Abstract

Background: Short questionnaire-style dietary assessment methods are useful for monitoring compliance with dietary guidelines. A reliable and valid short food-based questionnaire for assessing dietary risk in toddlers aged 1-3 years was recently adapted for use in pre-schoolers. This study aimed to determine the reliability and validity of this 19-item Preschooler Dietary Questionnaire (PDQ) that assesses dietary risk of 3-5 year-olds.

Methods: Primary caregivers of preschoolers completed a two-stage online survey: 1) a demographic questionnaire and the PDQ; 2) a second PDQ and a validated 54-item semi-quantitative food frequency questionnaire (FFQ). Dietary risk scores (0-100; higher score=higher risk) derived from the two PDQ administrations (2.1±1.0 weeks apart) were compared and average scores assessed against the FFQ. Cross-classification into dietary risk categories (low, 0-24; moderate, 25-49; high, 50-74; very high, 75-100) was determined. The relationship of dietary risk scores with BMI z-score was assessed using standard linear regression.

Results: Preschoolers' (n=74) risk scores were highly correlated yet statistically different for reliability (ICC=0.87; mean bias 1.51, 95% CI 0.07, 2.95, p=0.040) and validity (r=0.85; mean bias -1.64, 95% CI -2.86, -0.43, p=0.009). There was no systematic bias between the two tools. All participants were classified into the same (80%) or adjacent (20%) category upon administration of each tool. Risk scores were not associated with BMIz scores (β -0.09, 95%CI -0.02,-0.04, p=0.512).

Conclusion: The PDQ is a novel and useful screening instrument to rapidly identify preschooler dietary, but not obesity, risk. The tool could facilitate referral to appropriate health professionals for detailed assessment and intervention.

Keywords: Dietary Assessment, Children, Preschooler, Dietary Patterns, Validity, Reliability,

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 pre-schoolers. 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); very high (75-100) dietary risk.[6] Data were analysed using IBM SPSS version 22.0. 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 (ICC's, Pearson correlations; low ≤0.50; moderate 0.51-0.69; high ≥0.70 [12]) 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 sociodemographic characteristics and BMI z-score,[13] adjusting for covariates.

Seventy-four parents (35.5±4.1 years, 81% university-educated) of preschoolers (54% female, 3.7±0.6 years, BMIz 0.31±1.02, average IRSAD[14] 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' BMIz 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[18] 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[17] 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' BMIz score, consistent with findings from 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),[18] 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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Table 1 Test-retest reliability of the Preschooler Dietary Questionnaire (PDQ) risk scores and relative validity of the average PDQ (PDQave*) and FFQ risk scores for each section and total risk scores (n=74)

		Test-retest reliability (PDQ1, PDQ2)						Relative validity (PDQave*, FFQ)								
PDQ	Possible score range	PDQ1, Mean (SD)	PDQ2, Mean (SD)	ICC†	Mean bias	95% CI	p value‡	PDQave*, Mean (SD)	FFQ, Mean (SD)	Pearson correlation †	Mean bias	95% CI	p value‡	95% LOA	Slope of b§	p value§
Section 1: Core foods**	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††	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‡‡	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

PDQ, Preschooler Dietary Questionnaire; FFQ, Food Frequency Questionnaire; ICC, intraclass correlation; LOA, limits of agreement

*PDQave = [(PDQ1 risk scores + PDQ2 risk scores)/2]

†All correlations p<0.001

‡paired t-test used to compare differences in risk scores

§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 limits of agreement (LOA; ±2 standard deviation, SD) of the mean bias and at the group level by the mean bias and slope of the mean bias line (b).[15]

**Intake in the previous 7 days of 8 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)

††Intake in the previous 7 days of 8 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)

‡‡ 'usual' intake of bread (proportion of white: non-white bread), milk beverages, and non-milk beverages (e.g. fruit juice, soft drink, and cordial)

