HHS Public Access

Author manuscript

J Nutr Educ Behav. Author manuscript; available in PMC 2017 July 01.

Published in final edited form as:

J Nutr Educ Behav. 2016 ; 48(7): 505–509.e1. doi:10.1016/j.jneb.2016.04.006.

Assessing the Nutrition Literacy of Parents and its Relationship with Child Diet Quality

Heather D. Gibbs, PhD, RD[1], **Amy R. Kennett, MS, RD**[1], **Elizabeth H. Kerling, MS, RD**[1], **Qing Yu, MA**[2], **Byron Gajewski, PhD**[2], **Lauren T. Ptomey, PhD, RD**[3], and **Debra K. Sullivan, PhD, RD**[1]

Amy R. Kennett: akennett@kumc.edu; Elizabeth H. Kerling: ekerling@kumc.edu; Qing Yu: qyu@kumc.edu; Byron Gajewski: bgajewski@kumc.edu; Lauren T. Ptomey: lptomey@kumc.edu; Debra K. Sullivan: dsulliva@kumc.edu

[1]Department of Dietetics & Nutrition, University of Kansas Medical Center, Kansas City, KS, United States

[2]Department of Biostatistics, University of Kansas Medical Center, Kansas City, KS, United States

[3]Cardiovascular Research Institute, Department of Internal Medicine, University of Kansas Medical Center, Kansas City, KS, United States

Abstract

Objective—To estimate the reliability and validity of the *Nutrition Literacy Assessment Instrument for Parents* (NLit-P) and to investigate relationships between parental nutrition literacy, parental and child BMI, and child diet quality (Healthy Eating Index, HEI).

Methods—Cross-sectional study of 101 parent-child dyads which collected measures of socioeconomic status, nutrition literacy, 2–24 hour child diet recalls, and BMI. Reliability of NLit-P was assessed by confirmatory factor analysis. Pearson correlation and multiple linear regression was used.

Results—Fair to substantial reliability was seen across 5 NLit-P domains, while Pearson correlations support concurrent validity for the NLit-P related to child diet quality and parental income, age, and educational attainment ($p<0.001$). For every 1% increase in NLit-P, there was a 0.51 increase in child HEI ($R^2=0.174$; $p<0.001$).

Conclusions and Implications—The NLit-P demonstrates potential for measuring parental nutrition literacy, which may be an important educational target for improving child diet quality.

Corresponding and first author: Heather D. Gibbs, PhD, RD; hgibbs@kumc.edu, Phone: (913) 945-9138, Fax: (913) 588-8946; Full address: Department of Dietetics & Nutrition, Mail Stop 4013, University of Kansas Medical Center, Kansas City, KS, 66208, United States.

Data on a smaller sample size (n=48), entitled *A Pilot Study to Explore the Correlation Between Parental Nutrition Literacy, BMI and Child Healthy Eating Index-2010* was published in the JNEB 2014 supplement. Ms. Kennett's master's thesis is titled the same and can be found at https://kuscholarworks.ku.edu/handle/1808/14499.

Keywords

health literacy; patient education; body mass index; pediatrics; food habits

INTRODUCTION

Childhood obesity is a major health concern in the United States and 16.9% of children are now obese[1]. While childhood obesity has many etiological factors, public health initiatives that provide nutrition education to parents and children fail to demonstrate major improvements in dietary recommendations[2]. This discrepancy highlights an important question of whether parents can act upon the nutrition information available to them.

Health literacy is, “the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions”[3]. A 2003 National Assessment of Adult Literacy found only 15% of parents have “proficient” health literacy[4], indicating the majority of parents, to some degree, have difficulty making health decisions. Furthermore, it is not clear if parental health literacy influences child weight status. In a population of Hispanic children less than 30 months old, parental health literacy was not associated with child weight-for-length Z-score[5], but a study of children aged 7–11 years old found an inverse relationship between parental health literacy and odds of childhood obesity[6]. Other studies of adolescent-age children disputed these findings[6,7].

