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International conference

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

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A qualitative study of young peoples' thoughts and attitudes to follow a more plant-based diet

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Background:

- Plant-based diets (PBDs) represent dietary habits that reduce the consumption of animal-based products and increase the consumption of nutritionally rich plant foods[1]
- PBDs have been shown to provide significant health benefits, such as reducing likelihood of developing Type II diabetes, cardiovascular disease, obesity, colorectal cancer, and improving wellbeing[2-5]
- PBDs also help reduce the negative effects of animal-based food consumption on the environment[6]
- Young people (10-24 yrs) represent an age group at risk of adopting unhealthy diets that contain few nutritious plant-based foods which persist into adulthood, resulting in long-term health consequences[7]
- Despite the benefits of adopting PBDs, few studies have investigated young peoples' attitudes towards PBDs in the UK, where animal-based diets are more popular than in non-western countries

Research Aim:

- To investigate the factors that may influence young peoples' views and intentions to adopt a PBD
- Identify barriers and facilitators that affect young people adopting more PBD

Methodology

Design and participants

- Within-subjects qualitative research design
- Eligible participants were young people, aged between 18-24 years, of British nationality, living in the UK, and not currently consuming a vegan, vegetarian, or PBD
- Participants were recruited through convenience sampling using online advertisements posted on Facebook

Procedure:

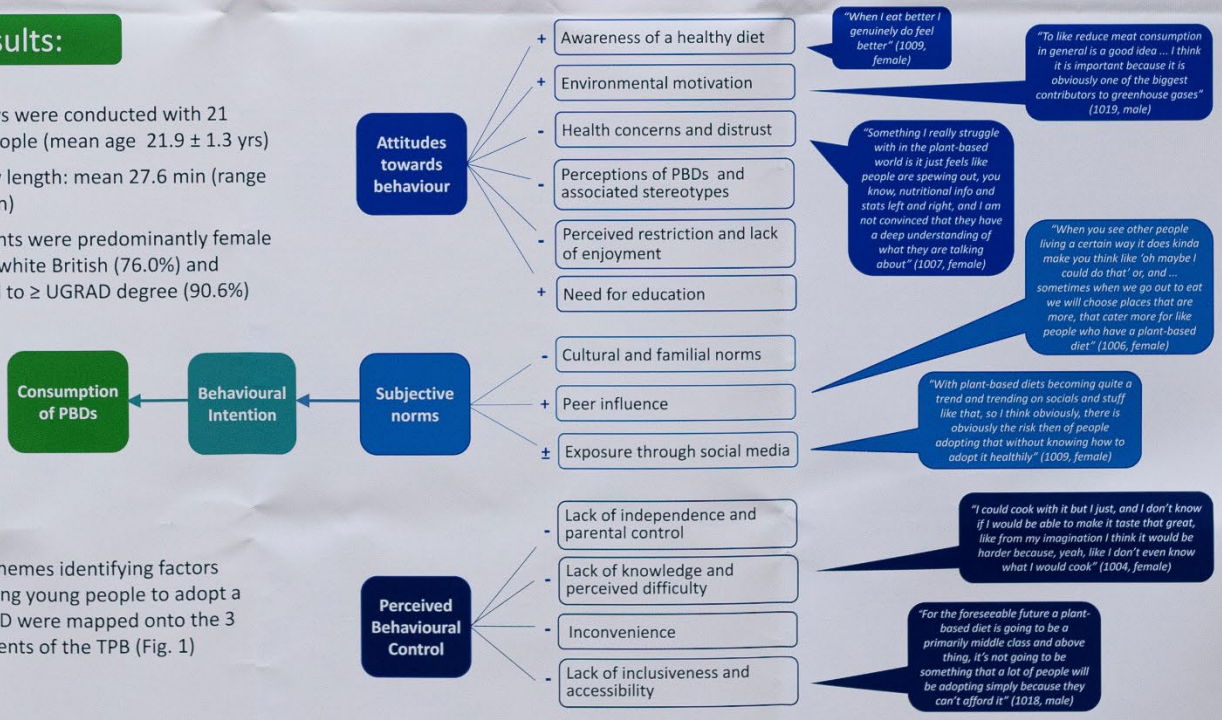
- Participants were asked about their views of PBDs in individual semi-structured interviews (SSIs) via Microsoft Teams, May-June 2022
- The interview schedule was developed and informed using the Theory of Planned Behaviour (TPB)[8]
- SSIs were audio recorded using mobile App: Voice Memos

