

VALIDITY AND RELIABILITY OF CIDDIE KIT ©, A DIETARY ASSESSMENT TOOL FOR CHILDREN WITH INTELLECTUAL DISABILITY

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ABSTRACT

People with intellectual disabilities (PWID) are susceptible to various diseases compared to the typical population. Dietary assessment is crucial in understanding their dietary intake. Hence, it is important to develop a dietary assessment tool that can improve the measurement of their dietary intake. This study aims to test reliability (inter-rater reliability and test-retest reliability) and comparable validity (limit of agreement against a multiple pass 24-hour diet recall recorded by a professional dietitian) of a recently developed dietary assessment kit, CIDDIE Kit© given to 26 parents or caretakers of children with intellectual disabilities (ID) registered with three selected Community Based Rehabilitation Centre in the Klang Valley area. Each subject was asked to complete two sets of CIDDIE Kit© in a two-week interval session, meanwhile, a certified dietitian conducted a 24-Hour Diet Recall. The validity and reliability were analysed using Bland-Altman method, percentage of correctly classified quartile. For comparable validity tests, the estimated intake from CIDDIE Kit© and Multiple Pass 24-Hour Diet Recall was considerably in agreement with each other. The test-retest reliability analysis showed significant high similarity ($p < 0.001$) between the estimated intake from both phases of CIDDIE Kit© where the ICC value ranged approximately 0.9 ($R = 0.889 - 0.930$). The inter-rater reliability analysis was significantly positive ($p < 0.001$) and strong correlation (indicating internal consistency), r (0.706 - 0.853). The specially designed CIDDIE Kit© can provide a considerably valid and reliable assessment.

Keywords: Dietary Assessment Tool, Children with Intellectual Disabilities, Validity Test, Reliability Test

INTRODUCTION

A polarisation of weight distributions, with the prevalence of overweight and obesity, are more common among people with intellectual disabilities (PWID) than in the general population¹⁻⁵. In fact, obesity, being underweight and lack of physical exercise are among the main health-related behavioural issues among PWID^{4,6,7}. This problem will lead to further implications such as non-communicable diseases and other illnesses that relate to poor fitness. There are limitations in assessing PWID's nutritional status due to the limited validated dietary assessment tool that is tailored with the limited cognitive abilities of this population. It was also being suggested that such assessment need to be done by a proxy reporter. Therefore, parents or caregivers are chosen as the respondent. As nutrition plays an important aspect in the well-being of PWID, developing a validated dietary assessment tool suitable for PWID is crucial, as a step to ensure equality of treatment for PWID⁸. Several studies looked into nutrition aspects of PWID such as in the United State of America⁹ and France¹⁰ to determine the malnutrition problem among adolescents with intellectual disabilities in their study group. The dietary intake assessments were conducted using a 3-day food record and questionnaire.

The photo image assisted dietary records and the proxy-assisted dietary records are reported to be the most suitable dietary assessment tool for children with ID due to their age range and health status that limit them to provide an accurate report^{11,12}. As compared to the dietary assessment tool for children without ID such as digital photographic method and weighed food records, children with ID need a specially modified dietary assessment tool in order to accommodate the social, behaviour and cognitive limitations¹¹. Recently, a photo-assisted and proxy-assisted dietary assessment tool named Children with Intellectual Disabilities Dietary assessment tool kit or CIDDIE Kit© was developed to address this limitation. The development of CIDDIE Kit© is an important approach to overcome the limitations of conventional dietary assessment methods that restrict the establishment of diet related disease and efficacy of dietary interventions among children with ID locally and potentially could be used internationally. Nevertheless, this assessment tool kit needs to be validated and test its reliability for this newly developed dietary assessment tool. Previously, a study has found that CIDDIE Kit© has a high degree of acceptability and feasibility¹³. Therefore, this study aimed to test the validity and reliability of CIDDIE Kit© in assessing the dietary intake of children with ID.

METHODOLOGY

Study design

In assessing the validity and the reliability of the newly developed CIDDIE Kit[®], the dietary assessment tool kit was given to parents or caretakers of the children with ID who have registered at the three selected Community Based Rehabilitation Centre. Each subject has completed two sets of CIDDIE Kit[®] with a two weeks interval between each set. Every subject had made a dietary intake record for three days (two weekdays and one weekend day) of their children with ID for each set of CIDDIE Kit[®] and submitted the dietary assessment tool to the researcher.