These discrepancies may be influenced by differences in instrumentation. Most have measured health literacy by the Short Test of Functional Health Literacy[5,7,8] or the Newest Vital Sign[6,9]. However, nutrition focused health literacy may involve constructs not reflected in general health literacy assessment tools. Some researchers have relied on study-specific tools for measuring parental nutrition knowledge[10,11] or nutrition literacy[12]. It is possible that an instrument that combines both nutrition knowledge constructs and health literacy constructs is more sensitive to nutrition literacy-related outcomes[13].

Given the current childhood obesity epidemic and complex relationship between parental health literacy and child health outcomes, development of a nutrition specific literacy measurement tool is important. The aims of this study were to, (1) estimate the reliability and concurrent validity of the Nutrition Literacy Assessment Instrument for Parents (NLit-P), and (2) investigate the relationships between parental nutrition literacy, parental and pediatric weight status, and dietary quality.

METHODS

Participants and Procedures

This study utilized a convenience sample of participants already enrolled in the KU DHA Outcomes Study (KUDOS; NCT00266825); a longitudinal randomized controlled clinical trial investigating the effect of prenatal DHA supplementation on gestation duration and early childhood development[14]. Eligible participants for the longitudinal trial were healthy, pregnant women between the ages of 16 and 36 who lived in the Kansas City Metropolitan

area. Additional inclusion and exclusion criteria can be found in a previous publication[14]. For the present ancillary study, eligible parents were English speaking, had a child between 4–6 years of age, and self-identified as the primary food purchaser and/or food preparer in their household. A total of 101 parent-child dyads enrolled. The University of Kansas Institutional Review Board approved this ancillary study (HSC# 11406), and all participants completed informed consent. Data collection occurred from October 2013 through May 2014.

Measures

Child age as well as parental education, maternal age, and socioeconomic status were collected as part of the larger KUDOS trial. When needed, maternal age was used as a proxy for paternal age (n=15). Parental and child height and weight were measured using clinic standard procedures[15].

Nutrition literacy was measured by a modified version of the Nutrition Literacy Assessment Instrument (NLit)[13]. The NLit was previously content validated by registered dietitians, cancer nutrition experts and breast cancer survivors, and demonstrated internal and test-retest reliability in breast cancer patients[13,16]. For the purpose of this study, the NLit was shortened to 42 items to reflect content and food items relevant for parents of preschoolers as determined by two research team registered dietitians. The resulting NLit-P consisted of five domains that together reflect constructs of health literacy and nutrition knowledge: Nutrition & Health (literacy), Household Food Measurement (nutrition knowledge), Food Label & Numeracy (literacy and numeracy), Food Groups (nutrition knowledge), and Consumer Skills (nutrition knowledge). Parents completed the NLit-P during a prescheduled appointment for the KUDOS. Data were recorded for each item as correct/incorrect, with missing answers coded as incorrect. Weighted percentages (giving each domain equal distribution to the total score) were calculated.

Two 24-hour dietary recalls obtained from parents for each child were entered into Nutrient Data System for Research (University of Minnesota, Minneapolis, MN; version 2014) and the combined total of the recalls were used to calculate an HEI-2010 score[17] following established guidelines[18]. Total score of HEI-2010 ranges 0 – 100. Subjects were excluded if parents were unable to recall one or more meals within an individual dietary recall (n=2).

Statistical Analyses

Instrument reliability was evaluated by confirmatory factor analysis to test the relationship between observed variables and each domain. Binary CFA is a generalization of Rasch models[19]. The binary CFA analysis was conducted using the Lavaan package from R2.15.3. Model fit was determined by Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). A CFI of 0.90 or greater and RMSEA of 0.06 or less indicate acceptable model fit. Reliability was interpreted as: 0.00–0.10 was virtually none; 0.11–0.40 was slight; 0.41–0.60 was fair; 0.61–0.80 was moderate; and 0.81–1.0 was substantial reliability[20].

The relationship between independent factors and dependent factors were evaluated using Pearson’s Correlation and multiple linear regression. Nutrition literacy (NLit-P), income,

parental age, and highest reported parental education were treated as independent variables while child diet quality (HEI-2010), child BMI percentile, and parental BMI were dependent variables. Data was further analyzed by domain of the NLit-P using the general linear model to test for relationships between each NLit-P domain and parental BMI or child HEI, while controlling for income, age, and education. Significance was set at $P<0.05$. Statistical tests were performed using the Statistical Package for the Social Sciences (SPSS release 20.0.0, IBM Corp., Armonk, NY, 2011) and SAS® (SAS 9.4, SAS Institute, Inc., Cary, NC, 2013).

