Diet Quality of Canadian Preschool Children: Associations with Socio-demographic Characteristics

ANA CAROLINA LEME, PhD, RD[a,b,c]; DABROWKA MUSZYNSKI, MSc, RD[d]; JULIA A. MIROTTA, BASc, MSc[d]; NICHOLAS CAROLL, BASc[a]; JAIMIE L. HOGAN, BASc, MSc[d]; KIRA JEWELL, MSc[d]; JESSICA YU, BASc[d]; REGINA MARA FISBERG, PhD, RD[b]; ALISON M. DUNCAN, PhD, RD[d]; DAVID W.L. MA, PhD[d]; JESS HAINES, PhD, RD[a]; ON BEHALF OF THE GUELPH FAMILY HEALTH STUDY

[a]University of Guelph, Department of Family Relations and Applied Nutrition, Guelph, ON; [b]University of São Paulo, Department of Nutrition, School of Public Health, Brazil, São Paulo, Brazil; [c]Center for Excellence in Nutrition and Feeding Difficulties, Children's Hospital Sabará, PENSI Institute, Brazil; [d]University of Guelph, Department of Human Health and Nutritional Sciences, Guelph, ON

Canadian Journal of Dietetic Practice and Research Downloaded from dcjournal.ca by USP UNIVERSIDADE DE SAO PAULO on 12/08/23
For personal use only.

ABSTRACT

Purpose: To examine associations between preschoolers' diet quality and parent and child socio-demographic variables.
Methods: Cross-sectional analysis with 117 preschoolers. Parents reported socio-demographics and their children's diet using 3-day food records. Diet quality was assessed using the Healthy Eating Index (HEI) 2015. Linear regression models were used to analyze associations between socio-demographics and HEI scores.
Results: A total of 86% of children had an HEI-2015 score in the "needs improvement" category (51–80 out of a maximum of 100). Children's overall HEI-2015 score was inversely associated with children's age (β = –0.19, 95% CI –0.37, –0.02). Parental education was positively associated with children's overall HEI score (β = 9.58, 95% CI 3.81, 15.35) and with scores for total fruit (β = 1.00, 95% CI 0.39, 1.76), vegetables (β = 1.11, 95% CI 0.03, 2.18), total protein (β = 1.06, 95% CI 0.28, 1.84), and seafood/plant protein (β = 1.67, 95% CI 0.43, 2.89) components. Children who identified as Caucasian (β = 4.29, 95% CI 2.46, 6.14), had a Caucasian parent (β = 3.01, 95% CI 0.78, 5.25), or parents who were born in Canada (β = 2.32, 95% CI 0.53, 4.11) had higher scores for dairy.
Conclusion: Our results suggest that preschoolers' diet quality needs improvement and that children's diet quality varies by children's age and parental education level.

(Can J Diet Pract Res. 2021;82:131–135)
(DOI: 10.3148/cjdpr-2021-009)
Published at dcjournal.ca on 20 April 2021

RÉSUMÉ

Objectif. Examiner les associations entre la qualité de l'alimentation des enfants d'âge préscolaire et les variables sociodémographiques des parents et des enfants.
Méthodes. Analyse transversale auprès de 117 enfants d'âge préscolaire. Les parents ont fourni des données sociodémographiques et sur l'alimentation de leurs enfants au moyen de journaux alimentaires tenus sur 3 jours. La qualité de l'alimentation a été évaluée à partir de l'indice de saine alimentation (ISA) 2015. Des modèles de régression linéaire ont été employés pour analyser les associations entre les données sociodémographiques et les scores d'ISA.
Résultats. Au total, 86 % des enfants ont obtenu un score d'ISA-2015 dans la catégorie « besoin d'amélioration » (51 à 80 sur un maximum de 100). Le score global d'ISA-2015 des enfants était inversement associé à leur âge (β = -0,19; IC à 95 % : -0,37–-0,02). L'éducation des parents était positivement associée au score global d'ISA de l'enfant (β = 9,58; IC à 95 % : 3,81–15,35) et aux scores pour les composantes fruits totaux (β = 1,00; IC à 95 % : 0,39–1,76), légumes (β = 1,11; IC à 95 % : 0,03–2,18), protéines totales (β = 1,06; IC à 95 % : 0,28–1,84) et fruits de mer/protéines végétales (β = 1,67; IC à 95 % : 0,43–2,89). Les enfants désignés comme étant de race blanche (β = 4,29; IC à 95 % : 2,46–6,14), dont un parent est de race blanche (β = 3,01; IC à 95 % : 0,78–5,25) ou dont les parents sont nés au Canada (β = 2,32; IC à 95 % : 0,53–4,11) ont obtenu des scores plus élevés pour les produits laitiers.
Conclusions. Nos résultats suggèrent que la qualité de l'alimentation des enfants d'âge préscolaire doit être améliorée et que la qualité de l'alimentation des enfants varie selon leur âge et le niveau d'éducation des parents.