A multiple pass 24-hour diet recall (MP24-HDR) was used as a reference method for validity and reliability test. The MP24-HDR was conducted by a certified dietitian among the same subjects for three days (two weekdays and one weekend day) using face-to-face and telephone interviews. The dietary intake of both sets of the CIDDIE Kit[®] and the MP24-HDR were analysed by the researcher using Nutritionist Pro. The mean difference, limit of agreement and correlation coefficient of the recorded data was analysed by using SPSS software version 23.

Research ethics

This research has received ethics approval from the Research Ethics Council (UKM PPI/111/8/JEP-2017-469) of Universiti Kebangsaan Malaysia (UKM). This research also has obtained approval from the Department of Social Welfare of Malaysia and all the three Community Based Rehabilitation centres involved in this research study.

Subject sampling

Convenient sampling involves 26 parents and caretakers of the children with ID that registered to the three selected Community Based Rehabilitation Centre around Klang Valley except for those who do not meet the criteria.

Inclusive and exclusive criteria

The inclusive criteria of this research study were parents or caretakers who registered their children with ID to the three selected Community Based Rehabilitation Centre around Klang Valley; PDK Selayang, PDK Hulu Klang and PDK Gombak Setia. Meanwhile, the exclusive criteria of this research study included parents or caretakers that have children with chronic diseases such as chronic kidney disease, cardiovascular disease and metabolic diseases, parents or caretakers without consent and parents or caretakers who have children with ID that were receiving treatment with a special diet.

CIDDIE Kit[®] food diary record

CIDDIE Kit[®] was a specially designed proxy-assisted and photo-assisted dietary assessment

tool. It was developed to address the social, behaviour and cognitive limitations characterized in the children with ID. The photo-assisted and proxy-assisted dietary records are reported to be the most suitable dietary assessment tool for children with ID^(11,12).

The development of CIDDIE Kit[®] is an important approach to overcome the limitations of conventional dietary assessment methods that restrict the establishment of diet-related disease and efficacy of dietary interventions among children with ID in Malaysia and potentially could be used internationally. The acceptability and feasibility test of CIDDIE Kit[®] have been done previously¹³. CIDDIE Kit[®] is presented in a pocket file that consists of a three-day food diary, an instruction card, a list of references for household measurement and a grid mat. Every subject was given a briefing on how to complete the three-day food diary based on the instruction card provided. The picture of each food intended to be recorded in the food diary was placed on the grid mat and captured using the parents' or caretakers' smartphones individually and send the photos through Whatsapp application.

Multiple pass 24-hour diet recall (MP24-HDR)

Multiple Pass 24-hour recall is the extended and more accurate version of 24-hour diet recall¹⁴. The multiple pass recall method was adapted to overcome the main limitation of the 24-hour diet recall where the recording of a single day dietary intake is seldom representative of a person's usual intake due to day-to-day variation^{15,16}. This method was developed in the USA to assess dietary intake of children and adults in large population studies; 1999-2000 National Health and Nutrition Examination Study (NHANES). The diet is assessed over a period of three to five days and can be a combination of face to face and telephone interviews¹⁴.

The multiple passes refer to the steps involved during the interview to allow checking of dietary information. In the first pass, a quick list of foods consumed is obtained; in the second pass, information about the meal/snacks consumed (including time and place) are recorded. The third pass prompts for foods that may have been forgotten followed by the fourth pass, a final review of the record and the fifth pass, completion of further details of foods consumed and portion sizes¹⁷.

In this research, the validated MP24-HDR was conducted by a certified dietitian to capture the habitual consumption of foods during the 24-hours prior to the interview session. The multiple pass recall method used in this research was adapted from a validation study that validated this method for measuring energy intake¹⁸. The time taken for the first recall interview (face to face) averaged from 15 to 20 minutes.

Meanwhile, the duration for the second and third recalls (via telephone) was approximately less than 10 minutes. The MP24-HDR was undertaken in chronological order of consumption (from morning wake up to night sleep) with the multiple pass approaches by collecting a list of foods and beverages usually consumed during the previous day according to mealtime, record time and eating occasion for each food, record detailed description, amount, cooking methods, brands of foods if purchased and recalled anything else consumed as a review of a 24-hour day¹⁸. Portion sizes were estimated from household measurements listed in the CIDDIE Kit© food diary.

