



**EGEA** edition 9  
International conference

## EGEA CONFERENCE POSTERS' ABSTRACTS

20-22 SEPTEMBER 2023 - BARCELONA

### DIET, FRUIT AND VEGETABLES AND ONE HEALTH: WHAT CONTRIBUTIONS?

Co-chairs: Joël DORE & Elio RIBOLI

Scientific Committee: Emma BOYLAND, Jean-Pierre CRAVEDI, Joël DORE, Frans FOLKVORD,  
Jean-Michel LECERF, Françoise LESCOURRET, Alain PEETERS, Christian REYNOLDS, Elio RIBOLI

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DAY 1

WEDNESDAY 20 SEPTEMBER



PROGRAMME

12:30 - 14:00 WELCOME (FREE LUNCH) – REGISTRATION – POSTER DISPLAY

14:00 - 14:30 OPENING SESSION

**Christel Teyssedre**, *Aprifel (FR)*

**Elio Riboli**, *Imperial College London (UK)*

**Joël Doré**, *INRAE (FR)*

**Claire Bury**, *DG Health, European Commission (BE)*

**Maria Del Camino Arroyo Perez**, *Ministry of Agriculture, Fisheries and Food (SP)*

**Marc Fesneau**, *French Minister of Agriculture and Food Sovereignty (FR)*

14:30 - 18:15 SESSION 1

**Fruit and vegetables: what are the benefits for human health and for food and nutritional security?**

**Moderators:** Jean-Michel Lecerf & Elio Riboli

**Introduction:** Jean-Michel Lecerf, Institut Pasteur de Lille (FR)

14:30 - 15:35 KEYNOTE LECTURES

**Research progress on fruit and vegetables on health and chronic diseases**

- Cardiovascular disease prevention

**Monique Verschuren**, *RIVM (NL)*

- Type 2 diabetes prevention – facts and gaps

**Nita Forouhi**, *University of Cambridge (UK)*

- Cancer prevention

**Marc Gunter**, *Imperial College London (UK)*

15:35 - 16:50 KEYNOTE LECTURES

**Emerging research on nutrition and global health**

- Innovation in evaluating gut microbiota and fiber-rich vegetables interactions

**Nathalie Delzenne**, *UCLouvain (BE)*

- The role of fruit and vegetables in mental and brain health

**Saverio Stranges**, *Western University (CA)*

- Nutrition transition towards plant-based foods: ultraprocessed, unprocessed and their health impact

**Benjamin Allès**, *EREN (FR)*

- Fruit and vegetables in food and nutritional security

**Boitshepo Bibi Giyose**, *NEPAD (SA)*

16:50 - 17:20 NETWORKING BREAK AND POSTER VISIT

17:20 - 18:15 ORAL COMMUNICATIONS

- Associations between species diversity in our diet and gastrointestinal cancer risk: results from the European Prospective Investigation into Cancer and Nutrition Study

**Bernadette Chimera**, *IARC (FR)*

- Association between metabolic syndrome and healthy and unhealthy plant-based diets: in the NutriNet-Santé study

**Clémentine Prioux**, *EREN (FR)*

- Antioxidant-rich foods, antioxidant supplements, and sarcopenia in old-young adults ≥55 years old: A systematic review and meta-analysis of observational studies and randomized controlled trials

**Maria de la Serra Besora-Moreno**, *University of Rovira i Virgili (SP)*

**Conclusion:** Elio Riboli, Imperial College London (UK)

**Concluding remarks** by **Olivier Ramadour**, *Consul General of France in Barcelona (SP)*

18:15 - 18:45 POSTER VISIT

19:00 - 20:00 WELCOME COCKTAIL



09:00 - 09:30 WELCOME COFFEE

09:30 - 12:30 SESSION 2

**Fruit and vegetables at the core of sustainability: what environmental and social impacts, and levers?**

**Moderators:** Françoise Lescourret & Alain Peeters

**Introduction:** Françoise Lescourret, INRAE (FR)

09:30 - 11:15 KEYNOTE LECTURES

- How to preserve and improve soil quality for fruit and vegetable production and health  
**Marc André Sélosse**, *Muséum national d'Histoire naturelle (FR)*
- Tackling climate impacts: fruit and vegetables as part of the crisis or the solution?  
**Giuseppe Montanaro**, *University of Basilicata (IT)*
- Water footprints for fruit and vegetable production: Definitions and optimization practice  
**Diego Intrigliolo**, *Spanish National Research Council (SP)*
- Functional biodiversity to control weeds in fruit orchards  
**Davide Neri**, *Polytechnic University of Marche (IT)*
- Social innovations in fruit and vegetables to address multiple Sustainable Development Goals in food systems  
**Marie-Josèphe Amiot-Carlin**, *INRAE (FR)*

11:15 - 11:45 NETWORKING BREAK AND POSTER VISIT

11:45 - 12:30 ORAL COMMUNICATIONS

- The role of fruit and vegetables in territorial cohesion  
**Rémi KAHANE**, *CIRAD HortSys (FR)*
- Poor access to fruit and vegetables limits the adherence to sustainable diets in The Gambia  
**Zakari Ali**, *LSHTM (GM)*
- The environmental, nutritional and cost impacts of vegan, vegetarian and meat-based meals  
**Berill Takacs**, *University College London (UK)*

**Conclusion:** Alain Peeters, RHEA (BE)

12:30 - 14:00 LUNCH BREAK AND POSTER VISIT

14:00 - 17:20 SESSION 3

**Vegetalizing the diet: what are the determinants of consumer behaviour and choice?**

**Moderators:** Emma Boyland & Frans Folkvord

**Introduction:** Emma Boyland, University of Liverpool (UK)

14:00 - 16:00 KEYNOTE LECTURES

- The factors that influence our food choices across the lifespan  
**Sophie Nicklaus**, *INRAE (FR)*
- I'll have what you're having: why we need to include social factors in healthy eating interventions  
**Roel Hermans**, *Leefstijl Lab (NL)*
- Creating healthy environments: encouraging fruit and vegetable intake at the day care and primary school  
**Gertrude Zeinstra**, *Wageningen University and Research (NL)*
- The role of marketing in shaping dietary preferences and behaviors  
**Tim Smits**, *KU Leuven (BE)*
- Movement behaviors, eating habits, and appetite control: are they really connected?  
**David Thivel**, *Université Clermont Auvergne (FR)*
- Opportunities for public health policies to promote greater fruit and vegetables intake  
**Emma Boyland**, *University of Liverpool (UK)* & **Frans Folkvord**, *Tilburg University (NL)*







DAY

THURSDAY 21 SEPTEMBER



PROGRAMME

**16:00 - 16:30 NETWORKING BREAK AND POSTER VISIT**

**16:30 - 17:20 ORAL COMMUNICATIONS**

- Time-trend of fruit, vegetables and sweets consumption among European adolescents between 2013 and 2018 and related to sociodemographic characteristics: Health Behaviour in School age Children study  
**Judit Queral**, *Institut d'Investigació Sanitària Pere Vi (SP)*
- Food Boost Challenge: application of participatory action research – by, for and with adolescents for assessing small-scale determinants of adolescent's behaviour and actionable possibilities for healthier food choices by adolescents  
**Wendy Scholtes-Bos**, *The Hague University of Applied Sciences (NL)*
- 'Less meat' or 'more fruit and veg'? The role of promotion-prevention framing on attitudes towards diet change in the UK  
**Heidi Zamzow**, *London School of Economics & Political Science (UK)*

**Conclusion:** Frans Folkvord, *Tilburg University (NL)*

**17:20 - 17:50 POSTERS SESSION AWARDS**

**19:30 - 23:00 GALA DINNER (REGISTRATION REQUIRED)**





08:30 - 09:00 WELCOME COFFEE

09:00 - 12:50 **SESSION 4: Placing fruit and vegetables at the center of the one health discussion: solutions, recommendations, actions and priorities**

**Moderators: Boitshepo Bibi Giyose & Christian Reynolds**

**Introduction:** Christian Reynolds, City University of London (UK)

09:00 - 10:00 **KEYNOTE LECTURES**

- State of art and role of public policies to achieve sustainable diet  
**Céline Giner**, *OECD (FR)*
- A mapping system to have a win-win solution to tackle food insecurity, the multiple forms of malnutrition and climate change  
**Kremlin Wickramasinghe**, *WHO Europe (DK)*
- Can all people access to healthy and sustainable diet?  
**Anna Herforth**, *Harvard T.H. Chan (USA)*

10:00 - 10:50 **ORAL COMMUNICATIONS**

- A global analysis of national dietary guidelines on plant-based diets and substitutions for animal-based foods  
**Anna-Lena Klapp**, *University of Göttingen (GE)*
  - A case study of 'food biodiversity' and experiences of community food growing environments in the City of Brighton & Hove  
**Leah Salm**, *University of Greenwich (UK)*
  - Protecting health by improving Food Literacy in primary and intermediate schools: an Italian experience with the MaestraNatura e-learning program  
**Annalisa Silenzi**, *Istituto Superiore di Sanità (IT)*
- Conclusion:** Boitshepo Bibi Giyose, NEPAD (SA)