(Rev can prat rech diétét. 2021;82:131–135)
(DOI: 10.3148/cjdpr-2021-009)
Publié au dcjournal.ca le 20 avril 2021

INTRODUCTION

Healthy dietary intake plays an important role in children's short- and long-term health. Yet evidence from the United States [1], United Kingdom [2], and Canada [3] suggests that many children are not meeting the recommended dietary guidelines. Most of the Canadian research examining childhood dietary intake has focused on daily intake of specific nutrients or foods [3, 4]. However, it has been recommended that studies should evaluate diets based on overall quality rather than specific nutrients [5]. The Healthy Eating Index (HEI) was designed to assess diet quality in people aged 2 years and older [6] and is considered a reliable tool to assess the diet quality of preschool-aged children [6].

Understanding socio-economic disparities in diet can inform nutrition policy and population-based interventions [7]. Socio-demographic differences in diet quality have been described in adults [8–10], older children, and adolescents [11–13]. However, less is known about socio-demographic differences in diet quality among Canadian preschool children. The objective of this study was to describe preschool children's diet quality and investigate how children's diet

Canadian Journal of Dietetic Practice and Research Downloaded from dcjournal.ca by USP UNIVERSIDADE DE SAO PAULO on 12/08/23
For personal use only.

quality is associated with parents' and children's socio-demographics among a sample of Canadian families.

METHODS

This study used baseline data from the Guelph Family Health Study pilots, which included data on 117 preschool children from 83 families [14, 15]. Specific details regarding sampling design and data collection methods have been published elsewhere [15]. Three-day food records were used to calculate HEI-15 scores for each child as an indicator of diet quality [16]. Scores are based on intake of 13 dietary components (9 adequacy and 4 moderation, see Figure 1 and Table 1), with potential scores from 0 to 100 (>80 = good, 50–80 = needs improvement, <50 = poor). Trained research assistants manually examined food records and converted intakes to HEI equivalents. Sodium and fatty acid intakes were obtained from Food Processor Nutrition Analysis Software version 11.6.441 (ESHA Research, Salem, OR, USA), and added sugar intake was manually calculated through retrieving information from designated food labels. Although the HEI has been adapted for use with Canadian populations [17], the HEI-2015 was selected for this analysis because the version of ESHA used only provides data based on the United States Department of Agriculture recommendations. Parents also reported socio-demographic characteristics. Child body mass index *z*-scores were calculated [18, 19] and overweight or obese children classified with a cut-off point ≥2 *z*-score. The University of Guelph Research Ethics Board approved the study.

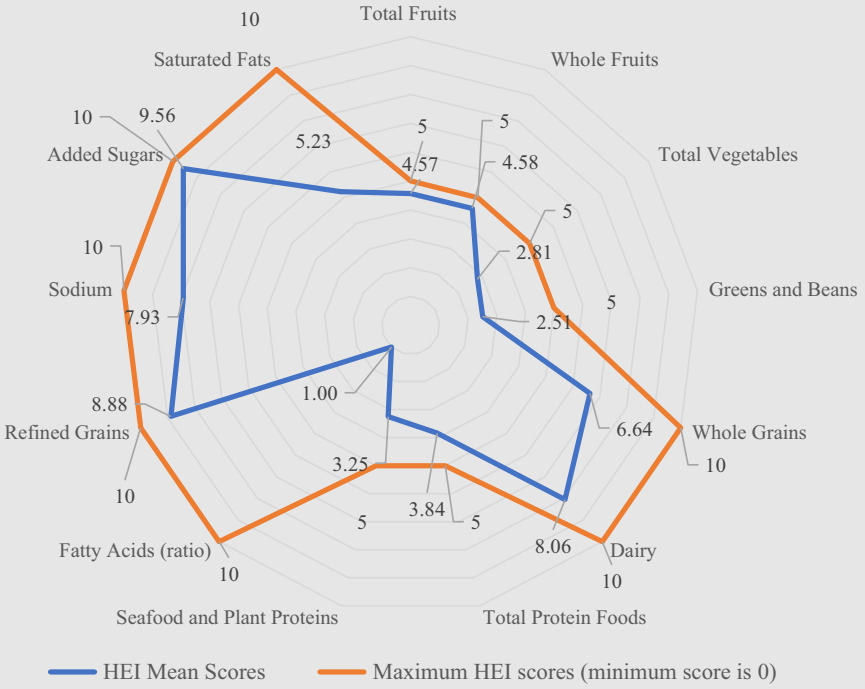
Descriptive statistics were used to describe parent and child characteristics. Data were normally distributed according to skewness curves [20, 21]. Linear regression analyses were used to determine associations between children's HEI-2015 scores and socio-demographics. Data were analyzed using SAS (software version 5.2 for MacBook IOS 10.14.16, SAS Institute Inc., Cary, NC, USA).

