helpful	1	0.8

*Respondents were allowed to provide more than one answer

a shared plate than for foods not eaten from a shared plate.

Ease of using the cubes to estimate amounts consumed (enumerator perspective)

During the FGDs, enumerators reported that respondents liked the material of the cubes. Respondents could point at a cube, but respondents with poor literacy often needed additional guidance and time to understand the instructions. The smaller cubes were not considered useful by several respondents because they were perceived as too small, and some respondents attempted to select a cube size that was in between two cube sizes (which is not allowed).

Enumerators felt that it was easier to use the cubes for liquid foods. One enumerator stated that it was not intuitive to use cubes to estimate how much food was consumed. The enumerator explained that the shape of the cube does not correspond with commonly used household utensils.

When asked for their recommendations, enumerators offered suggestions to improve the use of cubes. These included changing the cube's shape (e.g., to a round shape), adding a larger cube, adding a cube between cubes eight and nine which are the cubes with the largest size difference, using only four cubes instead of 10 while allowing for multiples and fractions of cubes, developing separate methods to estimate liquid and solid foods, developing a different method to estimate amounts of foods eaten from a shared plate, and acquiring a method of measuring ingredients.

Discussion

In this study, the feasibility and ease of use of the GDQS application and the associated set of 3D cubes were tested among a convenience sample of pregnant women. The overall feedback from both enumerators and respondents was positive, suggesting that the use of the application to collect dietary data in a field setting in a LMIC is feasible.

Feedback on the two most critical steps of data collection, which are the open recall of all foods consumed the previous day and the use of 3D cubes as visual aids to assist the respondent with estimating amounts consumed at the food group level, was mostly positive. An open recall interview is a well-known technique that has been validated as part of a 24-hour recall multi-pass method [16]. Although the open recall interview has the known limitation of relying on the respondent's memory and is susceptible to desirability bias [17], enumerators reported that it was a well-accepted technique during data collection with the GDQS application. The sense was that the open recall successfully captured all foods, beverages, and ingredients consumed by respondents. The use of cubes to estimate amounts at the food group level, which is an innovative tool in dietary assessment to provide a proxy method for categorizing consumption amounts as low, medium, or high, (or very high for one food group), also received mostly positive feedback. Although one-fifth (21.6%) of respondents considered the use of the cubes difficult, most respondents reported no difficulties in selecting the cube size to report. The overall results suggest that the cubes have good applicability in a field setting when a simple, proxy method for estimation of

quantities consumed at the food group level is of interest and that this method for collecting data is applicable also for respondents having a relatively low level of education, as observed with this study population.

Studies have shown that estimating individual dietary intake using conventional dietary assessment methods can be challenging when people consume meals from a shared plate [18–21]. Most respondents (80.0%) in this study consumed foods from a shared plate, and not surprisingly, many (49.0%) reported that this made the use of cubes to estimate amounts consumed more challenging. However, the challenge the respondents encountered in estimating their intake from shared plates is not unique to the GDQS application, as the challenge applies similarly to all dietary assessment methods and metrics that require information about the amount consumed.

Although the overall feedback of focus group participants was positive, study enumerators recommended some potential areas of improvement for the GDQS application. Enumerators expressed the need to add a feature for the automatic saving of new foods, beverages, and ingredients added manually during data collection to the built-in GDQS database for future interviews (thus avoiding the need for later manual entry and classification of those new foods). They also indicated that the foods, beverages, and ingredients list in the dropdown menu should appear in alphabetical order in all languages. Based on these recommendations, improvements have since been made to the application, for example, the application now always lists foods alphabetically in all languages and provides the ability for the enumerator to search for a food name in the GDQS database in the local language using the Latin script (if preferred) while maintaining the interviewer script in the application in the local language with the local language script. The study also provided lessons for how to better streamline the translation work required of the user interface interview script and the GDQS database for future users of the GDQS application.

There are some limitations in this study that could be addressed in future research. The interview duration could not be estimated accurately. Although the time needed to complete data collection was automatically recorded by the GDQS application, the application does not account for interruptions during data collection (which were frequently encountered during this study). To further expand the evidence base related to the use of the GDQS application, a study to validate the performance of the GDQS application was recently carried out in Thailand [22]. To provide additional evidence around the use of the cubes to quantify the amounts consumed, *Intake* conducted a formal validation of the use of cubes against weighed records among a convenience sample of 170 respondents in Washington, DC. The results of that study are forthcoming.

The GDQS application was in the development phase at the time of data collection for this study. This feasibility study was the first use of the GDQS application for data collection. As a result, some bugs were encountered at the start of data collection. These bugs account for some of the difficulties encountered by enumerators. Since the time this feasibility study was carried out, *Intake* has continued to improve the functionality of the application and to expand the GDQS database integrated into the GDQS application. The GDQS application is currently available for use in Amharic, Bengali, Burmese, English, French, Hausa, Hindi, Nepali, Portuguese, Spanish, Swahili, Thai, and Yoruba; and to date, has now been used in more than 15 studies in different countries around the world, including: Bangladesh, Cameroon, Democratic Republic of Congo, Ethiopia, India, Lebanon, Myanmar, Nepal, Nigeria, Philippines, Tanzania, Thailand, and the United States. Since the time of this feasibility study, *Intake* has also expanded the GDQS database integrated into the GDQS application from 2500 to more than 7000 rows of foods, beverages, and ingredients.

Conclusion

The results from this study suggest that the GDQS application and set of 10 3D cubes are easy to use and feasible for collecting data on diet quality among low-literacy populations in a low-income country setting and have the potential to be successfully rolled out at a larger scale globally.

Abbreviations

A&T	Alive & Thrive
FGD	Focus group discussion
GDQS	Global Diet Quality Score
NCD	Noncommunicable disease
SNNPR	Southern Nations, Nationalities and Peoples' Region

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40795-024-00965-4.

Additional file 1: Respondent questionnaire to be asked via the GDQS App.

Additional file 2: Respondent feedback questionnaire.

Additional file 3: Enumerator feedback questionnaire.

Additional file 4: Focus groups discussion guide.

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Authors' contributions
YTA, MM, MD, MV, AO were responsible for the study conception and design. YTA organized and supervised data collection. YTA and MV analyzed and interpreted the results. YTA drafted the original manuscript with support from MV and MM. All authors contributed, reviewed, and approved the final manuscript.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study was approved by the Office of International Research Ethics (OIRE) of FHI 360 and the ethics review committee of the Armauer Hansen Research Institute, and it was carried out following the principles of the Declaration of Helsinki. Written informed consent was secured from all study participants.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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