10:50 - 11:15 **NETWORKING BREAK**

11:15 - 12:40 **ROUND TABLE AND PANEL DISCUSSION**

**Animated by: Christian Reynolds, City University of London (UK)**

- **Boitshepo Bibi Giyose**, *NEPAD (SA)*
- **Carmen Gloria Gonzalez**, *University of Chile (CL)*
- **Machteld van Lieshout**, *The Hague University of Applied Sciences (NL)*
- **Daniel Sauvaitre**, *French National Association Apples and Pears (FR)*
- **Piedad Coscollá Toledo**, *Anecoop (SP)*
- **Philippe Binard**, *Freshfel (BE)*
- **Pilar Santacoloma**, *FAO (IT)*

12:40 - 13:00 **CONCLUSIONS OF THE EGEA CONFERENCE**

Elio Riboli, Imperial College London (UK)

Joël Doré, INRAE (FR)

Albert Rizenthaler, CESE (FR)

Christel Teyssède, Aprifel (FR)





**TITLE A qualitative study of young peoples' thoughts and attitudes to follow a more plant-based diet****AUTHORS AND INSTITUTIONS** C. McInnes <sup>(1)</sup>, SA. Carstairs <sup>(2)</sup>, JE. Cecil <sup>(1)</sup>\*<sup>(1)</sup> School of Medicine, University of St Andrews, Scotland<sup>(2)</sup> School of Health Sciences, University of Dundee, Scotland

\* Presenting author: J. Cecil; jc100@st-andrews.ac.uk

*Unpublished***OBJECTIVES**

Plant-based diets (PBDs) refer to dietary habits that reduce the consumption of animal-based products and increase the consumption of nutritionally rich foods. PBD's have been shown to provide significant health benefits, such as reducing obesity and improving psychological wellbeing, and are environmentally friendly. However, few studies have investigated factors that influence young people's thoughts and attitudes towards following a PBD in western societies, particularly in the United Kingdom. Understanding these factors may benefit public health interventions that encourage the consumption of more fruit and vegetables. The aim of this study was to explore the factors that affect young people's intentions towards following a PBD.

**METHODOLOGY**

Twenty-one young people (18-24 years) participated in this qualitative study. Participants were asked about their views of PBDs in a semi-structured interview. Thematic analysis was utilized to explore views and the barriers and facilitators to following a PBD. The Theory of Planned Behaviour (TPB) was used as a framework to organize the findings.

**RESULTS**

Within attitudes, the sub-themes identified were an awareness of a healthy diet, environmental concerns, health concerns and distrust, perceptions of PBDs and associated stereotypes, perceived restriction and lack of enjoyment, and need for education. Within subjective norms, the sub-themes identified were cultural and familial norms, peer influence, and exposure through social media. Within perceived behavioural control (PBC), the sub-themes identified were a lack of independence and parental control, lack of knowledge and perceived difficulty, lack of inclusiveness and accessibility, and inconvenience.

**CONCLUSION**

Overall, the findings suggest that increased provision of education and knowledge about PBDs to young people, and widening access to PBDs, could encourage and help improve their understanding and intention to follow this dietary style. Tailored health promotion strategies, which also consider barriers and facilitators found within this study, could motivate young people to consume a more PBD.



**TITLE** Dose-related regulatory effect of raspberry polyphenolic extract on cecal microbiota activity, lipid metabolism and inflammation in rats fed a diet rich in saturated fats

**AUTHORS AND INSTITUTIONS** Bartosz Fotschki (1)\*, Ewelina Cholewińska (2), Katarzyna Ognik (2), Michał Sójka (3), Joanna Milala (3), Joanna Fotschki (1), Wiesław Wiczkowski (1), Jerzy Juśkiewicz (1)

(1) Institute of Animal Reproduction and Food Research, Division of Food Science, Tuwima 10, 10-748 Olsztyn, Poland.

(2) Department of Biochemistry and Toxicology, Faculty of Animal Sciences and Bioeconomy Faculty of Biology, University of Life Sciences in Lublin Animal Sciences and Bioeconomy, Akademicka 13, 20-950 Lublin, Poland.

(3) Institute of Food Technology and Analysis, Łódź University of Technology, Stefanowskiego 4/10, 90-924 Łódź, Poland.

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Published in 01/2023: [doi.org/10.3390/nu15020354](https://doi.org/10.3390/nu15020354)

### OBJECTIVES

The aim of the study was to investigate the effects of two doses of raspberry polyphenols from pomace on intestinal microbiota activity, parameters of inflammation, and oxidative stress involved in the regulation of liver lipid metabolism in rats fed a high-fat diet.

### METHODOLOGY

Raspberry pomace was used as the raw material for the preparation of the raspberry phenolic extract (PP). The total concentration of polyphenols in PP was  $47.8 \pm 1.06$  g/100g. The nutritional experiment was performed on male Wistar rats allocated to 3 groups of 8 animals each. For 30 days, the animals were subjected to the following dietary treatments: C, control diet low-fat diet containing 2% rapeseed oil and 6% lard; HF, diet enriched with 2% rapeseed oil and 23% lard; HF + 0.1PP, diet HF enriched with 0.1% of PP; HF + 0.3PP, diet HF enriched with 0.3% of PP. The PP had been added to the diet at the expense of maize starch. Effects of two doses of PP on microbiota activity in the cecum, concentration of polyphenols and their metabolites in the plasma, mechanisms regulating lipid metabolism in the liver, oxidative stress, inflammation, and lipid profile in the plasma were tested

### RESULTS

Comparison of the two doses of PP showed that the higher dose significantly ( $P < 0.05$ ) decreased epididymal white adipose tissue weight, hepatic triglyceride content, PPAR $\gamma$  and SREBP-1c expression level in the liver, plasma IL-6 concentration, as well as increased acetic acid concentration in the cecal digesta. These effects might be partially associated with the enhanced content of ellagitannin and anthocyanin metabolites found in the blood plasma of rats administered a high dose of the PP.

### CONCLUSION

The use of raspberry polyphenol extract from pomace might be considered a valuable, affordable, and suitable way to enrich our diet with an effective amount of bioactive molecules.

This research was funded by the National Science Center, Poland (decision UMO-2018/31/D/NZ9/02196).

**TITLE Fruit and vegetable consumption: are they associated to movement behaviors?****AUTHORS AND INSTITUTIONS** E. Fournier<sup>1\*</sup>, M. Climchamps<sup>2</sup>, D. Thivel<sup>1</sup>, F. Dutheil<sup>2</sup><sup>1</sup> Laboratory of the Metabolic Adaptations to Exercise under Physiological and Pathological Conditions (AME2P), Clermont Auvergne University, 63000 Clermont-Ferrand, France<sup>2</sup> Physiological and Psychosocial Stress, CNRS UMR 6024, LaPSCo, Clermont Auvergne University, WittyFit, 63000 Clermont-Ferrand, France

\* Presenting author: E. Fournier; Elora.fournier@uca.fr

*Unpublished***OBJECTIVES**

The goal of this analysis was to evaluate potential associations between the different parameters composing movement behaviors (physical activity, sedentary behavior and sleep) and the diet quality including fruit and vegetable consumption.

**METHODOLOGY**

This analysis was performed using the COVISTRESS French database computed between March and June 2020. Data included participants' sociodemographic information (gender, age, country, bmi, occupation), sleep duration, physical activity and sitting time as well as eating pattern especially concerning fruit and vegetable consumption. Exclusion criteria targeted subjects between 18 to 50 years old providing all the information concerning sociodemographic and movement behaviors. Statistical analysis was performed in R studio version 4.2.2. An arbitrary diet quality index was made to classify subjects according to their consumption frequency of healthy or unhealthy food. Healthy food included fruits, vegetables and legumes while unhealthy ones concerned salty, prepared, cured meats, soft drinks, sweets and alcohol. A consumption of a healthy food item more than 4 to 6 times per week added one to the diet index while a lower consumption deducted one. The opposite was applied for unhealthy food items. Spearman correlation tests were performed to evaluate the association between each of the movement behaviors to the diet quality index and to each of the food category including fruits and vegetables.

**RESULTS**

criteria. Most of them were French (85.4%), females (71.5% vs 28.5%) and occupied an executive or intellectual position (47.9%). Almost half of them consumed 1 or 2 fruits (45.7%) and 1 or 2 vegetables per day (44.6%).

Spearman correlation tests highlighted a positive association between physical activity and the quality diet index ( $p$  value  $< 0.0001$  and  $\rho = 0.287$ ), and both fruit ( $p$  value = 0.0007 and  $\rho = 0.165$ ) and vegetable ( $p$  value = 0.0148 and  $\rho = 0.116$ ) consumption but correlation coefficients stayed very low. In contrary, physical activity was negatively associated with soft drink ( $p$  value = 0.01 and  $\rho = -0.122$ ) and cured meat ( $p$  value = 0.0371 and  $\rho = 0.099$ ) consumption. However, the sedentary time was only positively associated with the consumption of vegetables ( $p$  value = 0.02;  $\rho = 0.114$ ) and a negatively with soft drink ( $p$  value = 0.042 and  $\rho = 0.097$ ). Neither the diet quality index or fruit and vegetable consumption were associated to sleep duration. The physical activity, sedentary time and sleep were not correlated

**CONCLUSION**

Our results seem to indicate a positive correlation between higher physical activity and a healthier dietary pattern including a higher fruit and vegetable consumption. However, no association was identified between sedentary time and sleep with a specific dietary pattern apart from a positive correlation between sedentary time and vegetable consumption.