RESULTS

The child participants (n = 117) had a mean age of 3.58 (±SD 1.27) years, 52% were male, and 32% were classified as overweight or obesity. Mean age of parents was 35.97 (±5.51) years, 56.5% were female, 85.5% were married, 74.7% had a university degree, and average household income was $80 863.31 CAD. Approximately 91.5% of children and 88% of parents identified as Caucasian.

Mean HEI-2015 score was 68.85 (95% CI 67.01, 70.70); 86% of children had an HEI-2015 score in the "needs improvement" category (51–80 out of 100), and 2% had a low-quality diet (<51). Figure 1 shows the mean score for each

Figure 1. Children HEI-2015 mean components scores.[a] Guelph Family Health Study. 2015–2016 (n = 117).



[a]Higher scores indicated better diet quality for adequacy components (total fruits, whole fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, fatty acids) and for moderation components (saturated fats, added sugars, sodium, refined grains).

Canadian Journal of Dietetic Practice and Research Downloaded from dcjournal.ca by USP UNIVERSIDADE DE SAO PAULO on 12/08/23
For personal use only.

Table 1. Children's diet quality component and overall Healthy Eating Index-2015 scores, socio-demographics and weight status (n = 117). Guelph Family Health Study, 2015–2016.

	β (95% Confidence Interval)									
	Parents age	**Parents ethnicity[a]**	**Number of children[b]**	**Parental educational level[c]**	**Income[d]**	**Canadian parents**	**Children's age**	**Children's sex**	**Children's ethnicity[a]**	**Children's weight status[d]**
Adequacy components										
Total fruits	−0.02 (−0.06, 0.03)	−0.36 (−1.31, 0.58)	0.17 (−0.19, 0.53)	**1.08 (0.39, 1.76)**	**1.29 (4.50, 2.13)**	−0.23 (−0.98, 0.53)	**−0.19 (−0.37, −0.02)**	**0.53 (0.14, 0.91)**	0.17 (−0.62, 0.94)	−0.31 (−0.74, 0.13)
Whole fruits	−0.01 (−0.06, 0.05)	−0.58 (−1.74, 0.59)	0.18 (−0.26, 0.62)	0.58 (−0.31, 1.46)	8.59 (−1.48, 1.87)	−0.05 (−0.98, 0.87)	**−0.24 (−0.45, −0.03)**	**0.61 (0.14, 1.08)**	−0.24 (−1.19, 0.71)	**−0.57 (−1.11, −0.03)**
Total vegetables	−0.05 (−0.12, 0.01)	0.51 (−0.92, 1.95)	−0.28 (−0.83, 0.26)	**1.11 (0.03, 2.18)**	−4.48 (−1.82, 8.51)	−0.65 (−1.79, 0.49)	0.06 (−0.23, 0.35)	−0.06 (−0.73, 0.60)	0.19 (−1.11, 1.49)	0.23 (−0.51, 0.97)
Green and beans	−0.06 (−0.15, 0.02)	0.58 (−1.30, 2.45)	−0.29 (−0.99, 0.42)	1.11 (−0.31, 2.53)	−5.89 (−2.34, 1.16)	−0.51 (−2.01, 0.98)	−0.01 (−0.39, 0.37)	0.01 (−0.85, 0.87)	0.29 (−1.39, 1.99)	−0.02 (−0.98, 0.95)
