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LETTER TO THE EDITOR

VALIDATION TESTING OF A SHORT FOOD-GROUP-BASED QUESTIONNAIRE TO ASSESS DIETARY RISK IN PRESCHOOLERS AGED 3–5 YEARS

To the Editor,

Accurate measurement of dietary intake is crucial for understanding the relationship between diet and chronic disease, monitoring trends in predictors of health and determining intervention effectiveness. Traditional dietary assessment methods such as food records and recalls are subject to substantial error[1,2] whereas short questionnaire-style methods enable rapid food intake reporting, increased cooperation and completion,[3] and derivation of food-based data that are useful for monitoring dietary guideline compliance.[4] Dietary assessment in young children is particularly challenging due to variation in diet across brief time periods. Thus age-specific assessment tools are required. The reliable and valid short food-based Toddler Dietary Questionnaire (TDQ)[5,6] was adapted for use with Australian preschoolers. This study aimed to determine the test–retest reliability, relative validity and convergent validity of this new Preschooler Dietary Questionnaire (PDQ).

Primary caregivers of preschoolers aged 3–5 years, recruited via Flinders University newsletter advertisements and a study-specific Facebook page, completed a two-stage online survey. Stage 1 comprised a demographic questionnaire and the 19-item PDQ (PDQ1). Stage 2 (completed 2.1 ± 1.0 weeks later) comprised a second PDQ (PDQ2) and a validated 54-item Food Frequency Questionnaire (FFQ).[7] The PDQ and TDQ[6] are the same apart from the use of age-appropriate portion size categories.[8–10] Intake is scored against a dietary risk[11] criterion (0–100; higher score = higher risk) (Table 1) and scores categorised into: low (0–24); moderate (25–49); high (50–74) and very high (75–100) dietary risk.[6] Data were analysed using SPSS version 22.0 (IBM SPSS Statistics, IBM Corporation, Armonk, New York, USA). Dietary risk scores (sections 1–3; total) were examined for test–retest reliability (PDQ1 *vs* PDQ2) and relative validity (PDQave ((PDQ1 + PDQ2)/2) *vs* FFQ) at the individual (intraclass correlations (ICC), Pearson's correlations; low ≤0.50; moderate 0.51–0.69; high ≥0.70[13]) and group level (paired *t*-tests). To assess the strength of agreement between the two methods (PDQave and FFQ), Bland–Altman plots were constructed, assessed visually and linear regression analysis performed to test for systematic bias. Cross classification of subjects into dietary-risk categories was determined and standard linear regression employed to determine convergent validity by assessing the relationship of dietary risk scores with socio-demographic characteristics and Body Mass Index (BMI) *z*-score,[14] adjusting for covariates.

Seventy-four parents (35.5 ± 4.1 years, 81% university-educated) of preschoolers (54% female, 3.7 ± 0.6 years, BMI*z* 0.31 ± 1.02, average Index of Relative Socio-economic Advantage and Disadvantage (IRSAD)[15] score 1003.8 ± 58.66) completed all study questionnaires. Mean total dietary risk scores ranged from 32.7 ± 9.2 (PDQ2) to 35.1 ± 9.7 (FFQ) (Table 1; i.e. 'moderate' risk). Total and section risk scores from each PDQ administration were highly correlated (ICC 0.83–0.92) yet statistically different for section 1 (mean bias 4.1, 95% CI 0.5, 7.7, $P = 0.027$) and total (mean bias 1.5, 95%CI 0.1, 3.0, $P = 0.040$) risk scores (Table 1). Most (82%) participants were correctly classified (18%, adjacent category) upon each PDQ administration.

PDQave and FFQ dietary risk scores were highly correlated for sections 1 and 3 and total risk scores (all r ≥ 0.80), but not for section 2 (r = 0.67) (Table 1). Despite no statistically significant difference between the PDQave and FFQ for section scores (mean bias range: −1.0 section 3 to −2.8 section 1), there was for total risk scores (mean bias −1.6, 95% CI −2.9, −0.4, $P = 0.009$). Bland–Altman plots (Figure 1) show that the PDQave provides a higher estimate of risk than the FFQ for section and total risk scores (i.e. positive mean differences). Most measurements fell within wide 95% limits of agreement (total risk scores, LOA −11.9, 8.6) and there was no significant linear trend for the fitted regression line (Table 1). Participants were classified into the same (80%) or adjacent (20%) category upon administration of each tool. PDQave scores were significantly negatively associated with the number of people per household (β −0.32, 95% CI −6.69, −0.59, $P = 0.020$) but not with preschoolers' BMI*z* score (β −0.09, 95% CI −0.02, −0.04, $P = 0.512$).