**TITLE** Changing eating habits by decreasing the inherece heuristic: domain, framing, and individual differences in inherece bias in the French student population (exploring genericity and the inherece heuristic as cognitive mechanisms in food gender stereotypes)

**AUTHORS AND INSTITUTIONS** A. Guzman Garcia (1, 2) \*, J. Lafraire (1, 2)

(1) Laboratoire CHArt, Cognitions Humaine et Artificielle, EPHE - PSL, École Pratique des Hautes Études - Paris Sciences Lettres, Campus Condorcet, Aubervilliers, France

(2) Institut Paul Bocuse Research Center, Ecully

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*Unpublished*

**OBJECTIVES**

Gender stereotypes are still present in our society, and the food domain is no exception. Men have consistently been shown to eat more meat, while women eat more vegetables (Egolf, Siegrist, & Hartmann, 2018), which has led researchers to explore the association between meat and maleness and vegetables and femininity (Rozin, Hormes, Faith, & Wansink, 2012). In this study, we seek to explore two cognitive mechanisms that have been related to the justification and the fostering of stereotypes: the inherece heuristic (i.e. a shortcut facilitating choice using little information that leads us to explain regularities on the basis of the intrinsic properties of the entities they involve, such as "Women wear pink because pink is a delicate color"; Cimpian & Salomon, 2014; Scheibehenne, Miesler, & Todd, 2007) and genericity (i.e. bare plural sentences indicating a generalization, such as "Candy is bad for your teeth" or "Lion have manes"; Sterken, 2015).

Understanding these cognitive mechanisms and their role in gender stereotypes will allow us to design interventions that target them. Like a previous study by Markman and Bian (2020), whose intervention was successful in counteracting this heuristic and facilitating the integration of healthier alternatives in the American breakfast, we intend to utilize our results to flexibilize food beliefs and encourage both men and women towards a more well-balanced diet.

**METHODOLOGY**

We will use a 3 (genericity: bare plural vs "most" vs "many"; between-subject) x 3 (typicality: typical vs counter-typical vs arbitrary stereotypes; within-subject) design. Across conditions, participants will provide descriptive and prescriptive judgments from 1-7 for each stereotype. They will be asked to provide a justification, and their responses will be coded as inherent or not. The genericity conditions will be constructed with either bare plural or the quantifiers "most" and "many". Descriptive and prescriptive judgments will be analyzed by performing mixed-effects linear regressions on participant's judgment scores about each stereotype, with participant and item as random effects and genericity condition, typicality, and inherece of the justification as fixed effects

**RESULTS**

We expect the counter-typical stereotype to have lower descriptive and prescriptive scores than typical associations. We also hypothesize that people who endorsed an inherent explanation will be more likely to have a higher prescriptive judgment score than people who applied extrinsic reasons when it comes to typical gender associations. We believe that generic sentences will elicit more inherent responses than the quantifier conditions, since generics seem to elicit thought about generalizations (Hollander, Gelman, & Raman, 2009).

**CONCLUSION**

After exploring the effects that the inherece heuristic and genericity have in gender stereotypes, we will follow up with a second study devising interventions to counteract these effects, intending to encourage men and women towards greater flexibility when it comes to food variety in their diet.

**References**

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Cimpian, A., & Salomon, E. (2014). The inherence heuristic: An intuitive means of making sense of the world, and a potential precursor to psychological essentialism. *Behavioral and Brain Sciences*, 37(5), 461-480.

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## **TITLE** The influence of the AntioxObesity weight reduction program on carotenoid concentrations in the blood among adults with excessive body weight

**AUTHORS AND INSTITUTIONS** J. Hamulka (1)\*, A. Sulich (1)\*, M. Górnicka (1), M. Jeruszka-Bielak (1)

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*Unpublished*

### **OBJECTIVES**

Plasma carotenoid concentrations are associated with antioxidant defense which might be disturbed in people with excessive body weight due to the accumulation of these compounds in adipose tissue. The aim of this study was to evaluate the effect of a 6-week weight reduction program on the plasma concentration of  $\beta$ -carotene, lycopene, and lutein in adults with excessive body weight.

### **METHODOLOGY**

In this intervention study, a weight reduction program (AntioxObesity) based on 1000-1500 kcal diet with unchanged both the amount and structure of vegetables and fruits consumption was applied. A total of 130 adults were recruited for the study of whom 75 completed the program, 47 women and 28 men (average age  $34.7 \pm 9.0$  years). Data on food consumption were collected with a 3-day recording method and a semi-quantitative food frequency questionnaire. Anthropometric measurements: body height (H), body weight (BW), waist circumference (WC) were taken. Body composition analysis with the BIA method (Maltron BioScan 920-2) was conducted. Fat mass (FM), fat-free mass (FFM), abdominal subcutaneous adipose tissue (SAT), and visceral adipose tissue (VAT) were measured. In the blood samples, the lipid profile was determined with enzymatic tests, and the concentration of  $\beta$ -carotene, lycopene and lutein was determined by the high-performance liquid chromatography (HPLC/UV-VIS). All measurements were conducted three times - at the beginning (T0), in the middle (T3), and just after (T6) the 6-week intervention

### **RESULTS**

The AntioxObesity program resulted in a significant reduction in body weight (-3.9 kg on average), WC (average: -5 cm) as well as FM (average: -3.3 kg), SAT (average: -20 cm<sup>2</sup>), and VAT (average: -26.7 cm<sup>2</sup>). Considering the lipid profile, a significant decrease in total cholesterol and LDL cholesterol was found. The average plasma concentrations of  $\beta$ -carotene, lycopene, and lutein increased significantly after the intervention and equaled at T0 vs. T6: 612 vs. 651 nmol/L; 426 vs. 447 nmol/L, and 340 vs. 384 nmol/L, respectively. The reduction of FM above 4 kg significantly increased the concentration of  $\beta$ -carotene (by 47.7 nmol/L) and lutein (by 37.0 nmol/L), as well as the total carotenoids (by 109.5 nmol/L). The plasma lycopene concentration did not change significantly due to the degree of adipose tissue reduction. Moreover, higher FM was associated with lower concentrations of  $\beta$ -carotene, lycopene, and lutein by 17%, 9%, and 26%, respectively in obese vs. normal weight adults. Significant negative correlations between plasma  $\beta$ -carotene concentration and FM ( $r=-0.30$ ), including SAT ( $r=-0.30$ ) and VAT ( $r=-0.34$ ) were detected.

### **CONCLUSION**

It was observed that the increase in carotenoid levels was associated with a reduction in fat mass, as fruit and vegetable intake remained unchanged. This positive effect of reducing fat mass may contribute to reducing the risk of developing diseases associated with the coexistence of oxidative stress and inflammation in people with excessive body weight. However, this requires further research to understand the mechanisms and determinants of these compounds' distribution in the organism.



**TITLE Occurrence of pesticides in fruit and vegetables - potential risk in aspect of consumer' health.****AUTHORS AND INSTITUTIONS** B. Lozowicka\*, E. Rutkowska, P. Kaczynski, I. Hrynko, M. Jankowska, A. Pietraszko, J. Sniadach, M. Czerwinska, W. Rogowska

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The authors declare that they have any financial or other conflict of interest with a company related to the submitted work.

*Unpublished***OBJECTIVES**

This study aims to evaluate pesticide residues in fruit and vegetables during a 5-year official control in Poland (2018-2022) to estimate health risk assessment

**METHODOLOGY**

One thousand six hundred fifty-two samples - fruits (574) and vegetables (1078) - were collected. The presence of 548 active substances (a.s.) of pesticides in samples was detected using the LC/GC-MS/MS technique and spectrophotometry. In order to assess the likelihood of adverse effects on human health, samples with pesticide residues exceeding the maximum residue limits (MRLs) were selected as potentially dangerous to consumers (25 samples). An innovatory tool, EFSA's PRIMo Pesticide Residue Intake Model with embedded intake data from EU member states, has been used for short-term (acute) exposure to pesticides.