Whole grains	0.03 (−0.09, 0.15)	0.61 (−1.93, 3.15)	−0.12 (−1.09, 0.84)	0.73 (−1.21, 2.68)	8.06 (−1.53, 3.14)	−0.52 (−2.55, 1.51)	0.23 (−0.29, 0.75)	0.95 (−0.22, 2.12)	2.01 (−0.28, 4.31)	−0.61 (−1.93, 0.72)
Dairy	−0.03 (−0.14, 0.08)	**3.01 (0.78, 5.25)**	−0.41 (−1.29, 0.47)	−0.45 (−2.24, 1.34)	1.94 (−1.05, 3.99)	**2.32 (0.53, 4.11)**	−0.20 (−0.66, 0.25)	−0.58 (−1.61, 0.44)	**4.29 (2.46, 6.13)**	−0.61 (−1.76, 0.54)
Total protein foods	−0.03 (−0.08, 0.02)	−0.23 (−1.31, 0.84)	−0.03 (−0.43, 0.38)	**1.06 (0.28, 1.84)**	−2.35 (−1.03, 9.83)	0.36 (−0.49, 1.21)	0.12 (−0.10, 0.34)	0.10 (−0.39, 0.61)	−0.51 (−1.49, 0.47)	−0.12 (−0.69, 0.46)
Seafood and plant proteins	−0.03 (−0.11, 0.05)	0.26 (−1.42, 1.94)	0.18 (−0.26, 0.62)	**1.67 (0.43, 2.89)**	4.32 (−1.17, 1.98)	0.49 (−0.85, 1.83)	−0.11 (−0.45, 0.22)	0.35 (−0.41, 1.12)	−0.04 (−1.55, 1.47)	0.44 (−0.41, 1.29)
Fatty acids	−0.04 (−0.11, 0.04)	−0.46 (−2.08, 1.16)	−0.08 (−0.69, 0.53)	0.39 (−0.85, 1.63)	−5.38 (−2.05, 9.79)	−0.33 (−1.62, 0.96)	−0.32 (−0.67, 0.04)	0.02 (−0.81, 0.85)	0.42 (−1.19, 2.04)	0.06 (−0.88, 1.00)
Moderation components										
Refined grains	−0.11 (−0.67, 0.46)	−1.27 (−3.25, 0.71)	**0.88 (0.15, 0.61)**	1.09 (−0.42, 2.60)	−1.55 (−2.04, 1.73)	−0.56 (−2.15, 1.03)	**−0.57 (−0.93. −0.21)**	−0.05 (−0.91, 0.81)	−0.72 (−2.41, 0.96)	0.18 (−0.80, 1.16)
Sodium	−0.15 (−0.71, 0.42)	−0.18 (−2.15, 1.80)	0.21 (−0.54, 0.95)	0.53 (−0.98, 2.04)	−3.49 (−2.20, 1.51)	0.17 (−1.40, 1.75)	**−0.62 (−1.01, −0.24)**	0.88 (−0.02, 1.79)	−0.51 (−2.31, 1.29)	0.06 (−0.99, 1.11)
Added sugars	−0.90 (−2.38, 0.57)	−0.14 (−0.91, 0.61)	−0.09 (−0.37, 0.20)	0.47 (−0.10, 1.04)	−4.07 (−1.04, 2.21)	0.13 (−0.48, 0.73)	−0.14 (−0.28, 0.00)	−0.15 (−0.48, 0.18)	−0.17 (−0.82, 0.48)	−0.15 (−0.52, 0.23)
Saturated fats	0.27 (−0.14, 0.69)	−1.50 (−4.14, 1.13)	0.46 (−0.54, 1.46)	0.22 (−1.82. 2.26)	1.44 (−1.03, 3.92)	−0.71 (−2.82, 1.40)	−0.01 (−0.58, 0.56)	0.43 (−0.86, 1.72)	−0.59 (−3.12, 1.95)	−0.16 (−1.61, 1.29)
Overall score	−0.22 (−0.59, 0.16)	**0.25 (−7.28, 8.32)**	**0.59 (−2.46, 3.63)**	**9.58 (3.81, 15.35)**	−4.23 (−3.11, 0.00)	−0.07 (−6.50, 6.36)	**−2.01 (−3.59, −0.43)**	3.04 (−0.62, 6.71)	4.61 (−2.61, 11.83)	−1.56 (−5.68, 2.57)

Note: Bolded values are significant results ($P < 0.05$).
[a]Ethnicity was dichotomized into Caucasian and non-Caucasian.
[b]Parents educational level was coded as: (*i*) ≤high school, (*ii*) some college or university degree, and (*iii*) ≥ university degree.
[c]Mid-point of 11 categories ranging from CAD$ <10 000 and CAD$ ≥150 000/year.
[d]Dichotomized into normal weight and overweight/obese.