Analysis:

- Interviews were transcribed verbatim and thematic analysis[9] was utilized to explore views, and the barriers and facilitators to following a PBD
- The TPB was used as a framework to organize the findings

Results:

- Interviews were conducted with 21 young people (mean age 21.9 ± 1.3 yrs)
- Interview length: mean 27.6 min (range 14-45 min)
- Participants were predominantly female (76.2%), white British (76.0%) and educated to ≥ UGRAD degree (90.6%)



- 13 sub-themes identifying factors influencing young people to adopt a more PBD were mapped onto the 3 components of the TPB (Fig. 1)

Fig. 1: Emerging sub-themes mapped onto TPB components explaining the attitudes, subjective norms, and perceived behavioural control influencing young people's intention to follow a more PBD [+ve symbol: perceived facilitator; -ve symbol: perceived barrier]

Conclusions:

- Increased provision of education and knowledge about PBDs to young people, and widening access to PBDs, could help improve their understanding and intention to follow this dietary style
- Tailored health promotion strategies, which consider additional barriers and facilitators in this study, could motivate young people to consume a more PBD

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The effect of raspberry polyphenolic extract on cecal microbiota activity, lipid metabolism and inflammation in obese rats

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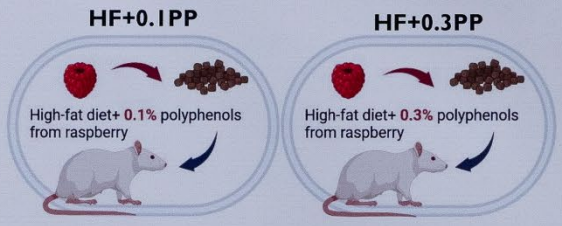
BACKGROUND

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.

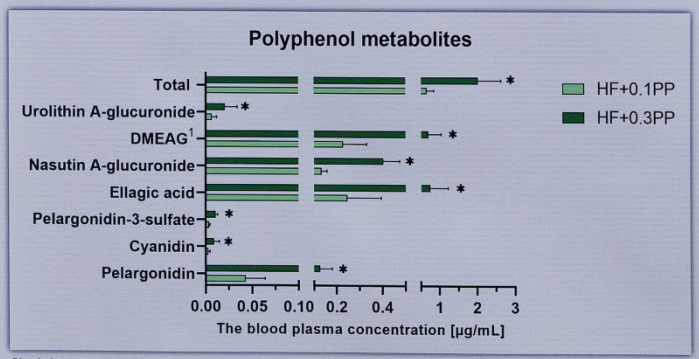


METHODS

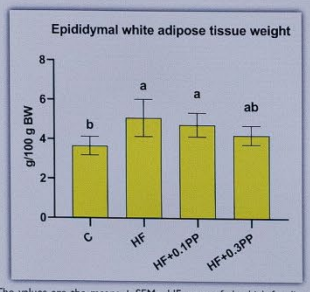
Raspberry pomace was used as the raw material for the preparation of the raspberry phenolic extract (PP). The total concentration of polyphenols in PP was 47.8 ± 1.06 g/100g. The nutritional experiment was performed on male Wistar rats allocated to 3 groups of 8 animals each. For 30 days, the animals 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.