**RESULTS**

The occurrence of pesticide residues depended on the type of commodity, chemical protection, the timing and number of treatments performed, the withdrawal periods and the rate of disappearance of these substances in plants. In 55.6% of the tested samples no a.s. was detected, while 44.4% contained pesticides - 42.9% below the MRL and 1.5% above the MRL. Strawberries and dill were the fruits and vegetables in which pesticide residues were most frequently detected - 9.3% and 6.7%, respectively. Out of 548 active substances, 94 were detected. The most frequently detected pesticides were acetamiprid (8.7% of detections), captan (7%), and difenoconazole (6.3%). Acetamiprid was most often present in cherries (3.6% of detection). Official control also revealed incompatibilities related to the presence of non-recommended a.s. Non-authorized a.s. accounted for 3.3% of detection in fruit and 11.9% in vegetables. The irregularities mainly were chlorpyrifos and prosulfocarb in dill, captan in plum, and carbendazim in cherries. The level of pesticide residues ranged from 0.005 to 5.97 mg/kg. The highest concentration was noted for thiacloprid in Chinese cabbage (5.97 mg/kg) and captan in apples (5.79 mg/kg). From the full spectrum of analyzed pesticides, we considered nine exceeded safety limits in the concentration range of 0.036 to 2.5 mg/kg. The acute exposure was estimated by comparing a single intake of the highest detected residue of pesticides to a set volume ARfD (Acute Reference Dose). Short-term exposure results were up to 70.9% ARfD for adults and 114.2% for children. Samples containing chlorpyrifos/lettuce (114.2% ARfD) and chlorpyrifos/rocket (108.1% ARfD) may adversely affect human health.

**CONCLUSION**

The results of this study indicated that Polish fruit and vegetables are safe. Nevertheless, continuous pesticide residue monitoring is necessary, and special attention must be paid to fruit and vegetables with non-authorized pesticides.



## **TITLE** The effect of technological processes on fungicide residues in berries fruit and dietary risk assessment

**AUTHORS AND INSTITUTIONS** B. Lozowicka\*, E. Rutkowska, I. Hrynko, M. Jankowska, P. Kaczynski

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The authors declare that they have any financial or other conflict of interest with a company related to the submitted work.

*Unpublished*

### **OBJECTIVES**

The objective of the study was to investigate the effects of four processes on the reduction of twelve fungicides in berries and to estimate the acute (short-term) risk for the most critical subpopulations of adults and children, according to a new strategy proposed by EFSA's Pesticide Residue Intake Model PRIMo without and with a correlation of processing factor (PF).

### **METHODOLOGY**

The material for the study consisted of three berry species (currants, raspberries and strawberries) obtained at the stage of field experiments conducted in 2022. Crops from representative cultivation sprayed with pesticides were subjected to the following processes: freeze-drying, drying (40°C, 48 h), pasteurization (95°C, 10 min) and cold pressing. The concentration of pesticides in the samples was determined by GC/LC-MS/MS, and then PF was calculated for each pesticide-process-product combination. The assessment of acute health risk for consumers connected with the consumption of pesticide residues-containing fruits was conducted based on available epidemiological studies done for German (DE), Netherlands (NL), and Ireland (IE) subpopulations of children and Finland (FI) and German adults.

### **RESULTS**

The study compared the effectiveness of freeze-drying, drying and pasteurization, and cold-pressing juice berries fruit and determined a range of PFs for 144 combinations (0.019-5.11). The freeze-drying process affected the concentration of compounds in all fruit (PF=1.08-4.13). The highest concentration was obtained for boscalid in currant (PF=4.13). For the other processes, PFs varied and ranged from 0.019 to 5.11. PFs after the drying process ranged from 0.019 (boscalid/strawberry) to 3.22 (difenoconazole/strawberry). The highest removal percentage was recorded for boscalid /strawberry (PF=0.026), while the highest concentration was obtained for azoxystrobin/raspberry (PF=1.31) after the pasteurization process. In the cold-pressing process, the highest residue concentration occurred for the pyrimethanil/strawberry combination (PF=5.11), while the highest residue reduction was obtained for the boscalid/strawberry (PF=0.026). Only in the case of azoxystrobin residues were concentrated (PF=1.14-1.78), while the concentration of boscalid was reduced (0.19-0.82) after all processes in all types of berries. The data presented confirms that children are the most exposed age group. Acute exposure did not exceed: 68.5% ARfD for the NL toddler (boscalid/strawberry) without correction for PF and 20% for the IE child (boscalid/raspberry) after correction for PF. For adults, the risk did not exceed 39.1% ARfD for DE women (boscalid/strawberry), while it was below 11.6% ARfD for FI men (boscalid/raspberry) after correlation with PF.

### **CONCLUSION**

The efficiency of technological processes in removing fungicides follows the order: pasteurization < drying < cold pressing of juice < freeze-drying. The performed risk assessment showed that pesticide residues detected in berries would not constitute a risk to the health of adults and children.



## POSTER N° 8

### **TITLE** Extending the validity of four French tools on eating difficulties, parental feeding practices and motives for buying food, in UK children 6-23months-old: associations with children's frequency of consumption and liking of fruits and vegetables

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*Unpublished*

### **OBJECTIVES**

Parents' feeding practices significantly impact children's eating behaviours. However, the lack of appropriate measurement tools limits our understanding of how parents respond to eating difficulties. Although numerous questionnaires exist for children over two years old, there are few validated instruments for younger children, and even fewer allow for cross-age and cross-cultural comparisons. This study aimed to validate the English versions of four French questionnaires - Children's Eating Difficulties Questionnaire (CEDQ), Feeding Strategy Questionnaire (FStrQ), Feeding Style Questionnaire (FStylQ), and Child Food Motivation Questionnaire (CFMQ) - and extend their validation from 20-36months to a younger age-range (<20 months).

### **METHODOLOGY**

The translated questionnaires underwent psychometric assessment, including testing of their factor structure (Confirmatory Factor Analysis), reliability (content validity, face validity, and internal consistency), test-retest reliability within 2-weeks (intraclass correlations), convergent validity through correlations with related measures, and construct validity through associations with children's fruit and vegetable (F&V) consumption-liking. The CEDQ and CFMQ were validated for 6-36m UK children (n=506). Measurement invariance was assessed to confirm that the constructs were measured equivalently for younger (6-20m) and older children (20-36m), and direct comparisons can be drawn between age groups. The FStrQ and FStylQ could only be validated for 20-36 months-old children (n=248).

### **RESULTS**

The CEDQ 4-factor structure was confirmed, whereas the CFMQ favoured a 5-dimension solution over the original 6-dimension one. Both questionnaires demonstrated excellent reliability, temporal stability, convergent validity, and scalar factorial invariance. Eating difficulties were strongly negatively correlated with vegetable intake-liking and moderately negatively correlated with fruit intake-liking. Parents' healthy food-buying motivations were positively correlated with vegetable consumption-liking, whereas accommodating children's preferences was negatively correlated with vegetable consumption-liking. The FStrQ exhibited a good fit for its 4-factor model, showing good overall reliability and test-retest reliability, except for the preference subscale, which had poor internal consistency. The FStylQ's 3-factor model had a near-acceptable fit after modifications, with good test-retest reliability and convergent validity, although internal reliability varied among subscales. No significant associations were found between parents' feeding styles and strategies and children's F&V intake-liking.

### **CONCLUSION**

Although the factor structure of the FStylQ was not confirmed, the psychometric evaluation provides valuable insights for future modifications. The validated CEDQ, CFMQ and FStrQ contribute to the assessment of eating difficulties, parents' food buying motivations and feeding practices, enabling cross-cultural comparisons between UK and French children. This study is one of a few to have tested for measurement invariance. The CEDQ and CFMQ established scalar invariance indicates that the questionnaires can validly assess longitudinal changes in eating difficulties and in parents' food-buying motives in children 6-36m. Overall, the validated questionnaires serve as valuable tools for future research, offering opportunities to investigate cross-cultural differences, changes in parents' food-choice motivations and the developmental trajectories of eating difficulties.





## POSTER N° 9

### **TITLE** A fresh look at food environments in Sri Lanka.

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*Unpublished work*

### **OBJECTIVES**

Fruit and Vegetables for Sustainable Healthy Diets (FRESH) is a multi-partner research project which aims to increase fruit and vegetable intake, improve diet quality, nutrition and health while also improving livelihoods, empowering women and youth and mitigating negative environmental impacts. In this session we will present the innovative work in progress on food environments in one of the focus countries, Sri Lanka. Understanding how food environment's influence diet and nutrition requires understanding the *features* of the environment, as well as *people's experience* of the environment which will be very different depending on economic, social, and cultural factors. This involves exploring both the physical/ material environment (such as markets, food vendors, home gardens) and the availability of different foods within them, as well as the behavioural and socio-cultural context in which people, whether consumers or vendors, operate and make decisions around food (including marketing, accessibility, convenience, desirability and price).

This research aims to provide an in-depth understanding into urban and rural food environments for fruit and vegetables, with a view to identifying entry points for intervention and informing relevant policies and programmes to increase consumption of fruits and vegetables for improved nutrition and health.

### **METHODOLOGY**

The research integrates three different participatory and qualitative methodologies enhanced with visual and geographical display methods. A participatory and collaborative assessment of needs of different groups of stakeholders, at policy, community and vendor levels will help refine a set of research questions suitable for the Sri Lankan context, particularly tailored towards disconnects between community needs and stakeholder understanding of those needs. Qualitative and visual methods in selected urban and rural communities will then be directed towards gaps in knowledge about what is guiding choices related to fruit and vegetable consumption within a wider food environment setting (through 'lived experience'). These will be brought together with vendor type and location data using GIS software. Further qualitative research about the factors influencing vendor decisions (on price, availability, diversity, promotion) will also be explored. This 'GIS mapping' will then be overlaid with photographs taken by community members as well as narratives of the experiences they have and choices they make in the environment, as well as vendor narratives. Together a 'story-map' will be developed that captures physical features and lived experiences.