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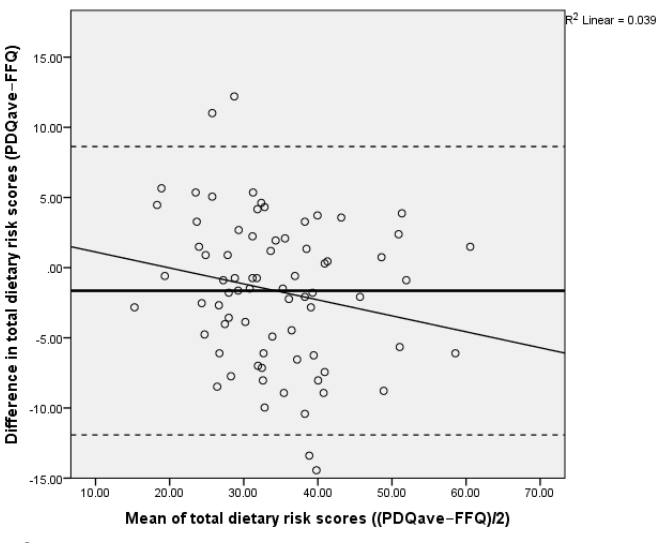

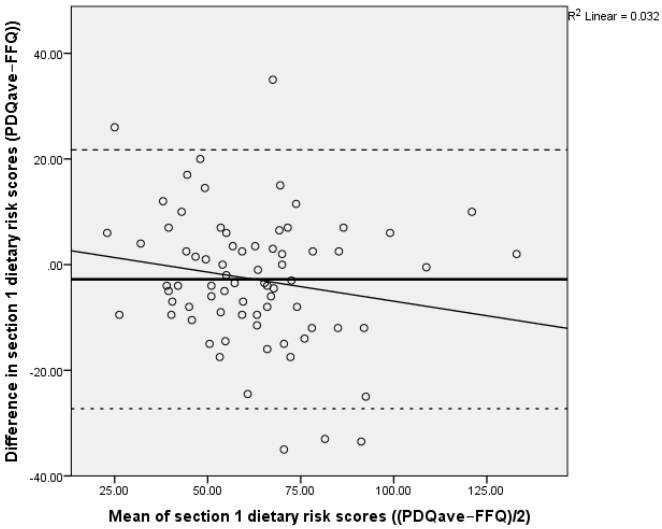

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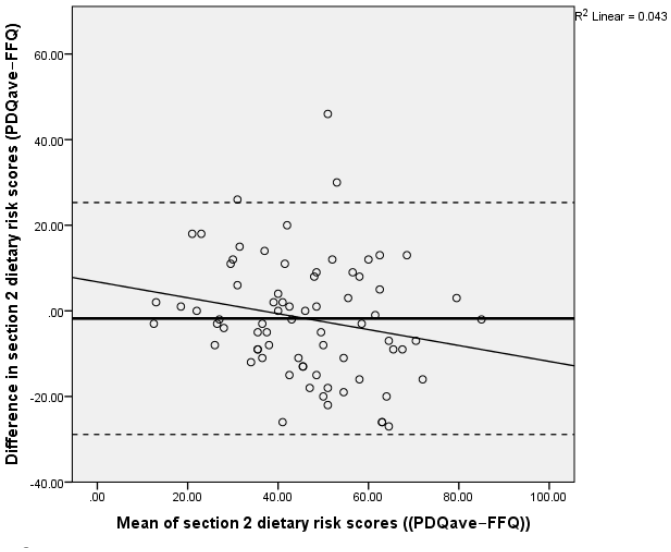

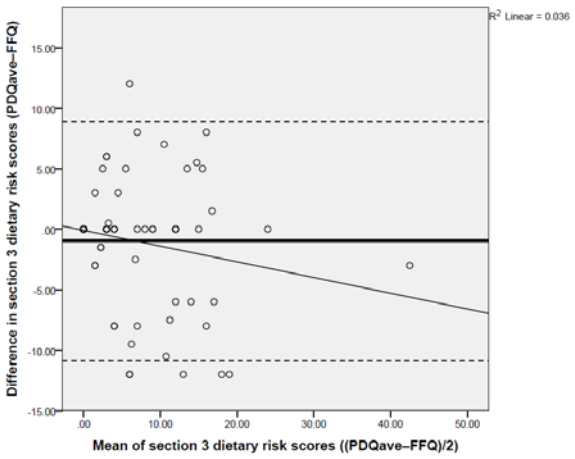

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21 **Figure 1** Bland-Atlman plots assessing the validity of section (1, 2, and 3) and total dietary risk scores derived
22 from the average Preschooler Dietary Questionnaire (PDQave) versus those derived from the FFQ among
23 Australian children (n=74)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

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