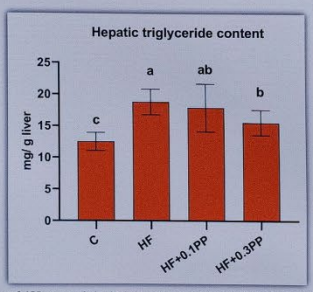
RESULTS

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, PPARγ 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.

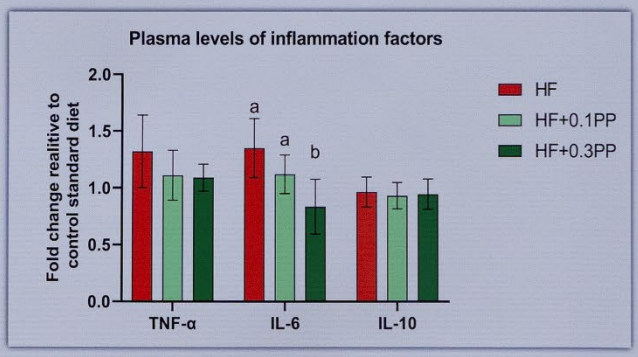


Blood plasma concentrations of polyphenolic metabolites in rats fed diets supplemented with raspberry extract. The values are the means ± SEMs. HF + 0.1PP, group fed a high-fat diet supplemented with 0.1% raspberry polyphenolic extract; HF + 0.3PP, group fed a high-fat diet supplemented with 0.3% raspberry polyphenolic extract. * Mean values are significantly different ($p < 0.05$; t test). 1ellagic acid dimethyl ether glucuronide.

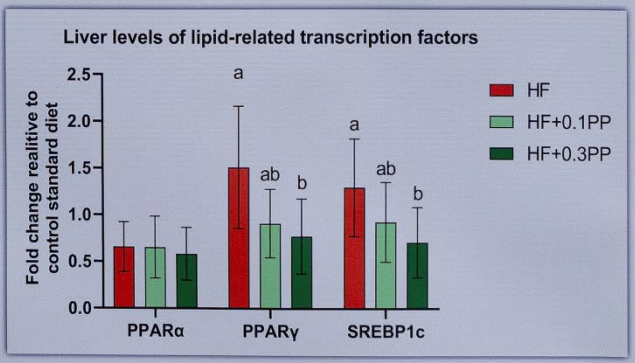




The values are the means ± SEMs. HF, group fed a high-fat diet; HF + 0.1PP, group fed a high-fat diet supplemented with 0.1% raspberry polyphenolic extract; HF + 0.3PP, group fed a high-fat diet supplemented with 0.3% raspberry polyphenolic extract. Mean values with different superscript letters (a or b) are different at $p < 0.05$ (post hoc test).



The levels of TNFα, IL-6, and IL-10 in the plasma of rats fed experimental diets (expressed as fold change relative to the control). The values are the means ± SEMs. HF, group fed a high-fat diet; HF + 0.1PP, group fed a high-fat diet supplemented with 0.1% raspberry polyphenolic extract; HF + 0.3PP, group fed a high-fat diet supplemented with 0.3% raspberry polyphenolic extract. Mean values with different superscript letters (a or b) are different at $p < 0.05$ (post hoc test). TNFα, tumor necrosis factor α; IL-6, interleukin 6; IL-10, interleukin 10



mRNA expression of PPARα, PPARγ, and SREBP-1c in the livers of rats fed experimental diets (expressed as fold change relative to the control). The values are the means ± SEMs. HF, group fed a high-fat diet; HF + 0.1PP, group fed a high-fat diet supplemented with 0.1% raspberry polyphenolic extract; HF + 0.3PP, group fed a high-fat diet supplemented with 0.3% raspberry polyphenolic extract. Mean values with different superscript letters (a or b) are different at $p < 0.05$ (post hoc test). PPARα, peroxisome proliferator-activated receptor alpha; PPARγ, peroxisome proliferator-activated receptor gamma; SREBP-1c, sterol regulatory element-binding protein 1c.