These different levels of analysis, including the visual representation of the community data emerging from the GIS work, will be used to broker further conversations with community members, programme implementers and policy stakeholders on potential solutions for fruit and vegetable promotion amongst poorer and marginalised communities.

### **RESULTS**

Forthcoming

### **CONCLUSION**

Forthcoming



**TITLE** Exploratory consultation to evaluate availability of fruit and vegetable consumption data in AIAM5 member countries.

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*Unpublished in a peer review journal - some data were used for the 9<sup>th</sup> edition of the World Fruit and Vegetables Day [http://aiam5.com/wfvd/2020\\_9th-edition/](http://aiam5.com/wfvd/2020_9th-edition/)*

**OBJECTIVES**

As an active entity within the International Year of Fruit and Vegetables 2021 (IYFV), the Global Alliance for the Promotion of Fruit and Vegetable Consumption "5 a day" (AIAM5) agreed to collect information on fruit and vegetable (F&V) intake from its 32 member countries worldwide to contribute to the IYFV action plan.

**METHODOLOGY**

The survey and data analysis were carried out between August 2020 - September 2021. Data was collected using an online platform with a questionnaire in Spanish and English. Besides F&V intake, the F&V terminology, national recommendations of F&V and food included in "5 a day" messages and the policies in place to promote F&V consumption and reducing food waste were also explored.

**RESULTS**

24 entities responded the questionnaire. Only 2 of the 18 reporting consumption data reached the goal of at least 400 g/person/day. Italy had the highest consumption with 461 g followed by Uruguay with 399 g, while Argentina with 160 g and Brazil with 134 grams were among the ones that reported the lowest. Among those countries with a higher percentage of consumption:  $\geq 5$  portions/day, Costa Rica (35.9%), New Zealand (32.5%), Canada (28.6%) and Finland (26.8%) stand out. As a general trend, as age increases so does the intake of F&V. In terms of F&V affordability, spending is high, exceeding the annual average of \$630 USD, representing around 18% of the food basket. Most of the food based dietary guidelines and some "5 a day" programs define what counts as F&V. Whilst most include immature legumes and corn, and dried, fresh and minimally processed F&V, the inclusion of nuts and processed foods is limited.

The most common recommendation was of " $\geq 5$  portions/day" (n = 19) and specific recommendations for F&V separately were  $\geq 3$  portions for fruits and  $\geq 2$  for vegetables. 18 countries included 100% juices specifying "no added sugar" and limiting their consumption to  $\leq 1$  portion/day.

19 countries reported national policies and/or programs to promote F&V consumption. However, when conducting an exhaustive review, only 7 countries had national plans, laws or decrees that support "5 a day" policies and/or programs in place. Most of the countries reported F&V communication campaigns (n = 18), and although having websites that promote "5 a day", very few have government support. Regarding food waste regulations, 8 countries reported not having a national guideline to avoid or manage food waste.

**CONCLUSION**

AIAM5 partners are committed to promote consumption of F&V as essentials for achieving healthier and more sustainable agrifood systems, however, collection of data regarding F&V is a challenge to be assumed nationally and periodically since it is a major driver behind food insecurity and malnutrition trends that prevent healthy affordable diets and increase inequalities.



**TITLE SALSA Questionnaire: A tool to assess people's barriers and facilitators for following a healthy and sustainable diet.**

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*Unpublished*

**OBJECTIVES**

Develop and validate a questionnaire sensitive to socioeconomic differences capable of identifying barriers and facilitators people experience for following a healthy and sustainable diet.

**METHODOLOGY**

The SALSA-Questionnaire (which stands for sustainability and healthy diets, as its acronym in Spanish) has been designed and validated following the methodology proposed by Boateng et al.: (1) Item generation based on a Scoping Review that followed the 6 steps proposed by Arskey and O'Malley using a citizen-based consultation; (2) Content validation through consultation to nine experts and fourteen citizens; (3) Pre-test through cognitive interviews to five individuals; (4) Online questionnaire administration to approximately 500 people living in Spain; (5) Item reduction through inter-item and item-total correlation; (6) Factors extraction through regression analysis; (7) Confirmatory factor analysis to test items dimensionality; (8) Test-retest to assess the reliability.

**RESULTS**

This section describes the results from each validation phase, which are foreseen to be completed by July 2023. The development of this questionnaire enabled a comprehensive understanding of what prompts or blocks individuals from following a healthy and sustainable diet(HSD). The first methodological phase identified over 100 items which were grouped into five categories covering internal, socio-cultural, and external factors. This enabled to create a first draft of the questionnaire with 49 items. Of these, twenty-two were modified, and five were added after the experts' consultation. Content validity with citizens implied modifying 29 items and adding another one. Pre-test allowed further refinement of the questions resulting in modifying ten items and a final questionnaire with 55 items. These items are expected to be further reduced after completing steps 5-8. Overall, the questionnaire explored the sustainability of diets using a comprehensive approach to cover the three dimensions of sustainability (health, socioeconomic-cultural, and environmental). This was done taking as a reference sustainable diets as a general concept but also using specific elements that compose a sustainable diet, such as foods produced in a socially just way, plant-based vs. animal-based protein, ultra-processed vs. fresh foods, and seasonal and local foods.

**CONCLUSION**

This work represents a step forward in the promotion of HSD for two main reasons. First, this research provides a comprehensive analysis of people's inner and outer determinants to follow a HSD giving special attention to the differences that exist between socioeconomic groups. In this way, our research contributes to the One Health approach. Second, the SALSA-Questionnaire explores consumers behavioural drivers towards a SHD; thus, it represents a fundamental tool for planning strategies that are citizen-oriented. Throughout its development, a humanistic perspective has guided the process, ensuring that the determining factors that may vary among socioeconomic groups have been considered which will avoid sources of inequalities during its utilization.





## **TITLE Sour taste sensitivity in children aged 4 - 12 years**

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### **OBJECTIVES**

Fruit consumption is a vital part of a healthy diet but often stays below recommended intake. Fruit consumption at a young age contributes to fruit consumption later in life, therefore children are a key target group to gain insight in taste acceptance. Most fruits can be grouped as sour or sweet/sour. Studies have shown that there are children who prefer extreme sour tastes and children that do not. Sour taste preference might be influenced by taste sensitivity. Few studies have focused on sour taste sensitivity in children and those include only limited age groups. This study aims to investigate sour taste sensitivity in children in the age of 4 to 12 years old.

### **METHODOLOGY**

Four beverages were prepared with tap water and citric acid. The four beverages had pH7.0; pH3.3; pH3.2 and pH3.0 and cups were color-coded. Children who, with their supervisors, visited a public science day in the Netherlands in May 2023 were recruited to join the test. Each child was seated in one of nine individual mobile test rooms. The test started with an oral instruction. Children received four beverages in random order and were asked to rank these from least to most sour. An A4 form visualized the four categories, rank number 1 was visualized with one lemon, and rank number 4 with four lemons. Information on gender and age was collected. Statistical data analyses were performed by applying Chi-square tests in SPSS.

### **RESULTS**

In total 469 children, of which 238 girls and 231 boys, were tested. The mean age was  $9.1 \pm 4.3$  years. 38.4% of the children ranked the beverages correctly from least to most sour. To assess the differences in age, children were divided in three age groups, the youngest group of 4-7 years old (n=157), the middle group of 8-9 years old (n=145) and the oldest group of 10-12 years old (n=167). In each age group the gender distribution was equal. Children in the youngest age group significantly ( $p < 0,05$ ) ranked beverages less frequently correct (26,8%) compared to the middle age group (46,2%) and the older age group (42,5%). There was no significant difference in correct ranking between middle and the older age group.

### **CONCLUSION**

These preliminary results suggest that children younger than 8 years were less sensitive to sour taste compared to children of 8 years and older. These results suggest kid-friendly strategies which take into account effects of sour sensitivity of the age of children might help to increase the acceptance of fruit. Future studies could further investigate the link between sour taste sensitivity and sour preference in children.



## **TITLE Better nutrition among refugee households with home gardens; effects of the Nutrition and Income Generation Intervention on vegetable consumption in Omogo refugee settlement, Uganda.**

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*Unpublished*

### **OBJECTIVES**

In Uganda's West Nile region, refugees from South Sudan and Democratic Republic of the Congo that have been affected by forced displacement live in several refugee settlements. The Nutrition income generation intervention (NIGI) aims to achieve healthier lives and more resilient livelihoods for refugees living in the Arua district in northern Uganda. The project seeks to support refugees, and those living in the surrounding host community to grow vegetables, which are often completely absent in their diets. Especially in times of shocks, such as Covid 19 when the World Food Programme cut food rations by 30 per cent, self-reliance in provision of diverse food, especially fruits and vegetables, is of extreme importance.