RESULTS

Demographic data are summarized in Table 1. Most participants (65%) did not participate in food assistance programs; however some did participate in the Supplemental Nutrition Assistance Program (25%) and the Special Supplemental Program for Women, Infants, and Children (15%).

The Nutrition & Health and Food Groups domains demonstrated substantial reliability (0.841 and 0.851, respectively), the Food Label & Numeracy domain demonstrated moderate reliability (0.776), and the Household Food Measurement and Consumer Skill domains demonstrated fair reliability (0.47 and 0.549 respectively). Reliability is reported in Table 2.

There were significant positive relationships between parental nutrition literacy and child diet quality (r=0.418, $P<0.001$), income (r=0.477, $P<0.001$), parental age (r=0.398, $P<0.001$) and parental education (r=0.595, $P<0.001$). An inverse relationship was found between nutrition literacy and parent BMI (r=−0.306, $P=0.002$). Correlational statistics are provided in Table 3. The linear relationship between parental nutrition literacy and child diet quality demonstrates that for every 1% increase in NLit-P, there was a 0.51 increase in child HEI ($R^2=0.174$; $P<0.001$). With parental nutrition literacy, income, age, and education held constant in the model, only nutrition literacy was a significant predictor of child diet quality ($P=0.005$).

Looking at specific NLit-P domains, child HEI demonstrated significant relationship with parent nutrition literacy for Household Food Measurement ($P=0.01$, B = 12.66) and Consumer Skills ($P=0.049$, B=13.59) whereas education was significantly related to Nutrition & Health ($P=0.01$, B=1.77), Household Food Measurement ($P=0.02$, B=1.54), Food Label & Numeracy ($P=0.04$, B=1.44), and Food Groups ($P=0.01$, B=1.75). Parental BMI was significantly related to two domains including Nutrition & Health ($P=0.01$, B= −8.53) and Food Label & Numeracy ($P=0.001$, B=−6.73), however, these relationships were no longer significant when income, age and education were included in the model. No relationship was seen between parental nutrition literacy and child BMI percentiles ($P>0.05$).

DISCUSSION

Significant correlations between parental nutrition literacy, educational attainment, parental age and income, and child diet quality support the concurrent validity of the NLit-P. While the sample size is inadequate to evaluate overall reliability of the NLit-P, fair to substantial

internal reliability in each of the five domains suggests the likelihood of instrument reliability.

The finding that parental nutrition literacy was not related to child weight status is congruent with similar health literacy research[5–7]. While one study reported inverse relationships between adult BMI and health literacy[21], others have not[22,23]. Still others report a relationship with numeracy and not literacy[24]. Further, some studies demonstrate that child, but not parent, health literacy is significantly associated with BMI[6,7,10,25]. Differences in instrumentation aside, other factors that could be explored, including socioeconomic status, education, and even behavioral motivations or access to healthy food may mediate the BMI and health literacy relationship. Thus, strong conclusions regarding relationships between health or nutrition literacy and obesity cannot be made.

Educational attainment was the most significant confounder in our analyses for both parental obesity and nutrition literacy. A recent systematic review found that in high-income countries, including the United States, there is an inverse relationship between educational attainment and obesity[26]. Additionally, low health literacy is associated with low educational attainment[27,28] and causal pathways of the effect of education upon health outcomes have been demonstrated[29,30]. A few studies have reported that health literacy partially mediates the relationship between educational attainment and health outcomes[28,31]. Within the context of nutrition, one study found that knowledge of recommendations about fruit and vegetable intake mediated the relationship between parental education and child fruit and vegetable intake[32]. Thus, as research into nutrition literacy moves forward to designing effective interventions, it is useful to consider the role of education in improving diet quality.