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CONCLUSION

In summary, the use of raspberry polyphenol extract from pomace should be considered a valuable, affordable, and suitable way to enrich our diet with an effective amount of bioactive molecules. Furthermore, this experiment was performed in model animals; therefore, the use of raspberry polyphenolic extracts as a functional additive to food should also be verified by human studies.

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Fruit and vegetable consumption: Are they associated to movement behaviors?

EGEA édition 9 Conférence internationale

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INTRODUCTION

While physical activity (PA). sleep and sedentary behaviors (SB) are almost always considered independently. they have been considered as integrated human movement behaviors for the first time in the 24 h Movement approach to promote overall health. Not only do these behaviors impact energy expenditure. but they have also been shown to separately impact energy intake. Indeed. a high level of PA seems to enable better regulation of our intake (both physiological and neurocognitive). whereas a lower level of PA leads to a loss of this regulation. Thus, favoring a very positive energy balance (low energy expenditure and high intake). While the work carried out to date has focused on crude caloric analyses. with no distinction made as to the source of the latter. more qualitative analyses appear to be necessary. especially concerning a main health-promoting food category. fruits and vegetables.

Aims of this study

In this context. the aims 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

DATABASE: COVISTRESS French database

DATE: March to June 2020

DATA COLLECTED

- Sociodemographic information (gender. age. country. bmi. occupation)
- Sleep duration
- Physical activity
- Sitting time
- Eating pattern especially concerning fruit & vegetable consumption

EXCLUSION CRITERIA

- 18 to 50 years old
- All the information concerning sociodemographic & movement behaviors

STATISTICAL ANALYSIS (Software R studio version 4.2.2)

- Establishment of an **arbitrary diet quality index** 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.

- Creation of a new variable corresponding to the **terciles of physical activity & sedentary time**.
- **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

Descriptive analysis

- **854** individuals provided their information.
- **466** individuals completed the inclusion criteria.
- Most of them were:
  - ➢ **French** (85.4%)
  - ➢ **Females** (71.5% vs 28.5%)
  - ➢ 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 analysis

- A **positive** association between **PA** and the **quality diet index** and both **fruit** and **vegetable** consumption
- **PA** was **negatively** associated with **soft drink** and **cured meat** consumption.
- The **sitting time** (sedentary behavior) was only **positively** associated with the consumption of vegetables and **negatively** with soft drink.
- 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.