The specific objectives of the study were to understand the impact of the intervention on increasing refugee's access to fresh vegetables including production and consumption of vegetables by those participating in the project, as well as overall increases in dietary diversity

### **METHODOLOGY**

An evaluation involving a cross-sectional survey of 349 refugee households from targeted (n=176) villages and non-targeted (n= 175) villages in Omogo refugee settlement. For households from the targeted villages, 16 lead farmers, those with a background in agriculture and garden visible from the road, were selected, along with 10 associated farmers (sample size =160). The same criteria was applied to households from the comparison villages. Data was collected between June and July 2020 Using the standardized Resilience Index Measurement and Analysis (RIMA) survey from the FAO.

All statistical analyses were done using IBM statistics SPSS 26. An alpha of 0.05 was applied for all analyses but adjusted for multiple testing using the Benjamini Hockberg (BH) method with parametric tests and the Bonferroni method for non-parametric tests (Benjamini & Hochberg, 1995; Sedgwick, 2014). All analysis were done with and without key farmers since key farmers received more support and different selection criteria were applicable compared to non-key farmers.

### **RESULTS**

Analysis of the data shows that households who participated in the project produce more vegetables and fruits, both in terms of quantity (KGs) as well as varieties, than non-participating households, and earn more income as a result. Those who participated in the project were twice (OR=2.19) as likely to consume vegetables. This was also reflected in the household dietary diversity score, with a mean increase of 0.40 (out of 10 possible food groups) for households who had crop farming as their main livelihood (the majority of households).

### **CONCLUSION**

The project was able increase household dietary diversity, and increase access to fresh vegetables for refugee households participating in the intervention. Projects like NIGI are useful to contribute to increased access to fresh vegetables and fruits and increase dietary diversity in refugee communities where access to fresh vegetables is often limited.

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doi:10.1136/bmj.g6284



**TITLE: Nutritional impact of no-added sugar fruit puree consumption at different eating occasions: a modelling study on French children**

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*Submitted in July 2023 in Public Health Nutrition*

### OBJECTIVES

While there is strong evidence that fruits and vegetables are beneficial for health, the recommended level of 5 per day is reached by a minority of French children. If fresh fruits must be encouraged, other forms like apple puree appears as a complement in order to reach the recommended 2 daily servings of fruits. Moreover, the consumption of high-sugar and high-fat foods (HSHFF), frequently offered to children at snack, should be limited. The objective of the present study was to evaluate the nutritional impact among French children of consuming a portion of no-added sugars fruit puree (NASFP) on four different times of consumption, together with or without a reduction in sweetened foods.

### METHODOLOGY

The study was conducted on children from 1 to 17 years old using the last available French representative dietary survey (INCA3). Simulations were performed on each individual (n=1,934), each dietary recall and each of the four eating occasions (breakfast, lunch, snack, dinner) The necessary amount of NASFP (from 0 to 100 g) to reach one serving of fruit puree was introduced. The nutritional composition of the NASFP was based on the composition of a "standard" NASFP from INCA 3 database and serving sizes corresponded to the median NASFP portion consumed calculated by eating occasion and age groups. In the second stage, this introduction was compensated by the removal of the same serving of other pre-defined (according to a list provided by French health authorities) replaceable foods. Intakes in nutrients to favor, nutrients to limit and prevalence of adequacy to nutritional requirements were compared between observed and simulated diets in the whole sample and in 5 different age groups.

### RESULTS

Simulated diets were more nutrient dense thanks to increases of favorable nutrients (especially fibers, iodine, selenium, vitamin A and C) from NASFP and a decrease in calories from nutrients to limit (especially free sugars) from the substitution step. It was especially visible for teenagers which were less likely to consume fruit puree in their observed diet and, as a consequence, more likely to benefit from simulations. The decrease in free sugars was even greater with substitution at breakfast and snack thanks to the decrease of replaceable HSHFF. Prevalence of adequacy increased from 2 to 14.5 points for fibers and from 4.5 to 12 points for free sugars according to age group and eating occasion.

### CONCLUSION

Promoting NASFP in replacement of HSHFF, especially at breakfast and snack, is a promising strategy to improve the nutritional quality of French children's diet through a better adherence to national guidelines. Identified barriers to break down in order to shift toward an increased consumption of fruit puree were their accessibility for low socio-economic status as well as their attractivity for oldest children.





## **TITLE** Adherence to the Mediterranean Diet Among Pregnant Women in Jersey

**AUTHORS AND INSTITUTIONS** U. Śliwka (1), K. Przybyłowicz (2)\*, J. Borawska-Dziadkiewicz (3), A. Danielewicz (2), B. Kroplewski (2)

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### **OBJECTIVES**

This observational study, based on a cross-cultural population in Jersey, the Channel Islands (native-born Jersey, British, Polish and Portuguese/Madeiran nationals), was designed to assess diet and the issue of obesity among pregnant women.

### **METHODOLOGY**

Antenatal Clinic at Jersey General Hospital in 2017. Of the 115 women who agreed to participate in this project, 81 completed all stages of the research. Socioeconomic and demographic data, as well as data on the maternal diet compared with selected anthropometric measurements of mothers. The EPIC-NorfolkFFQ v.6 was used to obtain a retrospective diet review before pregnancy (FFQ1) and during pregnancy (FFQ2). Maternal dietary habits were described by the degree of adherence to the alternateMediterranean diet (aMED) score constructed by Fung et al. The period of time the mothers had lived on the island was used to split the groups for Native and the UK, women who had lived on the island less than 10 years (Europe <10y on the island) and women who had lived on the island more than 10 years (Europe ≥10y on the island). Advanced statistical software programmes were used to analyse the data, including Statistica 10.0 PL StatSoft.

### **RESULTS**

Regarding the maternal diet, the general intake of animal proteins during pregnancy for all women did not change from the pre-pregnancy period, the intake of fats and oils increased during pregnancy, and the intake of milk and dairy products decreased during pregnancy for all three groups of women. Although the intake of vegetables decreased for all the groups, the intake of fruit increased for the Native and Europe < 10y on the island groups. The women in the Europe ≥10y on the island group were the only participants who registered the alcohol intake during pregnancy. In terms of the Mediterranean diet scores, the participants in the immigrants ≥10yrs group shifted to a worse diet during pregnancy, while the women in the immigrants <10yrs group adopted a healthier diet after becoming pregnant. No relationships were observed between the maternal pregnancy parameters and the aMED score. Neither weight nor BMI was different among the aMED score levels. Therefore, women with better aMED diet scores did not have healthier BMIs as expected.

### **CONCLUSION**

There is a need for large population studies within this remote island community based on one to one nutritional assessments to produce a more comprehensive analysis of the beneficial effects of dietary patterns. Moreover, this would facilitate conclusions regarding the diets among pregnant women and nutritional trends amongst families in Jersey as well as specific subgroups. Project financially supported by the Minister of Education and Science under the program entitled "Regional Initiative of Excellence" for the years 2019-2023, Project No. 010/RID/2018/19, amount of funding 12.000.000 PLN (2.666.666 euros).

**TITLE Sustainable school food procurement in England: when there is a will, there is a way****AUTHORS AND INSTITUTIONS** F. Sabet

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Published, [https://doi.org/10.3920/978-90-8686-939-8\\_10](https://doi.org/10.3920/978-90-8686-939-8_10)**OBJECTIVES**

This study explores sustainable school food and discusses the implications of a doctoral study on sustainable food procurement in primary schools in England.

**METHODOLOGY**

Data were collected using a mixed methods approach: methods included a survey to 8 schools, observations in three schools in England and semi-structured interviews with 15 key informants. Participants included parents, caterers, local producers, school heads and school food experts.

**RESULTS**

Findings uncovered current food procurement (FP) practices in schools in England, where local, seasonal, organic and sustainable food procurement (SFP) is considered as an overly idealistic ambition. Local producers are marginalised and catering staff disempowered by the over reliance on large multi-national wholesale corporations and industrial pre-packaged foods. However, producers and school caterers expressed a growing interest in transforming school food. Schools could potentially be a lucrative market for local producers while school caterers are driven to inspire best practice.

**CONCLUSION**

These findings have significant implications on public food procurement in the UK of which schools account for the largest share. Schools, caterers, and local food producers could collaborate to initiate a dynamic school food procurement system aimed at shortening food chains, empowering kitchen staff and rewarding local and organic growers. Such a synergy could improve both health and sustainability standards of school food in England.

**TITLE** Betalains-rich products inhibit sodium-dependent glucose co-transporter 1-mediated glucose uptake by intestinal epithelial cells**AUTHORS AND INSTITUTIONS** T. Sawicki (1)\*, A. Nynca (2), S. Swigonska (3), M. Jabłońska (1)

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*Unpublished*

**OBJECTIVES**

The study focused on the regulatory mechanism of dietary glucose absorption. We aimed to clarify the inhibitory effects of six different betalains-rich products (red beetroot, yellow and red prickly-pear, yellow and red pitaya, and Swiss chard) on sodium-dependent glucose co-transporter (SGLT) 1-mediated gastrointestinal glucose absorption.