Data analysis

Prior to the statistical analysis of validity and reliability test, the energy, carbohydrate, protein and fat intake of the children with ID recorded in the CIDDIE Kit© food diary and the MP24-HDR are estimated and analysed using the Nutritionist Pro software. Validity test analysis aims to evaluate the comparable validity in terms of Limit of Agreement (LOA) of the new specially designed CIDDIE Kit© (average of phase 1 and phase 2) against the MP 24-H DR (recorded by a certified dietitian) of the same sample, where the mean difference was assessed using the one sample student T-test.

LOA estimates the interval proportion of the differences between the estimated dietary intake. The quantitative data obtained are analysed using the software SPSS version 23 using Bland-Altman method¹⁹⁻²¹. This method involves one sample student T-test, Bland-Altman plot and regression analysis. One sample student T-test is conducted to identify whether there are, or no significant group mean differences of dietary intake of the same sample between the CIDDIE Kit© food diary and the MP24-HDR (recorded by a certified dietitian). If there is no significant mean difference, it indicates that there is some degree of agreement between both methods. The limit of agreement hence will be evaluated by means of Bland-Altman plots.

A graph that displays a scatter diagram of the differences is plotted against the averages of the two measurements of the estimated intake from both methods for each dietary intake analysed. Three horizontal lines are drawn at the mean difference, and at the limits of agreement (+1.96 sd, -1.96 sd) indicating the maximum difference allowed. The interpretation of the LOA is based on four criteria set by Bland and Altman¹⁹⁻²¹, which are mean difference close to zero, variance close to mean difference, score dissemination approaching mean and the existence of minimal outliers. Plots that meet these four criteria considerably possess a high similarity and agreement¹⁹⁻²¹.

Hence, a regression analysis by assessing the Regression Coefficient (R) to identify any proportional bias in the differences of energy intake estimated from CIDDIE Kit© food diary and the MP24-HDR method against the mean¹⁹⁻²¹. In addition, in evaluating the similarity of classification based on the levels of nutrient intake between CIDDIE Kit© and the 24-Hour Diet Recall, the quartile classification obtained by both methods was compared using the quartile method. This is the standard statistical method that has been used for this purpose^{22,23}. The percentage of participants who could be classified in the correct fourth of the distribution of the reference method (MP24-HDR) using the newly developed CIDDIE Kit©.

On the other hand, the reliability test analysis includes test re-test reliability and inter-rater reliability. The test-retest reliability of CIDDIE Kit© is tested using Student paired sample t-Test and Intra-class Correlation Coefficient (ICC) value. The test-retest reliability by the mean difference of dietary intake between CIDDIE Kit© food diary 1 (first phase) and 2 (second phase) of each subject using Student paired sample t-Test. A high test-retest reliability by mean difference is indicated in a non-significant mean difference between the estimation of energy and all macronutrients intake estimated from both phases of CIDDIE Kit©.

On top of that, the Intra-class Correlation Coefficient (ICC) value is used in analysing the test-retest reliability (on the similarity of the values). A high Intra class Correlation Coefficient (ICC) close to 1 indicates high similarity between values from the same group. A low ICC close to zero means that values from the same group are not similar.

In terms of interrater reliability of CIDDIE Kit©, the Pearson's Correlation statistical analysis is conducted to evaluate the correlation between the dietary intake recorded using CIDDIE Kit© (recorded by parents/caretaker) against the MP24-HDR recorded by a certified dietitian. If there is a positive and strong correlation of dietary intake estimated from CIDDIE Kit© and MP24-HDR for energy and all macronutrients intake, it shows that there is internal consistency between both methods.

RESULTS

The parents/caretakers of the subjects involved in this present study were from equal income classes (low to mid-income class) with low to medium education levels. Table 1 presents the demographic characteristics of the subjects. The mean age of the subjects was 10 years old, sd \pm 3.97 years. Most of the subjects were diagnosed with Cerebral Palsy (31%) followed by Autism

Spectrum Disorder (27%) and Down Syndrome (19%) while others (23%) are Attention Deficit Hyperactive Disorder (ADHD) and Learning Disability (LD). Although about 40% of the subjects had normal weight-for-age, more than half of the subjects were categorised into less than 5th and 25th percentiles for all anthropometric classes; BMI-for-age (54%), height-for-age (58%) and weight-for-age (58%).

Table 2 presents the results of the one sample student T-test used to assess the limit of agreement of the newly developed CIDDIE Kit© against the MP24-HDR (recorded by a professional dietitian) where the mean difference was first assessed. There was no significant mean difference of energy and all macronutrients intake estimated except for carbohydrate ($p = 0.042$).