Canadian Journal of Dietetic Practice and Research Downloaded from dcjournal.ca by USP UNIVERSIDADE DE SAO PAULO on 12/08/23
For personal use only.

component. Parental education was positively associated with children's overall HEI score ($\beta = 9.58$, 95% CI 3.81, 15.35) as well as with scores for total fruit ($\beta = 1.00$, 95% CI 0.39, 1.76), total vegetables ($\beta = 1.11$, 95% CI 0.03, 2.18), total protein foods ($\beta = 1.06$, 95% CI 0.28, 1.84), and seafood and plant protein ($\beta = 1.67$, 95% CI 0.43, 2.89). Having a Caucasian parent ($\beta = 3.01$, 95% CI 0.78, 5.25) and having a parent born in Canada ($\beta = 2.32$, 95% CI 0.53, 4.11) was positively associated with dairy component scores. Higher income was positively associated with total fruit score ($\beta = 1.29$, 95% CI 2.13, 4.50).

Children's overall HEI-2015 score was inversely associated with children's age ($\beta = -0.19$, 95% CI −0.37, −0.02); specific HEI-2015 components scores that decreased with children's age, included total fruit ($\beta = -0.19$, 95% CI −0.37, −0.02), whole fruit ($\beta = -0.24$, 95%CI −0.45, −0.03), refined grains ($\beta = -0.57$, 95% CI −0.93, −0.21), and sodium ($\beta = -0.62$, 95%CI −1.01, −0.24; as a moderation component, a lower score for sodium is associated with higher intake). Caucasian children had higher dairy scores ($\beta = 4.29$, 95% CI 2.46, 6.14), and females had higher scores for total fruit ($\beta = 0.53$, 95% CI 0.14, 0.91) and whole fruit ($\beta = 0.61$, 95% CI 0.14, 1.08). Children who classified as overweight or obese had lower whole fruit scores ($\beta = -0.57$, 95% CI −1.11, −0.03) (Table 1).

DISCUSSION

Among this sample of preschoolers from Southwestern Ontario, the mean diet quality score was 68.85. This score is similar to those found among preschool children using data from the 2004 Canadian Community Health Survey (CCHS), but higher than scores using the 2014 and 2015 cycles of the CCHS with older children (6–17 years old) [22]. Although a different measure of diet quality was used in our study (HEI-C vs HEI-15), our observation that diet quality decreases with age, suggests that the older age captured in the 2014 and 2015 CCHS may explain the difference in scores. The 2009–2014 National Health and Nutrition Examination Survey, a representative survey in the United States, found that the mean diet quality score of preschoolers was 60.1 [23]. This U.S. sample included a more diverse sample, with regards to socio-economic status (SES), which may contribute to the discrepancy in HEI scores.

Parental education was positively associated with children's diet quality. Existing research exploring associations between parental education level and children's diet quality have been inconsistent [7, 24, 25]. A study of nearly 700 parents and their school-aged children in the United States found no significant differences between diet quality and household education level [26], whereas a review including 8 studies from Europe and North America found that maternal education was associated with school-aged children's diet quality. Additional research is needed to understand how education level of both mothers and fathers influences diet quality among preschool-aged children.

While research has shown that adults, adolescents, and school-aged children who are more affluent have relatively higher diet quality [27–29], fewer studies have explored this association among preschool-age children. Similar to our findings, the NHANES study found that U.S. children from a lower income status had lower scores for fruit or whole-fruits components of the HEI. Taken together, results suggest that intake of specific dietary components, i.e., fruit intake, may be particularly sensitive to income disparities [23].

Some limitations should be considered when interpreting our results: our sample was relatively small, which could have increased risk for type 2 error. We used HEI-15 as an indicator of diet quality which aligns with dietary guidelines for Americans not Canadians, and our sample included primarily Caucasian participants from high SES; thus, our results may not be generalizable. Future research should consider exploring influence of socio-demographics on dietary intake among a larger and more representative sample of families.

