EVALUATING THE CONCURRENT VALIDITY OF A NOVEL WEB-BASED SURVEY TO DETECT NUTRITIONAL RISK AMONG ELITE COLLEGIATE ENDURANCE RUNNERS

By Caroline Olson; Michelle Barrack, PhD; Virginia Gray, PhD; and Erin Arruda, PhD

Department of Family and Consumer Sciences

College of Health and Human Services, California State University Long Beach

Abstract

Low energy availability (LEA) can detrimentally affect an athlete's metabolic rate, bone health, and the reproductive health of female athletes.[1, 2] Screening tools to identify athletes at risk for LEA are needed.[1-3] However, dietary recall methods such as the RD-administered 24-hour recall are burdensome for both registered dietitians and athletes.[4-6]

The purpose of this study is to evaluate the concurrent validity of a web-based nutrition screening survey (NSS) meant to facilitate the efficient evaluation of food intake and nutritional risk, against a registered dietitian-administered 24-hour recall among male and female collegiate endurance runners.

Participants attended a meeting with their sports dietitian, at which point an initial RD-administered 24-hour recall was collected. After a washout period of two weeks, athletes were prompted to complete the NSS. Correlations and means tests were used to compare energy and macronutrient intakes.

A total of 46 collegiate endurance runners were included in the final analysis. Based on the correlation analysis, the NSS and RD-administered recall displayed significant association for energy ($r = .565$, $p < .001$), fat ($r = .535$, $p < .001$), and protein intake ($r = .414$, $p < .01$), when outliers were excluded. There were no significant differences in average intake, for each nutrient assessed, between recall methods, indicating agreement at the group level. Bland-Altman Plot Analysis displayed proportional bias in energy intake between recall methods. This study suggests agreement between NSS and the RD-administered 24-hour recall, particularly for group data.

Methods

The dietitians from both athletic institutions used a standardized assessment worksheet and 24-hour recall to assess nutritional status and nutrition-related risks. Eating patterns and individual nutrition goals were also discussed. Nutrient composition of each 24-hour recall was calculated using the ESHA Food Processor and USDA Diabetic Exchanges.

Within two weeks of the initial assessment completed by an RD, the student-athletes were prompted to complete the novel web-based nutrition screening survey. The online intake survey consisted of 47 items intended to catalogue each athlete's consumption in the previous month. The ESHA Food Processor and USDA Nutrient Database were used to calculate nutrient composition of recorded intakes. There were also questions regarding food intake patterns and the survey also recorded any athlete-reported dietary restrictions, like meat, dairy, and gluten. Formulas were developed to calculate typical dietary intake based on the participant-reported frequency of consumption of each item, ultimately summarizing each runners' mean daily dietary intakes. The survey also assessed typical regimen of athletic training, body weight, and body composition over the previous four weeks, and an estimation of exercise expenditure calculated using the American College of Sports Medicine Compendium of Physical Activities.[7]

Results

TABLE 1. Demographics of Participants

	n	Age (years)	Body mass (lb)	Height (in)	Miles run per week (mi)	History of BSI (%)	Displayed Disordered Eating Patterns (%)	Delayed menarche [15+ years] (%)	Menstrual cycles in the past year (Avg. #)
Male	25	19.6	149.0	70.0	60.9	56.0	8.0	-	-
Female	21	19.8	125.2	66.0	39.7	71.4	28.0	38.1	9.2

TABLE 2. Statistical Analyses Including Statistical Outliers

	Repeated Measures t-Test									Correlations Between Dietary Intake Per Recall Methods			
	Mean Diff.	SD	Paired Differences Std Error Mean	95% CI of the Difference: Lower	95% CI of the Difference: Upper	t	df	Sig. (2-tailed)		Mean	Standard Deviation	Pearson Correlation	Sig. (2-tailed)
Energy (kcal)	-24.76	1169.93	172.50	-372.19	322.66	-.144	45	.886	NSS	2985.58	960.620	.150♦	.314
									RD Recall	3010.34	827.51		
CHO (g)	-13.34	149.27	22.01	-57.67	30.98	-.606	45	.547	NSS	350.43	102.94	.058♦	.701
									RD Recall	363.77	114.25		
Protein (g)	2.34	69.41	10.23	-18.27	22.95	.229	45	.820	NSS	153.45	62.54	.204♦	.173
									RD Recall	151.11	45.47		
Fat (g)	-10.92	53.19	7.84	-26.72	4.88	-1.392	45	.171	NSS	101.64	44.28	.227♦	.129
									RD Recall	112.56	41.21		