This indicated that there was some degree of agreement between both methods in estimating the energy, protein and fat intake of the participants. The significant mean difference of carbohydrate intake estimated from CIDDIE Kit© and MP24-HDR might be due to varying interpretations of household measurements used by the parents in recording their children's food intake in CIDDIE Kit©.

The limit of agreement of energy, protein and fat intake estimated from CIDDIE Kit© and the MP24-HDR was further evaluated using Bland-Altman Plot²¹. It was shown in the Bland-Altman plot that the differences in the estimated energy, protein and fat intake from both methods do not exceed the maximum allowed difference. Based on the four criteria mentioned before, all three energy, protein and fat intake had a high degree of agreement as the mean differences were close to zero, the variances close to mean difference, scores dissemination approaching mean and very minimal outliers (only one outlier) for all three dietary aspects assessed¹⁹⁻²¹.

Table 3 presented that CIDDIE Kit© food diary (the average dietary intake of the first set and second

set of CIDDIE Kit©) and the MP24-HDR classified approximately 31% to 54% of the subjects into the same quartile for energy and all macronutrients intake. This indicated that there was an acceptable agreement between these two methods²⁴. Thus, CIDDIE Kit© can provide a similar estimation in assessing energy, protein and fat intake in children with intellectual disabilities to that obtained from the MP 24-H DR¹⁹⁻²¹.

In assessing the test-retest reliability of CIDDIE Kit©, the mean differences of energy, carbohydrate, protein and fat intake estimated from CIDDIE Kit© food diary 1 (first set) and 2 (second set) conducted on the same subjects were evaluated using Paired Sample T-test. The results tabulated in Table 4 showed that there was no significant mean difference between the estimation of energy and all macronutrients intake estimated from both phases of CIDDIE Kit©. This indicated considerably high test-retest reliability.

In further assessing the similarity between values for test-retest reliability of CIDDIE Kit©, the Intra-class Correlation Coefficient (ICC) value was identified. Table 5 shows a significantly high degree of reliability ($p < 0.001$) was found for energy and all macronutrients where the ICC value ranged approximately 0.9 (from 0.889 to 0.930) with a 95% confidence interval. This indicated that there was a high similarity between the estimated energy, carbohydrate, protein and fat intake from both phases of CIDDIE Kit©. On the other hand, in order to assess the inter-rater reliability of CIDDIE Kit©, a bivariate Pearson's correlation coefficient (r) was calculated.

Table 6 presented that the bivariate correlation between CIDDIE Kit© and the MP24-HDR was significantly positive and considerably strong, r (0.706 - 0.853), $p < 0.001$. This result indicated an internal consistency of dietary intake estimated from CIDDIE Kit© and 24-Hour Diet Recall for energy and all macronutrients intake.

Table 1: Demographic Characteristics of Subjects

Mean age (\pm SD) (years)	9.47 \pm 3.44 n (%)	10.82 \pm 4.67 n (%)	10.04 \pm 3.97 n (%)
Diagnosis			
Autism Spectrum Disorder (ASD)	4 (27%)	3 (27%)	7 (27%)
Cerebral Palsy (CP)	4 (27%)	4 (36%)	8 (31%)
Down Syndrome (DS)	2 (13%)	3 (27%)	5 (19%)
Others ^a	5 (33%)	1 (9%)	6 (23%)
BMI Categories (BMI for age)^b			
BMI <5 th percentiles	4(27%)	2 (18%)	6 (23%)
BMI 5 th - 25 th percentiles	6 (40%)	2 (18%)	8 (31%)
BMI 25 th - 85 th percentiles	4 (27%)	5 (46%)	9 (35%)
(>85 th percentiles)	1 (6%)	2 (18%)	3 (11%)
Height Categories (Height for age) ^b			
Height <5 th percentiles	7 (46%)	1 (9%)	8(31%)
Height 5 th - 25 th percentiles	3(20%)	4(36%)	7(27%)
Height 25 th - 85 th percentiles	4(27%)	6(55%)	10(38%)
(>85 th percentiles)	1(7%)	0 (0%)	1(4%)
Weight Categories (Weight for age) ^b			
Weight <5 th percentiles	5(33%)	2 (18%)	7(27%)
Weight 5 th - 25 th percentiles	6(40%)	2 (18%)	8(31%)
Weight 25 th - 85 th percentiles	4(27%)	7 (64%)	11(42%)
(>85 th percentiles)	0(0%)	0 (0%)	0(0%)

^a Attention Deficit Hyperactive Disorder (ADHD) and Learning Disability (LD)

^b According to the WHO growth chart where children with DS and CP were assessed using their specific growth chart respectively.