The PDQ is the first tool of its kind for use in Australian preschoolers as it assesses whole of diet intake (core/non-core food groups[16]), allowing comprehensive evaluation of intake against dietary guidelines[17] and thus assessment of dietary risk.[11] Despite significant differences between PDQ-derived total dietary risk scores upon two administrations and on comparison with scores derived from a FFQ, the differences were small (1.5 and −1.6 respectively, out of 100 points). Bland–Altman plots revealed arguably wide 95% LOA[18] but no systematic bias between the two tools, indicating good group-level agreement. The high proportion of participants classified into the same risk category highlights the usefulness of the PDQ as a screening instrument to identify those at highest risk requiring intervention. However, the lack of association between PDQ-derived dietary risk scores and preschoolers' BMI*z* score, consistent with findings from

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Table 1 Test–retest reliability of the Preschooler Dietary Questionnaire (PDQ) risk scores and relative validity of the average PDQ (PDQave[(a)]) and Food Frequency Questionnaire (FFQ) risk scores for each section and total risk scores (n = 74)

		Test–retest reliability (PDQ1, PDQ2)						*Relative validity (PDQave[(a)], FFQ)*								
PDQ	*Possible score range*	*PDQ1, Mean (SD)*	*PDQ2, Mean (SD)*	*ICC[(b)]*	*Mean bias*	*95% CI*	P-*value[(c)]*	*PDQave,[(a)] Mean (SD)*	*FFQ, Mean (SD)*	*Pearson's correlation[(b)]*	*Mean bias*	*95% CI*	P-*value[(c)]*	*95% LOA*	*Slope of* b[(d)]	P-*value[(d)]*
Section 1: Core foods[(e)]	0–144	63.1 (22.3)	59.0 (21.1)	0.84	4.1	0.47, 7.72	**0.027**	61.0 (20.2)	63.8 (22.4)	0.83	−2.8	−5.7, 0.2	0.060	−27.3, 21.7	−0.11	0.125
Section 2: Non-core foods[(f)]	0–144	46.0 (16.6)	44.4 (16.9)	0.83	1.6	−1.32, 4.56	0.275	45.2 (15.5)	47.0 (18.1)	0.67	−1.8	−5.0, 1.4	0.271	−28.9, 25.3	−0.19	0.077
Section 3: Bread, beverages[(g)]	0–48	5.9 (7.4)	6.5 (7.7)	0.92	−0.6	−1.56, 0.29	0.177	6.2 (7.3)	7.2 (8.22)	0.80	−1.0	−2.1, 0.2	0.103	−10.8, 8.9	−0.13	0.106
Total risk score	0–100	34.2 (9.7)	32.7 (9.2)	0.87	1.5	0.07, 2.95	**0.040**	33.4 (8.9)	35.1 (9.7)	0.85	−1.6	−2.9, −0.4	**0.009**	−11.9, 8.6	−0.11	0.093

ICC, intraclass correlation; LOA, limits of agreement.
(a) PDQave = ((PDQ1 risk scores + PDQ2 risk scores)/2).
(b) All correlations $P < 0.001$.
(c) Paired *t*-test used to compare differences in risk scores.
(d) Linear regression analysis of difference in risk scores (PDQ average – FFQ) and the mean of difference of risk scores ((PDQave – FFQ)/2). Agreement at the individual level is defined as the LOA (±2 SD) of the mean bias and at the group level by the mean bias and slope of the mean bias line (*b*).[12]
(e) Intake in the previous 7 days of eight items (fruit, vegetables (green, orange and other), dairy products, grains, lean red meat and fish) estimated from the product of how often *how often* (nil, once, 2–4 times, ≥5 times) and *how often* (nil, once, 2–4 times, ≥5 times).
(f) Intake in the previous 7 days of eight items (spreadable fats, vegemite-type spreads, snack products, hot potato products, meat products, sweet biscuits and cakes, chocolates and ice creams) estimated from the product of how often *how often* (nil, once, 2–4 times, ≥5 times) and *how often* (nil, once, 2–4 times, ≥5 times).
(g) 'Usual' intake of bread (proportion of white: non-white bread), milk beverages and non-milk beverages (e.g. fruit juice, soft drink and cordial).
Bold text indicates a statistically significant difference with a *P*-value less than 0.05.