Within the NLit-P, the Nutrition & Health domain requires literacy, the Food Label & Numeracy domain requires literacy and numeracy skills, and the Food Groups domain reflects an ability to categorize foods according to the USDA's Food Guidance System, a widely incorporated public health education initiative[33]. It is intuitive to postulate that skills obtained through formal education are associated with improved nutrition literacy in these domains. Although Household Food Measurement and Consumer Skills domains had fair reliability, the results of this study indicate improvements in diet quality beyond skills obtained through formal education.

This study has important limitations. Parental nutrition literacy was measured in only one parent, and in some families, parents participate equally in making nutrition decisions. Capturing nutrition literacy for both parents may provide a more complete understanding. Recruitment of parents from an ongoing larger trial may introduce participant bias, however no nutrition education was provided as part of the trial. Also, because paternal age was not collected as part of the larger trial, maternal age was substituted for paternal age. Additionally, other caregivers (i.e. child care settings) are often involved in feeding children. While we addressed this limitation by excluding unreliable dietary recalls, lesser parental involvement in food delivery may weaken the relationship between parental nutrition literacy and child diet quality. Because fluctuations in diet are common, especially among children, two 24-hour diet recalls may not accurately reflect intake. Finally, interpretation of our nutrition literacy scores is limited because there is no standard for nutrition literacy

measurement to compare, and, because food choices can vary regionally, and by age, culture, etcetera, results are not generalizable. Validation in other populations that deviate from this sample is recommended.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The results of this study suggest that the NLit-P has potential as a valid and reliable measurement tool for parental nutrition literacy, however, further research is needed with a larger sample size, a more diverse group, and a more robust recall of children's dietary intake. Such studies could establish cut-points of nutrition literacy relative to diet quality, further improving interpretation of nutrition literacy scores. Parental nutrition literacy may be an important target for nutrition professionals and researchers seeking to improve the diet quality of children aged 4–6 years.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The study was supported by R01 HD047315 and R03 HD081730 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development and KU Endowment.

References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. J Am Med Assoc. 2012; 307(5):483–490.
2. Hazel, A.; Guenther, P.; Rihane, C. Alexandria, VA: US Department of Agriculture; 2013. Diet quality of children age 2–17 years as measured by the healthy eating index—2010.
3. Nielsen-Bohlman, L. Health Literacy: A Prescription to End Confusion. Washington DC: The National Academies Press; 2004.
4. Yin HS, Johnson M, Mendelsohn AL, Abrams MA, Sanders LM, Dreyer BP. The health literacy of parents in the United States: a nationally representative study. Pediatrics. 2009 Nov; 124(Suppl 3):S289–S298. [PubMed: 19861483]
5. Ciampa PJ, White RO, Perrin EM, et al. The association of acculturation and health literacy, numeracy and health-related skills in Spanish-speaking caregivers of young children. J Immigr Minor Health. 2013; 15(3):492–498. [PubMed: 22481307]
6. Chari R, Warsh J, Ketterer T, Hossain J, Sharif I. Association between health literacy and child and adolescent obesity. Patient Educ Couns. 2014; 94(1):61–66. [PubMed: 24120396]
7. Sharif I, Blank AE. Relationship between child health literacy and body mass index in overweight children. Patient Educ Couns. 2010 Apr; 79(1):43–48. [PubMed: 19716255]
8. Baker DW, Williams MV, Parker RM, Gazmararian JA, Nurss J. Development of a brief test to measure functional health literacy. Patient Educ Couns. 1999; 38(1):33–42. [PubMed: 14528569]
9. Weiss BD, Mays MZ, Martz W, et al. Quick assessment of literacy in primary care: the newest vital sign. Ann Fam Med. 2005; 3(6):514–522. [PubMed: 16338915]
10. Nelson MC, Lytle LA, Pasch KE. Improving literacy about energy-related issues: the need for a better understanding of the concepts behind energy intake and expenditure among adolescents and their parents. J Am Diet Assoc. 2009; 109(2):281–287. [PubMed: 19167955]
11. Cluss PA, Ewing L, King WC, Reis EC, Dodd JL, Penner B. Nutrition Knowledge of Low Income Parents of Obese Children. Transl Behav Med. 2013; 3(2):218–225. [PubMed: 24039639]

