



Abstract

Fruits and Vegetables as Sources of Carotenoids in Complementary Feeding [†]

Daria Masztalerz-Kozubek , Monika A. Zielinska-Pukos * and Jadwiga Hamulka

Department of Human Nutrition, Institute of Human Nutrition Sciences, Warsaw University of Life Sciences (SGGW-WULS), 02-776 Warszawa, Poland; daria_masztalerz_kozubek@sggw.edu.pl (D.M.-K.); jadwiga_hamulka@sggw.edu.pl (J.H.)

* Correspondence: monika_zielinska_pukos@sggw.edu.pl

[†] Presented at the 2nd International Electronic Conference on Nutrients, 15–31 March 2022; Available online: <https://iecn2022.sciforum.net/>.

Keywords: carotenoids; antioxidants; breastfeeding; complementary feeding



Citation: Masztalerz-Kozubek, D.; Zielinska-Pukos, M.A.; Hamulka, J. Fruits and Vegetables as Sources of Carotenoids in Complementary Feeding. *Biol. Life Sci. Forum* **2022**, *12*, 2. <https://doi.org/10.3390/IECN2022-12390>

Academic Editor: Torsten Bohn

Published: 14 March 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Introduction: Fruits and vegetables are sources of numerous nutrients and bioactive compounds. Among these are carotenoids with antioxidant potential, particularly abundant in yellow-orange, red, and dark-green fruits and vegetables. **Aim:** The aims of this study were: (1) to investigate if fruits and vegetables rich in carotenoids are offered as first solids; (2) to assess if early nutritional factors, such as exclusive breastfeeding duration (EBF), timing (CFI), and method (CFM) of complementary feeding introduction may be associated with offering them. **Methods:** This internet-based study was conducted in 2016–2018 among 4104 mothers of children aged 12–36 months, recruited through social media in Poland. Mothers were asked about EBF, CFI, CFM, as well as the first 5–10 products that were given to their infants as first solids. Data on the consumption of the first products were collected using the qualitative method. **Results:** The majority of children were introduced to complementary feeding at 4–6 months (60.6%). The majority were often offered vegetables/fruits were carrot (89.8%), broccoli (54.0%), and pumpkin (39.7%), whereas avocado (3.1%), pepper (0.9%), and kale (0.02%) were rarely used as first weaning products. EBF, CFI, and CFM were associated with offering pumpkin ($p < 0.001$; $p < 0.05$; $p < 0.001$), sweet potato ($p < 0.01$; $p < 0.001$; $p < 0.001$), tomato ($p < 0.01$; $p < 0.001$; $p < 0.001$), avocado ($p < 0.01$; $p < 0.05$; $p < 0.001$), and broccoli ($p < 0.001$) as first vegetables/fruits. In a group with CFI ≥ 7 months, sweet potato (13.7%), tomato (5.1%), avocado (4.0%), and broccoli (61.2%) were more often offered as first vegetables/fruits than in a group with CFI at 4–6 months (7.5%, 2.7%, 2.7%, 50.4%; respectively) or CFI < 4 months (3.9%, $p < 0.001$; 2.0%, $p < 0.001$; 0.0%, $p < 0.05$; 33.3%, $p < 0.001$; respectively). **Conclusions:** Early nutrition may be a factor associated with offering different foods during weaning. Carrot and broccoli were the most often offered solids. According to the literature, carrot is the richest source of carotenoids, whereas broccoli has the highest antioxidant capacity [1–3].

Supplementary Materials: The conference poster is available at <https://www.mdpi.com/article/10.3390/IECN2022-12390/s1>.

Author Contributions: Conceptualization, D.M.-K., J.H. and M.A.Z.-P.; methodology and validation, D.M.-K., M.A.Z.-P. and J.H.; formal analysis, D.M.-K. and M.A.Z.-P.; investigation, D.M.-K.; data curation, D.M.-K. and M.A.Z.-P.; writing—original draft preparation, D.M.-K.; writing—review and editing, D.M.-K., M.A.Z.-P. and J.H.; visualization, D.M.-K.; supervision, J.H. All authors have read and agreed to the published version of the manuscript.

Funding: The study was financially supported by sources of the Polish Ministry of Sciences and Higher Education within funds of the Institute of Human Nutrition Sciences, Warsaw University of Life Sciences (WULS), for scientific research.

Institutional Review Board Statement: The survey did not require approval by the ethics committee because of the anonymous nature of the online survey and impossibility of tracking sensitive personal data.

Informed Consent Statement: Respondent's consent was waived due to the anonymous nature of the online survey and impossibility of tracking sensitive personal data. No personal or contact information were required. Respondents were informed about solely scientific purpose of the study, its anonymity and possibility of resign from participating in the study at any stage.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. USDA National Nutrient Database. Available online: <https://fdc.nal.usda.gov/> (accessed on 10 May 2021).
2. USDA Database for the Oxygen Radical Absorbance Capacity (ORAC) of Selected Foods. 2010. Available online: https://www.orac-info-portal.de/download/ORAC_R2.pdf (accessed on 10 May 2021).
3. Hamułka, J.; Wawrzyniak, A. *Lycopene and Lutein—Pro-Health Properties and Their Content in Products*; SGGW: Warsaw, Poland, 2004.