TABLE 3. Statistical Analyses Excluding Statistical Outliers

	Repeated Measures t-Test									Correlations Between Dietary Intake Per Recall Methods			
	Mean Diff.	SD	Paired Differences Std Error Mean	95% CI of the Difference: Lower	95% CI of the Difference: Upper	t	df	Sig. (2-tailed)		Mean	Standard Deviation	Pearson Correlation	Sig. (2-tailed)
Energy (kcal)	4.02	759.36	117.17	-232.61	240.66	.034	41	.973	NSS	2962.70	897.88	.565++	< .001*
									RD Recall	2959.35	626.13		
CHO (g)	-1.33	126.49	18.86	-39.33	36.67	-.071	44	.944	NSS	352.55	101.89	.176♦	.247
									RD Recall	354.14	92.71		
Protein (g)	5.30	55.58	8.48	-11.80	22.41	.630	42	.535	NSS	153.21	56.45	.414+	<.01*
									RD Recall	147.97	42.74		
Fat (g)	-11.33	37.58	5.80	-23.04	0.38	-1.95	41	.058	NSS	99.57	40.43	.535++	<.001*
									RD Recall	110.89	36.20		

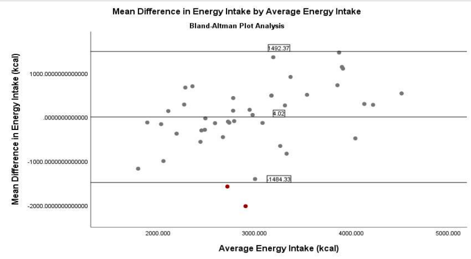
- The Bland Altman Plot Analyses did not reveal evidence of proportional bias in energy [β=.258; t(45)=1.005, *p* = .317], carbohydrate [β=.-.196; t(45)=-.694, *p* = .491], and fat intakes [β=.117; t(45)=.491, *p* = .626]. Protein intakes did initially show evidence of proportional bias [β=.516; t(45)=2.196, *p* = .033]. However, after transformation via natural logarithmic function to correct nonnormality of the data distribution for this variable evidence for proportional bias was mediated [β=.675; t(45)=1.551, *p* = .128].
- Another set of Bland-Altman Plot Analyses were conducted to test for proportional bias between recall methods excluding statistical outliers from the first set. There were no significant differences between recall methods for carbohydrate [β=.160; t(44)=.631, *p* = .532] and fat intake [β=.144; t(41)=.829, *p* = .412]. Protein intakes displayed borderline significance for proportional bias [β=.138; t(42)=1.982, *p* = .054]. However, after being transformed via natural logarithmic function, the evidence of proportional bias once again disappeared [β=.602; t(42)=1.507, *p* = .140]. Energy intake displayed statistically significant evidence of proportional bias [β=.452; t(41)=2.824, *p* < .01]. Even when transformed via natural logarithmic function, evidence of proportional bias for energy intake between recall methods remained [β=.925; t(41)=2.721, *p* = .01]

Discussion & Conclusions

Compared with the 24-hour recall, the NSS displayed moderate agreement between energy and fat intake, weak agreement between protein intakes, and a negligible and non-significant relationship between carbohydrate intakes when outliers were excluded. The initial lack of relationships between recall methods including outliers is likely related to the **high degree of variance** in dietary intakes and indicates that the NSS is **sensitive to extreme values**.

There were no significant differences between mean energy in calories, grams of carbohydrate, grams of protein, or grams of fat intake between NSS and RD-administered 24-hour recall when paired t-tests were conducted both including and excluding outliers

Sports RDs could use the NSS to identify groups, if not athletes, at higher risk for LEA and effectively intervene with appropriate education and follow up counselling to provide accurate sports nutrition information, evidence-based nutrition advice, and improve dietary choices.



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For more information

Please contact Caroline.Olson@student.csulb.edu.

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