RELEVANCE TO PRACTICE

These results underscore the importance of dietitians supporting families with young children in establishing healthy eating habits early in life. Dietary intervention and additional supports are indicated to improve the diet quality of children with parents with lower socioeconomic status and education.

Acknowledgements

We would like to thank the parents and preschoolers for participation in the Guelph Family Health Study and the study team for collection and organizing this data.

Financial support: ACL receives a post-doctoral scholarship from the São Paulo State Foundation (process n° 2015/20852-7). The Guelph Family Health Study Pilot was funded by the Health for Life Initiative—University of Guelph.

Conflict of interest: The authors declare no conflict of interest.

References

1. Banfield EC, Liu Y, Davis JS, Chang S, Frazier-Wood AC. Poor adherence to US dietary guidelines for children and adolescents in the national health and nutrition examination survey population. J Acad Nutr Diet. 2016;116(1):21–7. PMID: 26391469. doi: 10.1016/j.jand.2015.08.010.
2. Albani V, Butler LT, Traill WB, Kennedy OB. Fruit and vegetable intake: change with age across childhood and adolescence. Br J Nutr. 2017;117(5):759–65. PMID: 28367762. doi: 10.1017/S0007114517000599.
3. Nishi SK, Jessri M, L'Abbe M. Assessing the dietary habits of Canadians by eating location and occasion: findings from the Canadian Community Health Survey, Cycle 2.2. Nutrients. 2018;10(6):682. doi: 10.3390/nu10060682.
4. Black JL, Billette JM. Do Canadians meet Canada's Food Guide's recommendations for fruits and vegetables? Appl Physiol Nutr Metab. 2013;38(3):234–42. PMID: 23537013. doi: 10.1139/apnm-2012-0166.
5. WHO. Diet, nutrition and the prevention of chronic diseases. Geneva, Switzerland: World Health Organization (WHO); 2003.
6. Krebs-Smith SM, Pannucci TE, Subar AF, Kirkpatrick SI, Lerman JL, Tooze JA, et al. Update of the Healthy Eating Index: HEI-2015. J Acad

Canadian Journal of Dietetic Practice and Research Downloaded from dcjournal.ca by USP UNIVERSIDADE DE SAO PAULO on 12/08/23
For personal use only.