SPEARMAN RANK CORRELATION TEST		Sleep duration (hour)	Tertile of physical activity time	Tertile of sitting time
Tertile of physical activity time	Spearman's rank correlation coefficient	0.053	—	—
	df	408	—	—
	p value	0.287	—	—
Tertile of sitting time	Spearman's rank correlation coefficient	0.074	0.003	—
	df	408	464	—
	p value	0.133	0.945	—
Diet quality index	Spearman's rank correlation coefficient	0.084	0.185	0
	df	408	464	464
	p value	0.088	0.002	0.998
Healthy food component from the index	Spearman's rank correlation coefficient	0.08	0.113	0.011
	df	408	464	464
	p value	0.104	0.015	0.818
Unhealthy food component from the index	Spearman's rank correlation coefficient	-0.095	-0.182	0.036
	df	408	464	464
	p value	0.055	<0.001	0.44
Salty food frequence of consumption	Spearman's rank correlation coefficient	-0.049	-0.058	0.025
	df	399	443	443
	p value	0.33	0.222	0.593
Sweets frequence of consumption	Spearman's rank correlation coefficient	0.037	-0.078	0.043
	df	390	434	434
	p value	0.469	0.14	0.37
Soda frequence of consumption	Spearman's rank correlation coefficient	-0.073	-0.122	0.097
	df	394	438	438
	p value	0.149	0.011	0.042
Alcohol frequence of consumption	Spearman's rank correlation coefficient	0.002	-0.031	0.021
	df	395	439	439
	p value	0.967	0.52	0.667
Ready-made food frequence of consumption	Spearman's rank correlation coefficient	-0.047	-0.002	-0.042
	df	399	443	443
	p value	0.352	0.965	0.379
Fruits frequence of consumption	Spearman's rank correlation coefficient	0.093	0.195	0.048
	df	378	422	422
	p value	0.069	<0.001	0.323
Dairy frequence of consumption	Spearman's rank correlation coefficient	0.103	-0.06	0.02
	df	382	426	426
	p value	0.043	0.213	0.686
Fish frequence of consumption	Spearman's rank correlation coefficient	-0.055	-0.029	0.048
	df	399	442	442
	p value	0.273	0.547	0.318
Cured meat frequence of consumption	Spearman's rank correlation coefficient	-0.017	-0.099	0.05
	df	401	445	445
	p value	0.727	0.037	0.289
Eggs frequence of consumption	Spearman's rank correlation coefficient	0.025	0.028	-0.005
	df	401	446	446
	p value	0.613	0.554	0.923
Meat frequence of consumption	Spearman's rank correlation coefficient	-0.007	-0.059	-0.014
	df	393	439	439
	p value	0.894	0.214	0.777
Cereals frequence of consumption	Spearman's rank correlation coefficient	0.01	0.02	0.026
	df	391	438	438
	p value	0.839	0.677	0.583
Veggies frequence of consumption	Spearman's rank correlation coefficient	0.086	0.116	0.114
	df	392	440	440
	p value	0.089	0.015	0.017
Legumes frequence of consumption	Spearman's rank correlation coefficient	-0.008	-0.016	0.003
	df	399	449	449
	p value	0.876	0.739	0.942

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. This work could help guide our nutritional recommendations. adapting them to the population's level of daily activity.

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Cognitive mechanisms in food gender stereotypes : exploring genericity and the inherence heuristic

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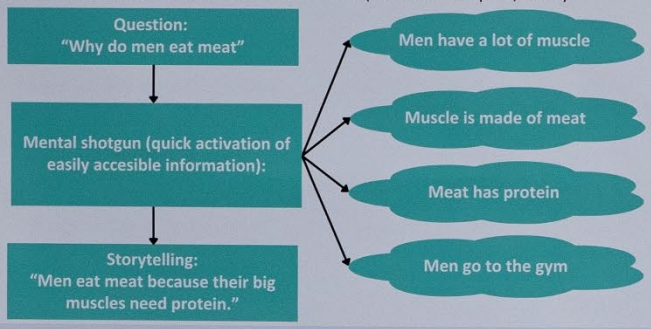
Context and objectives

- Gender stereotypes are still present in our society, and the food domain is no exception.
- Men are consistently shown to eat more meat, while women eat more vegetables (Egolf et al., 2018), which has led researchers to investigate the associations Meat/masculinity and Vegetables/femininity (Rozin et al., 2012).
- In this study, we explore two cognitive mechanisms related to the justification and fostering of stereotypes: the inherence heuristic (Cimpian & Salomon, 2014) and genericity (Sterken, 2015).

→ Knowing the role that the inherence heuristic and genericity play in food gender stereotypes will allow us to design interventions that target them, flexibilize food beliefs and encourage both men and women towards a more well-balanced diet.

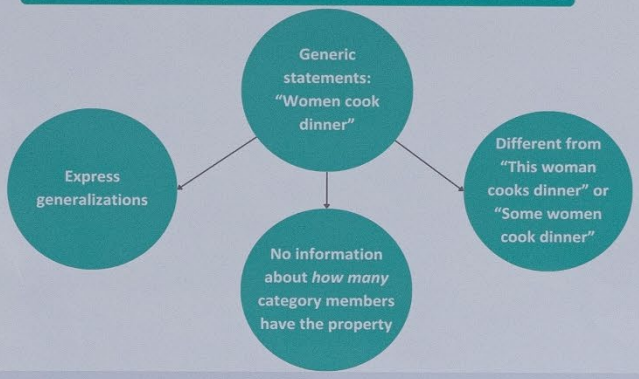
Inherence heuristic

- Implicit cognitive process that leads people to explain observed patterns in terms of the inherent features of their constituents (Hussak & Cimpian, 2015)