**METHODOLOGY**

Research materials were purchased at a local market in northeast Poland. After lyophilization, the samples obtained were pulverized and stored at -80°C until analysis. Betalains were analyzed using liquid chromatography coupled with the Ultra-High Resolution Qq-Time-Of-Flight mass spectrometer (LC-TOF-MS/MS). Uptake experiments were performed using human intestinal Caco-2 cells and the fluorescence glucose analogue, 2-deoxy-2-[(7-nitro-2,1,3-benzoxadiazol-4-yl)amino]-D-glucose (2-NBDG).

**RESULTS**

In the analyzed material, betalain contents ranged from 0.10 to 9.24 mg/g dm. The highest concentration of these pigments was determined in red beetroot. Betalains-rich products inhibited sodium-dependent 2-NBDG uptake in a concentration-dependent manner. Yellow and red prickly-pear showed the best inhibitory properties of 2-NBDG.

**CONCLUSION**

The results of this study suggest that the inhibitory effects of betalains-rich products on SGLT1-mediated glucose uptake contribute to the suppression of increased postprandial blood glucose level.

**Acknowledgments**

This work was supported by the National Science Centre (NCN), Poland under grant number: UMO-2020/37/B/NZ9/00651



## **TITLE Consumer knowledge and sentiment of fruit & vegetable dietary guidelines**

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Unpublished - Fielded 2022 March.

### **OBJECTIVES**

In the world we live in today, there are many health-related issues that can be linked to poor diet. According to the European Parliamentary Research Service, eating the recommended amount of fruits and vegetables can help prevent against chronic diseases such as cancer, heart disease, diabetes and obesity. Along with causing chronic diseases, not eating enough fruits and vegetables is among the top 10 risk factors for global mortality (1). The scientific and government communities agree that fruit and vegetables are the backbone of any healthy diet. The World Health Organization recommends adults consumes 400g of fruits and vegetables daily. (2) Despite this clear mandate and extraordinary efforts by agencies around the world, people have been under consumed fruits and vegetables for decades. This begged the question, do people know what they should be eating and more importantly, do they even care about fruit and vegetable consumption. Consumer knowledge and sentiment of fruit and vegetable dietary guidelines play a crucial role in determining individuals' dietary choices and overall health. One of the easiest ways to prevent chronic disease and poor nutrition is by choosing healthier foods, this includes incorporating fruits and vegetables into diets. Therefore, we tested the hypothesis that adults and teens around the world are unaware of the dietary guidelines which is why they are not meeting them daily.

### **METHODOLOGY**

To test the hypothesis, we conducted an online quantitative survey instrument to 500 adult respondents who were qualified by answering that they were the primary or share responsibilities for food and drink shopping in their household. The survey instrument was conducted in each of the following countries: US, Brazil, China, Germany, UK. An additional 200 interviews among 13 - 17-year-olds were added in each market. In the interviews, we asked questions about daily servings and recommended dietary guidelines, as well as questions linked to lifestyle. The survey had a confidence level of 95% with a margin of error of 4%.

### **RESULTS**

From these interviews we found that adults and teens around the world place a lot of importance on the role of fruits and vegetables in maintaining their lifestyle.

Yet many underestimate the daily number of recommended servings, do not regularly follow guidelines, and are not confident they are getting enough in their diet. In the USA, Germany, and Brazil, consumers perceived the recommended servings of fruits and vegetables to be 3 servings per day, however, the World Health Organization recommends consumers consume 400 grams or 5 servings of fruits and vegetables each day (2). The most startling finding was respondents' confidence they were eating their perceived recommended amount which was lower than the recommendation was woeful. The US and UK for instance, respondents were only 29% and 25% confident respectively. This means some respondents could be eating only 1 fruit and vegetable daily. Alternatively, respondents in China where fruits and vegetables are incorporated in multiple day parts consistently had a stronger response with 76% of people confident they are eating the daily recommended serving. Figure 1 outlines the data for adults in five markets.



	<b>US</b>	<b>UK</b>	<b>Germany</b>	<b>China</b>	<b>Brazil</b>
Fruits and Extremely Important/Very Important	83%	77%	77%	93%	94%
Perceived Recommended Daily Servings of F&V (Adults) Note: 400g = appx 5 daily	<b>3</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>3</b>
Very Confident/Confident Eating The Recommended Daily Serving	29%	25%	29%	76%	45%

## CONCLUSION

Our conclusion is that the seemingly rudimentary education around 400g and 5 daily is important for people to translate their high sentiment of importance of fruits and vegetables to behaviours. Further work is being explored to learn how to incorporate fruits and vegetables in every meal can translate into high consumption of fruits and vegetables on a routine basis which will lead to improved health outcomes and stronger societies.

- (1) [https://www.europarl.europa.eu/RegData/etudes/ATAG/2021/689367/EPRS\\_ATA\(2021\)689367\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/ATAG/2021/689367/EPRS_ATA(2021)689367_EN.pdf)
- (2) <https://www.who.int/news-room/fact-sheets/detail/healthy-diet>



**TITLE Gender differences in the eating behaviors of an Italian population of children participating to the nutrition education program MaestraNatura.**

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### OBJECTIVES

Dietary habits are acquired through a gradual process that begins early in life and are shaped by individual biological components and many external factors such as family and socioeconomic contexts strongly influenced by gender. Several studies carried out in adults have shown significant differences in food preferences and dietary behaviors between men and women that may be, thus, differently exposed to nutritional risk factors. Very few data, meanwhile, are available to define whether differences exist also between young girls and boys. The present study was aimed at assessing the eating habits and the degree of adherence to the principles of Italian Dietary Guidelines (IDG) of 11-13 years old children attending the nutrition education program MaestraNatura (MN), and their parents. The final goal was to evaluate possible influences of gender and family context on their eating choices and behaviors.

### METHODOLOGY

The study involved 25 first level intermediate schools located in 6 Italian regions (Lazio, Basilicata, Campania, Toscana, Marche, Umbria) participating to MN education program. Food frequency questionnaires (FFQ) were administered and filled in by 390 students and 145 parents. Each questionnaire got a score assigned considering the adherence to IDG regarding the intake of vegetables, fruit, cereals, legumes and fish. Four ranges of score were defined to indicate a scarce, low, medium, and high degree of adherence to IDG.

### RESULTS

Children and parents showed both a medium degree of adherence to the principles of IDG. The analysis of students' responses revealed interesting differences between girls (F) and boys (M) in the daily consumption of at least 3 servings of fruit and vegetables (F>M), 2-3 servings of cereal (M>F), having breakfast at least 5 days a week (M>F), and consumption of carbonated/sweetened drinks (M>F). Moreover, by matching the eating habits of parents with those of their children, we showed that some healthy habits (consumption of legumes, >2 daily servings of fruit and vegetables, fish) are hardly transferred to children.

### CONCLUSION

In conclusion, gender seems to influence eating behaviors even in childhood; thus this aspect should be taken in account to design effective nutrition preventive strategies. In addition, some healthy habits of parents are hardly transferred to their children. This finding suggests that, although eating habits are learned in the family context, some behaviors need more awareness to be taken up. Therefore, preventive nutrition education strategies, involving school and family and specifically targeting girls and boys are needed to make children aware of the importance of a healthy lifestyle and to correct eating habits.



## **TITLE** Dietary self-control as a way to improve fruit and vegetable consumption and adherence to dietary recommendations

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*Unpublished*

### **OBJECTIVES**

A high proportion of the world population does not meet the WHO dietary recommendations. One of the key dietary recommendations is to increase fruit and vegetable (F&V) consumption to at least 5 servings per day. Numerous campaigns have been launched on a global or regional level to promote pro-healthy dietary habits including F&V consumption. Despite of this, many people find difficult to follow dietary recommendations. This study tested a food self-monitoring diary to improve fruit and vegetable consumption and adherence to dietary recommendations.

### **METHODOLOGY**

The sample consisted of 49 females aged 21.3 years (SD 2.2). In order to monitor food consumption day by day, respondents were asked to keep a food diary, so-called "Self-monitorYourDiet®", for two consecutive months (M1, M2). The diary was designed as a simple graphic-textual form containing 11 food items, including 6 items recommended for consumption and 5 items with recommended consumption reduction, along with the recommended consumption frequency per day/week/month. The researcher summed up eating episodes of each food item during the month and calculated the average daily consumption frequency (times/day) in M1 and M2. The respondents' overall adherence to dietary recommendations was expressed as an Adherence Score (AdhS) in points (range 0-12). One point was assigned for compliance with each recommendation and an additional point for compliance with the recommendation for F&V. The following cut-offs (number of servings) were used to assess dietary adherence - for fruit:  $\geq$ once a day, vegetables:  $\geq$ 3 times/day, F&V:  $\geq$ 5 times/day, dairy foods:  $\geq$ 2 times/day, whole grains:  $\geq$ once a day, fish/seafood:  $\geq$ 2 times/week, legumes/nuts/seeds:  $\geq$ once a week, meat products:  $\leq$ 5 times/week, sweets/sugar/honey:  $\leq$ once a week, sweetened/energy drinks:  $\leq$ once a week, fast foods:  $\leq$ once a month, alcohols:  $\leq$ once a month.