Nutr Diet. 2018;118(9):1591–602. PMID: 30146071. doi: 10.1016/j.jand.2018.05.021.
7. Rashid V, Engberink MF, van Eijsden M, Nicolaou M, Dekker LH, Verhoeff AP, et al. Ethnicity and socioeconomic status are related to dietary patterns at age 5 in the Amsterdam born children and their development (ABCD) cohort. BMC Public Health. 2018;18:115. doi: 10.1186/s12889-017-5014-0.
8. Mello AV, Pereira JL, Leme ACB, Goldbaum M, Cesar CLG, Fisberg RM. Social determinants, lifestyle and diet quality: a population-based study from the 2015 Health Survey of Sao Paulo, Brazil. Public Health Nutr. 2020;23(10):1766–77. PMID: 31847928. doi: 10.1017/S1368980019003483.
9. Clifford Astbury C, Penney TL, Adams J. Home-prepared food, dietary quality and socio-demographic factors: a cross-sectional analysis of the UK National Diet and nutrition survey 2008-16. Int J Behav Nutr Phys Act. 2019;16(1):82. PMID: 31492141. doi: 10.1186/s12966-019-0846-x.
10. Kang M, Park SY, Shvetsov YB, Wilkens LR, Marchand LL, Boushey CJ, et al. Sex differences in sociodemographic and lifestyle factors associated with diet quality in a multiethnic population. Nutrition. 2019;66:147–52. PMID: 31288218. doi: 10.1016/j.nut.2018.11.022.
11. Gimenez-Blasi N, Latorre Rodriguez JA, Martinez Bebia M, Olea-Serrano F, Mariscal Arcas M. Comparison of diet quality between young children and adolescents in the Mediterranean basin and the influence of life habits. Nutr Hosp. 2019;36(2):387–93. PMID: 30864452. doi: 10.20960/nh.2110.
12. Wu XY, Ohinmaa A, Veugelers PJ. Diet quality, physical activity, body weight and health-related quality of life among grade 5 students in Canada. Public Health Nutr. 2012;15(1):75–81. PMID: 22014537. doi: 10.1017/S1368980011002412.
13. Golley RK, Hendrie GA, McNaughton SA. Scores on the dietary guideline index for children and adolescents are associated with nutrient intake and socio-economic position but not adiposity. J Nutr. 2011;141(7):1340–7. PMID: 21613454. doi: 10.3945/jn.110.136879.
14. Watterworth JC, Hutchinson JM, Buchholz AC, Darlington G, Randall Simpson JA, Ma DWL, et al. Food parenting practices and their association with child nutrition risk status: comparing mothers and fathers. Appl Physiol Nutr Metab. 2017;42(6):667–71. PMID: 28196327. doi: 10.1139/apnm-2016-0572.
15. Haines J, Douglas S, Mirotta JA, O'Kane C, Breau R, Walton K, et al. Guelph family health study: pilot study of a home-based obesity prevention intervention. Can J Public Health. 2018;109(4):549–60. PMID: 29981086. doi: 10.17269/s41997-018-0072-3.
16. Wallace A, Kirkpatrick SI, Darlington G, Haines J. Accuracy of parental reporting of preschoolers' dietary intake using an online self-administered 24-h recall. Nutrients. 2018;10(8):987. PMID: 30060605. doi: 10.3390/nu10080987.
17. Garriguet D. Diet quality in Canada. Health Rep. 2009;20(3):41–52. PMID: 19813438.
18. de Onis M, Lobstein T. Defining obesity risk status in the general childhood population: which cut-offs should we use? Int J Pediatr Obes. 2010;5(6):458–60. PMID: 20233144. doi: 10.3109/17477161003615583.
19. WHO. Software for assessing growth and development of the world's children. WHO Anthro for personal computers. 3.2.2, 2011 ed. Geneva, Switzerland: World Health Organization; 2010.
20. Gravetter F, Wallnau L. Essentials of statistics for the behavioral sciences. 8th ed. Belmont, CA: Wadsworth; 2014.
21. Trochim WM, Donnelly JP. The research methods knowledge base. 3rd ed. Cincinnati, OH: Atomic Dog; 2006.
22. Tugault-Lafleur CN, Barr SI, Black JL. Examining differences in school hour and school day dietary quality among Canadian children between 2004 and 2015. Public Health Nutr. 2019;22(16):3051–62. PMID: 31446898. doi: 10.1017/S1368980019000788.
23. Thomson JL, Tussing-Humphreys LM, Goodman MH, Landry AS. Diet quality in a nationally representative sample of American children by sociodemographic characteristics. Am J Clin Nutr. 2019;109(1):127–38. PMID: 30596813. doi: 10.1093/ajcn/nqy284.
24. Leal KK, Schneider BC, França GVA, Gigante DP, Santos ID, Assunção MCF. Qualidade da dieta de pré-escolares de 2 a 5 anos residentes na área urbana da cidade de Pelotas, RS. Rev Paul Pediatr. 2015;33:310–7. doi: 10.1016/j.rpped.2015.05.002.
25. Robson SM, Couch SC, Peugh JL, Glanz K, Zhou C, Sallis JF, et al. Parent diet quality and energy intake are related to child diet quality and energy intake. J Acad Nutr Diet. 2016;116(6):984–90. PMID: 27050725. doi: 10.1016/j.jand.2016.02.011.
26. Saelens BE, Glanz K, Frank LD, Couch SC, Zhou C, Colburn T, et al. Two-year changes in child weight status, diet, and activity by neighborhood nutrition and physical activity environment. Obesity. 2018;26(8):1338–46. PMID: 30138547. doi: 10.1002/oby.22247.
27. Attorp A, Scott JE, Yew AC, Rhodes RE, Barr SI, Naylor P-J. Associations between socioeconomic, parental and home environment factors and fruit and vegetable consumption of children in grades five and six in British Columbia, Canada. BMC Public Health. 2014;14(1):150. doi: 10.1186/1471-2458-14-150.
28. Tugault-Lafleur CN, Black JL, Barr SI. Examining school-day dietary intakes among Canadian children. Appl Physiol Nutr Metab. 2017;42(10):1064–72. PMID: 28831845. doi: 10.1139/apnm-2017-0125.
29. Ahmadi N, Black JL, Velazquez CE, Chapman GE, Veenstra G. Associations between socio-economic status and school-day dietary intake in a sample of grade 5–8 students in Vancouver, Canada. Public Health Nutr. 2015;18(5):764–73. PMID: 25098190. doi: 10.1017/S1368980014001499.