→ Inherent explanations lead to the interpretation that the current patterns are the way things should be, since there is something inherently natural/right about them

Genericity



→ The use of generics increases the belief that the properties of said category are naturally determined by internal causal properties (Hollander et al., 2009)

Methodology

		Genericity	Most quantifier	Some quantifier
Descriptive judgment: "From 1 to 7, to what extent do you consider this an established fact?"	Typical association	Men eat meat	Most men eat meat	Some men eat meat
	Counter-typical association	Women eat meat	Most women eat meat	Some women eat meat
Prescriptive judgment: "From 1-7, how much do you agree with this statement?"		Men should eat meat	Most men should eat meat	Some men should eat meat
		Women should eat meat	Most women should eat meat	Some women should eat meat
Justification: "Why"		Coded as inherent or non-inherent by two independent reviewers		
Demographics		Age, gender, nationality, dietary choices, commitment to gender equality		

Hypotheses & Analyses

H1. We expect the counter-typical associations to have lower prescriptive scores than typical associations.

H2 We 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

H3. We expect people exposed to generic sentences will have a higher prescriptive judgment score than people who were not exposed to generalizations.

→ **Analysis**: mixed-effects linear regression on participant's prescriptive judgment scores, with participant and item as random effects and genericity, typicality of the association, and response inherence as fixed effects.

Conclusion & Perpectives

- This study will pinpoint two plausible cognitive mechanisms that can unconsciously reinforce food gender stereotypes, since they support the belief that there are intrinsic reasons why men and women eat what they eat, without considering historical or marketing reasons.
- This methodology could be used to explore other food associations (e.g. cereal and breakfast) and why we seem to not want to expand our dietary repertoire (e.g. lamb for breakfast; Bian & Markman, 2020)

→ Our end goal is to reduce the cognitive rigidity when it comes to food choice, by targeting these cognitive mechanisms, which has shown promising results (Bian & Markman, 2020). Indeed, we intend to increase receptiveness to foods in context/groups where said foods are not well received.

Acknowledgements

Thank you to Claire Chambrier and the rest of the Aprifel team for supporting this project

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

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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.

Aim:
This study aimed to evaluate the effect of a 6-week weight reduction program on the plasma concentration of β-carotene, lycopene, and lutein in adults with excessive body weight.

Methodology:

Study design:

- Iintervention study with a weight reduction program (AntioxObesity): 1000-1500 kcal diet with unchanged both the amount and structure of vegetables and fruits consumption (Figure 1; Tabel 1)
- all measurements were conducted three times: at the beginning (T0), in the middle (T3), and just after (T6) the 6-week intervention

Data on food consumption: a 3-day recording method and a semi-quantitative food frequency questionnaire

Anthropometric measurements:

- body height (H), body weight (BW), waist circumference (WC)
- body composition analysis with the BIA method (Maltron BioScan 920-2): fat mass (FM), fat-free mass (FFM), abdominal subcutaneous adipose tissue (SAT), and visceral adipose tissue (VAT)

Blood samples:

- the lipid profile: enzymatic tests
- concentration of β-carotene, lycopene and lutein: high-performance liquid chromatography (HPLC/UV-VIS)