12. Silk KJ, Sherry J, Winn B, Keesecker N, Horodynski MA, Sayir A. Increasing nutrition literacy: testing the effectiveness of print, web site, and game modalities. J Nutr Educ Behav. 2008; 40(1): 3–10. [PubMed: 18174098]
13. Gibbs H, Chapman-Novakofski K. Establishing Content Validity for the Nutrition Literacy Assessment Instrument. Prev Chronic Dis. 2013; 10:E109. [PubMed: 23823698]
14. Carlson SE, Colombo J, Gajewski BJ, et al. DHA supplementation and pregnancy outcomes. Am J Clin Nutr. 2013; 97(4):808–815. [PubMed: 23426033]
15. CDC. [Accessed March 29, 2016] National Health and Nutrition Examination Survey: Anthropometry Procedures Manual. 2009. http://www.cdc.gov/nchs/data/nhanes/nhanes_09_10/BodyMeasures_09.pdf
16. Gibbs HD, Ellerbeck EF, Befort C, et al. Measuring Nutrition Literacy in Breast Cancer Patients: Development of a Novel Instrument. J. Cancer Educ. 2015 May 9.
17. Guenther PM, Casavale KO, Reedy J, et al. Update of the Healthy Eating Index: HEI-2010. J Acad Nutr Diet. 2013; 113(4):569–580. [PubMed: 23415502]
18. Nutrition Coordinating Center. Guide to Creating Variables Needed to Calculate Scores for Each Component of the Healthy Eating Index-2010 (HEI-2010). 2014 [Accessed July 7th, 2015] http://www.ncc.umn.edu/ndsrsupport/hei2010.pdf.
19. Wirth R, Edwards MC. Item factor analysis: current approaches and future directions. Psychol Methods. 2007; 12(1):58. [PubMed: 17402812]
20. Shrout PE. Measurement reliability and agreement in psychiatry. Stat. Methods Med Res. 1998; 7(3):301–317. [PubMed: 9803527]
21. Lassetter JH, Clark L, Morgan SE, et al. Health Literacy and Obesity Among Native Hawaiian and Pacific Islanders in the United States. Public Health Nurs. 2015; 32(1):15–23. [PubMed: 25273848]
22. Rothman RL, Housam R, Weiss H, et al. Patient understanding of food labels: the role of literacy and numeracy. Am J Prev Med. 2006; 31(5):391–398. [PubMed: 17046410]
23. Wolf MS, Gazmararian JA, Baker DW. Health Literacy and Health Risk Behaviors Among Older Adults. Am J Prev Med. 2007; 32(1):19–24. [PubMed: 17184964]
24. Huizinga MM, Beech BM, Cavanaugh KL, Elasy TA, Rothman RL. Low numeracy skills are associated with higher BMI. Obesity. 2008; 16(8):1966–1968. [PubMed: 18535541]
25. Mulvaney SA, Lilley JS, Cavanaugh KL, Pittel EJ, Rothman RL. Validation of the diabetes numeracy test with adolescents with type 1 diabetes. J Health Commun. 2013; 18(7):795–804. [PubMed: 23577642]
26. Cohen AK, Rai M, Rehkopf DH, Abrams B. Educational attainment and obesity: a systematic review. Obes Rev. 2013; 14(12):989–1005. [PubMed: 23889851]
27. Kutner M, Greenburg E, Jin Y, Paulsen C. The Health Literacy of America's Adults: Results from the 2003 National Assessment of Adult Literacy. NCES 2006-483. National Center for Education Statistics. 2006
28. van der Heide I, Wang J, Droomers M, Spreeuwenberg P, Rademakers J, Uiters E. The Relationship Between Health, Education, and Health Literacy: Results From the Dutch Adult Literacy and Life Skills Survey. J Health Commun. 2013; 18(sup1):172–184. [PubMed: 24093354]
29. Chandola T, Clarke P, Morris J, Blane D. Pathways between education and health: a causal modelling approach. Journal of the Royal Statistical Society. 2006; 169(2):337–359.
30. Lleras-Muney A. The relationship between education and adult mortality in the United States. Economic Stud. 2005; 72(1):189–221.
31. Schillinger D, Barton LR, Karter AJ, Wang F, Adler N. Does literacy mediate the relationship between education and health outcomes? A study of a low-income population with diabetes. Public Health Rep. 2006; 121(3):245. [PubMed: 16640146]
32. Lehto E, Ray C, Te Velde S, et al. Mediation of parental educational level on fruit and vegetable intake among schoolchildren in ten European countries. Public Health Nutr. 2015; 18(01):89–99. [PubMed: 24476635]
33. Post RC, Haven J, Eder J, Johnson-Bailey D, Bard S. MyPlate Reaches More Frontiers. J Acad Nutr Diet. 2013; 113(8):1014–1017. [PubMed: 23885698]