Table 2: Comparing Mean Difference (CIDDIE Kit© against diet recall)

Nutrients	t	df	Mean difference ^a	Significant test (p-value)	95% Confidence Interval of the Difference
Energy (kcal)	-1.162	25	-46.615	p = 0.256 (NS)	-129.256, 36.025
Carbohydrate (g)	-2.145	25	-13.039	p = 0.042	-25.556, -0.522
Protein (g)	0.850	25	0.192	p = 0.933 (NS)	-4.485, 4.869
Fat (g)	0.060	25	0.154	p = 0.953 (NS)	-5.170, 5.480

^a Analysis of mean difference using One sample t-Test at 2-tailed significance, reference value is zero.

Table 3: Percentage of correct classification

Nutrients	% correctly classified at ¼ quartile of 24 Hour Diet Recall ^a
Energy (kcal)	54
Carbohydrate (g)	31
Protein (g)	54
Fat (g)	46

^a Percentage of correct classification at ¼ quartile of 24-hour diet recall

Table 4: Test-retest Reliability Analysis (Comparing Mean Difference)

Nutrients	Mean phase 1	Mean phase 2	Difference (mean) ^a	Significant test (p-value)	95% Confidence Interval of the Difference
Energy (kcal)	1113	1146	-33.0	0.483	-128.697, 62.620
Carbohydrate (g)	141.7	149.3	-7.6	0.225	-20.126, 4.972
Protein (g)	42.0	43.5	-1.5	0.537	-6.274, 3.351
Fat (g)	42.1	42.1	0.0	1.0	-4.706, 4.706

^a Analysis of mean difference using paired sample t-Test on first set of CIDDIE Kit[©] against second set of CIDDIE Kit[©]

Table 5: Test-retest Reliability Analysis (ICC Value)

Nutrients	Intraclass correlation coefficient value (R) ^a	Significant test (p-value)	95% Confidence Interval (Lower, upper)
Energy (kcal)	0.905	p < 0.001	0.789, 0.957
Carbohydrate (g)	0.930	p < 0.001	0.845, 0.968
Protein (g)	0.889	p < 0.001	0.753, 0.950
Fat (g)	0.905	p < 0.001	0.788, 0.958

^a Analysis of Intra-class Correlation Coefficient (ICC) value at 2-tailed significance, first set of CIDDIE Kit[©] against second set of CIDDIE Kit[©]

Table 6: Inter-rater Reliability Analysis (Internal Consistency)

Nutrients	Pearson Correlation (r) ^a	Significant test (p-value)
Energy (kcal)	0.843	p < 0.001
Carbohydrate (g)	0.853	p < 0.001
Protein (g)	0.757	p < 0.001
Fat (g)	0.706	p < 0.001

^a Analysis of internal consistency of CIDDIE Kit[©] against 24-hour diet recall using Pearson's Correlation at 2-tailed significance

DISCUSSION

As observed from the result of the present study, about 40% of the subjects had normal weight-for-age. However, more than half of the subjects were categorised into less than 5th and 25th percentiles for all anthropometric classes; BMI-for-age (54%), height-for-age (58%) and weight-for-age (58%). This finding was in line with^{4,6,25,26}, where the majority of children with intellectual disabilities were malnourished and underweight.

The result of the comparable validity analysis using the Bland-Altman method had shown that CIDDIE Kit[©] provided similar estimations in assessing energy and macronutrients intake compared to the MP24-HDR except for carbohydrate (p = 0.042). It was shown in the Bland-Altman plot that the differences in the estimated energy, protein and fat intake from both methods do not exceed the maximum allowed difference. Based on the four criteria set - the energy, protein and fat intake had a high degree of agreement as the mean differences

were close to zero, the variances close to mean difference, scores dissemination approaching mean and very minimal outliers (only one outlier) for energy, protein and fat intake. Similarly, a study in Kuwait by²⁷ showed that a significant difference was observed for carbohydrate intake; but no statistical differences were observed for protein and fat intake. However, under-reporting was observed for energy intake²⁷.