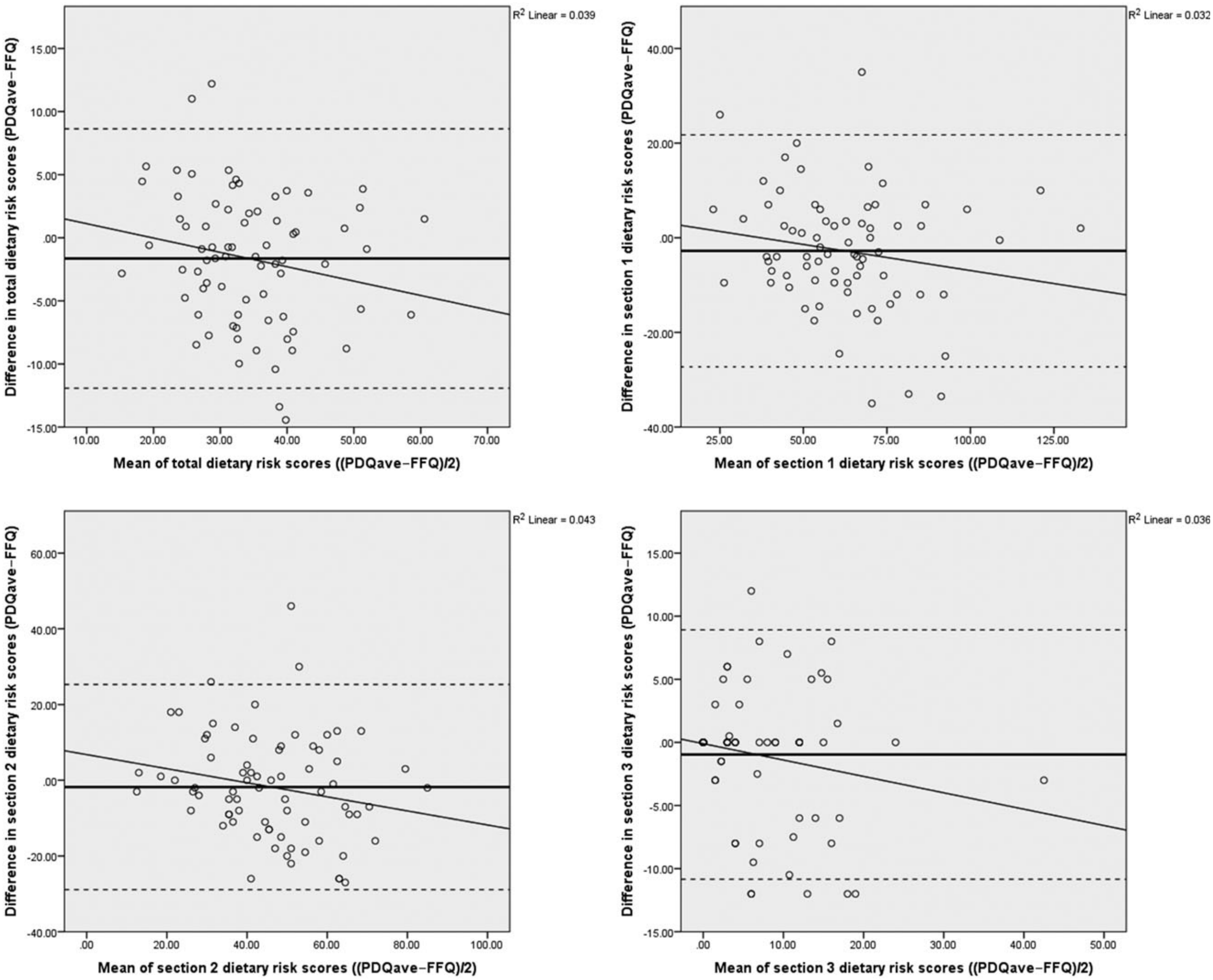

Figure 1 Bland–Altman plots assessing the validity of section (1, 2 and 3) and total dietary risk scores derived from the average Preschooler Dietary Questionnaire (PDQave) *versus* those derived from the Food Frequency Questionnaire (FFQ) among Australian children (n = 74) aged 36–60 months. The plot shows the mean difference (——), the 95% limits of agreement (------) and the fitted regression line (——) for each section (*P* for linear trend; section 1, $P = 0.125$; section 2, $P = 0.077$; section 3, $P = 0.106$) and total dietary risk cores (*P* for linear trend = 0.093).

psychometric testing of the TDQ,[5] suggests that the PDQ is not appropriate for use in the obesity context. In summary, despite a slightly advantaged sample and a sample size smaller than recommended for validation studies (≥100),[17] the PDQ is a useful screening tool for health professionals to rapidly identify those preschoolers at dietary risk and subsequently facilitate referral to a dietitian for detailed assessment and intervention.

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Conflict of interest

The authors report no conflicts of interest.

Authorship

All authors contributed the design of the study. LKB, AMM and RKG contributed to the development of the Toddler Dietary Questionnaire (TDQ). LKB was responsible for adaptation of the TDQ into the Preschooler Dietary Questionnaire (PDQ). LKB collected and analysed the data and wrote the first manuscript draft. All authors were involved in data interpretation, critically reviewing and editing the manuscript, and approving the final version.

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