Table 1

Characteristics of Parents and Children (n=101 dyads)

Characteristic	Result
Parents	
Gender, n (%)	
Female	86 (85.2)
Male	15 (14.9)
Race, n (%)	
Hispanic White	6(5.9)
Non-Hispanic White	70(69.3)
Non-Hispanic Black	24 (23.8)
Non-Hispanic American Indian or Alaskan Native	1(1.0)
Income, mean $ (SD)	50,286 (20,927)
Age, mean years (SD)[a]	32.2 (4.5)
Education, mean years (SD)	14.6 (2.5)
BMI, mean (SD)	27.5(5.9)
NLit-P Score, mean % (SD)[b]	80.2 (12.1)
Children	
Gender, n (%)	
Female	50(49.5)
Male	51(50.5)
Age, mean years (SD)	4.9(0.7)
BMI, %ile mean (SD)	64.3(27.1)
Child HEI total score[c], mean (SD)	52.5 (14.6)

[a] Maternal age was used as a proxy for paternal age

[b] Measured by the Nutrition Literacy Assessment Instrument for Parents

[c] Healthy Eating Index-2010 calculated from 24-h recall nutrient data obtained using the Nutrition Data Systems for Research (NDSR)

Table 2

Reliability and scoring statistics by domain

NLit-P[a] Domain	Confirmatory Factor Index (CFI)[b]	Root Mean Square of Approximation (RMSEA)[c]	Entire Reliability[d]	Mean Score n correct (Std Dev)
Nutrition & Health (6 items)	0.581	0.1	0.841***	5.5 (0.88)
Household Food Measurements (8 items)	1*	0**	0.47	4.5 (1.52)
Food Label & Numeracy (7 items)	1*	0**	0.776	5.6 (1.53)
Food Groups (15 items)	1*	0**	0.851***	14.0 (2.04)
Consumer Skills (6 items)	1*	0**	0.549	4.7 (1.24)

[a] Nutrition Literacy Assessment Instrument for Parents

[b] CFI ≥0.90 indicate acceptable model fit*

[c] RMSEA ≤ 0.06 indicate acceptable model fit**

[d] Entire reliability is the reliability of the entire domain. 0.81–1.0 is substantial reliability*** according to Shrout's guidelines[20]

J Nutr Educ Behav. Author manuscript; available in PMC 2017 July 01.

Table 3

Pearson Correlations between Parent Nutrition Literacy, Socioeconomic Variables, BMI, and Child Diet Quality

Variable	NLit-P[1] Score	Parent BMI	Household Income	Parental Age	Educational Attainment	Child BMI %ile	Child HEI[2]
NLit-P[1] Score	—	−.306*	.477**	.398**	.595**	−0.088	.418**
Parent BMI	−.306*	—	−.260*	−.195	−.268*	.322**	−.217*
Household Income	.477**	−.260*	—	.338**	.429**	.027	.218*
Parental Age	.398**	−.195	.338**	—	.386**	.067	.146
Educational Attainment	.595**	−.268*	.429**	.386**	—	−.027	.328**
Child BMI %ile	−0.088	.322**	.027	.067	−.027	—	−.119
Child HEI[2]	.418**	−.217*	.218*	.146	.328**	−.119	—

[1] Nutrition Literacy Assessment Instrument for Parents

[2] Healthy Eating Index -2010

** correlation is significant at the <0.001 level (2-tailed)

* correlation is significant at the <0.05 level (2-tailed)