The quartile method was another method conducted to analyse the comparable validity of CIDDIE Kit© against the MP24-HDR. The quartile method was very crucial in identifying the similarity of CIDDIE Kit© against multiple pass 24-hour recall based on the level of each dietary intake assessed at the fourth quartile of MP24-HDR²⁸⁻³¹. The presented result showed that CIDDIE Kit© food diary (the average dietary intake of the first set and second set of CIDDIE Kit©) and the MP24-HDR classified approximately 31 to 54% of the subjects into the same quartile for energy and all macronutrients intake. This indicated that there was an acceptable agreement between these two methods²⁴.

Thus, CIDDIE Kit© can provide a similar estimation in assessing energy, protein and fat intake in children with intellectual disabilities to that obtained from 24-Hour Diet Recall. However, the one sample student T-test showed that there was a significant mean difference in carbohydrate intake estimated from CIDDIE Kit© and MP24-HDR. This might be due to varying interpretations of household measurements used by the parents/caretakers in recording their children's food intake in CIDDIE Kit©. The diverse interpretation could be overcome by emphasizing the significance of using the correct unit of household measurements listed in the CIDDIE Kit©. Plus, this bias also can be overcome by explaining to the parents/caretakers the importance of the use of correct household measurements in estimating the real portion of their children's intake.

The results of the test-retest reliability using paired sample T-test, tabulated in Table 4, showed that there was no significant mean difference between the estimation of energy and all macronutrients intake estimated from both phases of CIDDIE Kit©. This indicated considerably high test-retest reliability. In further assessing the test-retest reliability of CIDDIE KIT©, the Intra-class Correlation Coefficient (ICC) value was identified. Table 5 showed a significantly high degree of reliability ($p < 0.001$) was found for energy and all macronutrients where the ICC value ranged approximately 0.9 (0.889 - 0.930) with a 95% confidence interval. This indicated that there was a high similarity between the estimated energy, carbohydrate, protein and fat intake from both phases of CIDDIE Kit©. According to a similar study that assessed the validity and

reproducibility of a newly developed dietary assessment tool, ICC value of 0.9 and more indicated that the tested instrument or tool was highly reliable³². Besides that, the high similarity of the value can be supported by studies regarding the food selectivity of children with intellectual disabilities on their limited variety of food selections and their rigid routine type of intake⁸.

On the other hand, the result of the internal consistency (inter-rater reliability) analysis of CIDDIE Kit© against MP24-HDR conducted using Pearson's correlation coefficient showed significantly positive correlations, r (0.706 - 0.853), $p < 0.001$. This result indicated an internal consistency for energy and all macronutrients estimated from CIDDIE Kit© and MP24-HDR. The result of the present study was in line with a systematic review studied on validation and reproducibility of dietary assessment methods in adolescents below eighteen years old³³. The study suggested that a correlation value of more than 0.4 indicated a valid and reproducible dietary assessment tool³³.

CONCLUSION

Overall, the specially designed CIDDIE Kit© could provide a considerably valid and reliable assessment of dietary intake in Malaysian children with intellectual disabilities. The significant mean difference of carbohydrate intake estimated from CIDDIE Kit© and MP24-HDR showed in the comparable validity test using Bland-Altman method that might due to varying interpretation of household measurement used by the parents/caretakers in recording their children's food intake in CIDDIE Kit©, this vary interpretation could be overcome by emphasizing the significance of using correct unit of household measurements listed in the CIDDIE Kit©. Plus, this bias also can be overcome by explaining to the parents/caretakers the importance of the use of correct household measurements in estimating the real portion of their children's intake.

In addition, this specially designed CIDDIE Kit© is highly potential to provide a reliable assessment of dietary intake in Malaysian children with intellectual disabilities. It is known that children, especially those with intellectual disabilities, have limited abilities to comprehend and therefore proxy reporters are usually being designated. The CIDDIE© Kit was designed to accommodate the proxy reporters (caretakers) daily routines that commonly have a tight schedule such as therapies visits. Hence, this tool can be easily carried out by the caretakers while still taking into account the sound technique of the measuring tool.

However, a bigger sample size is needed for validity and reliability tests that cover a wider health setting of children with intellectual

disabilities nationally. Thus, future research could include more varied and wider health settings for children with intellectual disabilities around Malaysia. In fact, this food diary could be further improvised by developing mobile apps that enable parents of children with intellectual disabilities to record and send pictures of their children's food intake in an easier and faster way.

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Conflict of interest

The authors declare that they have neither competing interests nor financial disclosure.

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