### **RESULTS**

Mean AdhS for M1 was 3.5 points (SD 1.8) while for M2 was 3.9 points (SD 1.7) ( $p>0.1$ ). In M1 following dietary recommendations was found in 2% respondents for F&V, 8% for vegetables, and 51% for fruit. In M2 when compared to M1 significantly more respondents followed dietary recommendation for F&V (51% vs 2%, respectively;  $p<0.0001$ ). No significant differences between M2 and M1 were found for proportion of respondents following recommendation for fruit (57% vs 51%, respectively;  $p>0.1$ ) or vegetables (6% vs 8%, respectively;  $p>0.1$ ).

### **CONCLUSION**

The diary, based on the user's own activity, can be useful to monitor the user's food consumption on a daily basis and promote an increase in fruit and vegetable consumption. This allows us to recommend the use of the "Self-monitorYourDiet®" diary in nutritional counseling to promote pro-healthy dietary habits.

Project financially supported by the Minister of Education and Science under the program entitled "Regional Initiative of Excellence" for the years 2019-2023, Project No. 010/RID/2018/19, amount of funding 12.000.000 PLN.

**TITLE Nudging food service users to choose fruit-and vegetable-rich items: Five field studies****AUTHORS AND INSTITUTIONS** S. Yi (1), V. Kanetkar(1), P. Brauer (2)

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Published in 04/2022: DOI: [10.1016/j.appet.2022.105978](https://doi.org/10.1016/j.appet.2022.105978)**OBJECTIVES**

Although frequent consumption of fruits and vegetables (FV) has been promoted, consumption is not increasing in most countries. In response, researchers are increasingly pointing to the importance of the immediate environment in which food choices are made every day. This is in line with findings that people's food choice decisions are frequently made on the spot in a heuristic fashion, influenced by cues that exist in the immediate choice environment. Given this, the concept of nudging has recently been applied to the promotion of fruits and vegetables in various eating contexts.

Although nudging has been found to promote the choice of fruits and vegetables in lab studies and ad-hoc field studies, relatively little research is available regarding effectiveness in real food venues that operate for profit. Given the paucity of empirical studies providing "proof of implementation", the aim of the research is to apply nudging techniques to promote FV in institutional food services contexts, in which a lot of individuals eat meals daily.

**METHODOLOGY**

Based on the typology of choice architecture in food choice contexts, we closely collaborated with the in-house food service operator to devise and implement five nudge interventions to promote FV in university cafeterias located in southern Ontario, Canada. Each study was conducted for one 12-week semester or more over a three-year period. In the first two studies, non-verbal point-of-purchase prompting increased the choice of kale/spinach-supplemented smoothies and whole fruits from baskets. In Study 3, the combination of sizing and point-of-purchase non-verbal prompting increased the sale of large size vegetable-rich bowls from a stir-fry grill. In Study 4, enhancing the proximity of the bin for spinach in a sandwich bar by placing it at the beginning of the station increased the sale of sandwiches containing spinach. In Study 5, the combination of sizing and proximity of large vs. small sized plates and serving spoons had no effect on sale of self-serve items in a salad bar.

**RESULTS**

Overall, our field studies in food service cafeterias show that the use of nudges can produce a significant increase in the choice of target FV-rich food items. The size of the nudging effect was relatively moderate. Each nudge led to about 10-15% of increase in the choice of target items compared to baseline, except for Study 5 in which no significant effect was observed.

**CONCLUSION**

Our field studies show that prompting, increasing proximity, sizing and their combination can produce significant long-term increase in the choice of FV-rich food items in everyday operation of competitive food services in a tertiary educational institution. Researchers are encouraged to closely work with food service operators to promote the diffusion of nudging and choice architecture for healthy eating in the food service sector.



**TITLE** Can social influence and norms promote more sustainable diets?**AUTHORS AND INSTITUTIONS** D. Pollicino (1), H. Zamzow\* (1), M. Galizzi (1), H. Naci (2), P. Freitag (1)

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**OBJECTIVES**

Social norms can be particularly strong drivers of behaviour in situations of uncertainty. One such context is often that of social eating, where norms may provide a guide for appropriate consumption. The evidence base regarding the effectiveness of behaviourally informed approaches leveraging the power of norm-based interventions to promote sustainable eating has grown. However, syntheses of this evidence are currently lacking, impeding our ability to inform and propose new research directions to increase sustainability in real-world contexts. The objective of this project is to determine which consumption-side interventions appealing to norms are the most effective in motivating a shift from animal-based to more plant-based food consumption in individual consumers and households.

**METHODOLOGY**

The review process followed the Collaboration for Environmental Evidence (CEE, 2018) guidelines. We used the RepORting Standards for Systematic Evidence Syntheses (ROSES) in designing our search and preregistered the review on the Open Science Framework (10.17605/OSF.IO/S3DXR). The Boolean search string was tested and adjusted by examining search results in two core databases, PsychINFO and SCOPUS. We searched in various bibliographic databases (PsychINFO, Scopus, GreenFile, Medline, Embase), Google Scholar, ProQuest theses repository, and also contacted authors in the field to obtain manuscripts and pre-prints. Eligible studies included randomized-controlled trials and difference-in-difference designs, comparing food consumption or purchasing behaviour against a control group or in a before-after intervention, with the primary intent of reducing climate emissions from food. Critical appraisal of the final pool of studies employed two independent reviewers to assess risk-of-bias, focusing on different aspects of trial design, conduct, and reporting.

**RESULTS**

We initially identified 2354 publications which fit our eligibility criteria, 92 of which passed title and abstract screening. After full-text analysis, 24 papers (34 studies) remained for the final stage of narrative synthesis. Of these, 12 reported a significant effect and 22 found no effect of social norms on food choice. Most studies used generic referent groups (e.g., "people" or "other customers"). Only 4 studies measured whether the study sample actually identified with the stated referent group. Further, only about half included a post-trial survey or manipulation check to explore whether participants had noticed or could recall the message in the experimental treatment. Finally, interventions with multiple components, including social-norm based messaging, and/or which ran for longer time periods, seemed to work better to modify dietary habits.

**CONCLUSION**

Overall, we conclude that evidence on the effectiveness of social norm interventions to encourage a shift from animal-based to plant-based diets is limited and mixed. Most studies employed a non-specific social referent, which may have limited their success. We recommend that future interventions employ multiple strategies and focus on first identifying the most relevant referent group when trying to use social influence to change consumers' food choice.



## **TITLE** Different determinants of preferences for botanically defined fruit and vegetables: evidence from omnivores, vegetarians, and vegans

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*Unpublished*

*Declaration: no financial or other conflict of interest with a company related to the submitted work for all co-authors*

### **OBJECTIVES**

Previously, studies have shown that children and adults prefer fruit and vegetables that are relatively energy dense (Brunstrom et al., 2018; Gibson & Wardle, 2003). However, our studies indicate that variation in energy density (ED, kcal/g) predicts preference for different vegetables but not different fruit, and that preference for different fruit is predicted by sweetness. However, these associations are observed in foods when grouped according to their botanical classification, rather than culinary use. In other studies, researchers found that habitual diets (e.g., vegan, vegetarian, and omnivore diet) may alter taste responses to nutrient content and sweetness (Jalil Mozhdehi et al., 2021; Leshem & Shaul, 2022). Specifically, vegans and vegetarians show greater sensitivity to sweetness and show a stronger sweet preference, compared to omnivores (Leshem & Shaul, 2022). Thus, in the current study, we explored whether vegans and vegetarians differ in the extent to which sweetness and ED predict preferences for botanical fruit and vegetables, compared to omnivores.

### **METHODOLOGY**

Two separate groups of participants (39 omnivores vs. 38 vegetarians and vegans) were recruited to investigate three groups of foods, 1) botanical fruit (n= 13) treated as fruit for culinary purposes, 2) botanical fruit (n= 11) treated as vegetables for culinary purposes (e.g., tomatoes), 3) botanical vegetables (n=12) treated as vegetables for culinary purposes. Participants were shown pictures (100g) of the fruit and vegetables and rated their 'liking' and completed a two-alternative forced choice task (2AFC). That is, food preference for each food was assessed using two measures - liking ratings, and frequency of foods being selected. Linear mixed models were used to analyse the data.

### **RESULTS**

We observed the same pattern in omnivores and in vegetarians and vegans. Sweetness predicts liking (group 1: beta =0.49, 95% CI = [0.37,0.61]; group 2: beta =0.41, 95% CI = [0.28,0.53]) and food choice (2AFC) (group 1: beta =0.33, 95% CI = [0.22,0.45]; group 2: beta =0.26, 95% CI = [0.15,0.36]) for botanical fruit in both groups 1 and 2. Besides, ED predicts preferences for botanical vegetables (liking: beta =0.22, 95% CI = [0.14,0.31]; 2AFC: beta =0.19, 95% CI = [0.06,0.32]).

### **CONCLUSION**

Consistent with an explanation based on human-plant co-evolution, our results indicate that, irrespective of habitual diets, a common set of predictors explain preference for foods that are related botanically but not those that are related by a culinary classification (i.e., foods with the same botanical origins may share similar underlying driver(s) of developing food preference). We conclude that botanical classification may be an important consideration in plant breeding strategies aimed at promoting the consumption of everyday fruit and vegetables.



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