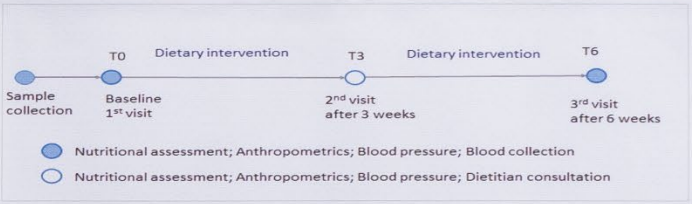

Figure 1. Timeline and activities of the AntioxObesity weight reduction program

Table 1. Comparison of carotenoids intake

Carotenoids intake	Stage of the AntioxObesity program			p-value*
	T0	T3	T6	
β-carotene (mg/d)	4.5 ± 2.5[1] 4.0[2]	4.8 ± 2.5 4.4	4.7 ± 2.3 4.5	NS
Lycopene (mg/d)	3.6 ± 2.2 3.3	3.8 ± 2.3 3.5	3.8 ± 2.3 3.4	NS
Lutein (mg/d)	2.1 ± 1.3 1.9	2.1 ± 1.2 2.2	2.2 ± 1.2 2.1	NS

[1]mean ± SD; [2]median * ANOVA Friedman; NS – not significant

Results:
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±9.0 years). The AntioxObesity program resulted in a significant reduction in body weight (Table 2). Considering the lipid profile, a significant decrease in total cholesterol and LDL cholesterol was found (Table 3). The median plasma concentrations of β-carotene, lycopene, and lutein increased significantly after the intervention (Figure 2). The reduction of FM above 4 kg significantly increased the concentration of plasma carotenoids, except lycopene. Moreover, higher FM was associated with lower concentrations of β-carotene, lycopene, and lutein by 17%, 9%, and 26%, respectively in obese vs. normal weight adults. Significant negative correlations between plasma β-carotene concentration and FM (r=-0.30), including SAT (r=-0.30) and VAT (r=-0.34) were detected.

Table 2. Changes of anthropometric parameters during AntioxObesity program

Variables	Stage of AntioxObesity program			p-value*
	T0	T3	T6	
BW (kg)	93.3 ± 17.2[1a] 90.0[2]	90.5 ± 17.1[b] 88.0	89.4 ± 16.9[c] 87.5	<0.001
BMI (m^2/kg)	32.0 ± 4.7[a] 30.9	31.1 ± 4.6[b] 29.8	30.7 ± 4.5[c] 29.4	<0.001
WC (cm)	94.8 ± 12.3 [1a] 94.0	91.8 ± 11.9[b] 92.0	89.9 ± 11.9[c] 89.0	<0.001
FFM (kg)	53.6 ± 11.6[1] 48.7	53.8 ± 12.3 47.7	53.1 ± 11.3 48.2	NS
FM (kg)	39.6 ± 13.3[a] 35.8	36.6 ± 13.0[b] 33.9	36.3 ± 13.3[b] 32.9	<0.001
SAT (cm^2)	248.0 ± 82.5[a] 238.0	240.1 ± 82.3[a] 237.0	228.2 ± 86.6[b] 209.0	0.002
VAT (cm^2)	175.5 ± 71.7[a] 161.0	158.0 ± 72.5[b] 144.0	148.8 ± 75.3[c] 135.0	<0.001

[1]mean ± SD; [2]median * ANOVA Friedman; BW-body weight; BMI – Body Mass Index; WC – waist circumference; FFM – fat free mass; FM – fat mass; NS - not significant; a-c – differences significant at p<0.05

Table 3. Changes of lipids profile during AntioxObesity program

Lipids profile	AntioxObesity		p-value*
	T0	T6	
TC (mg/dL)	198.4 ± 30.8[1] 198.6[2]	183.8 ± 30.7 184.7	<0.001
HDL (mg/dL)	51.1 ± 8.9 49.8	50.8 ± 9.1 48.4	NS
LDL (mg/dL)	122.9 ± 32.0 120.5	109.9 ± 30.7 104.2	<0.001
TG (mg/dL)	122.1 ± 42.8 109.8	115.8 ± 36.1 106.4	NS

[1]mean ± SD; [2]median* ANOVA Friedman; NS – not significant

> 4 kg FM

Plasma:
β-carotene (by 47.7 nmol/L)
lutein (by 37.0 nmol/L)
total carotenoids (by 109.5 nmol/L)

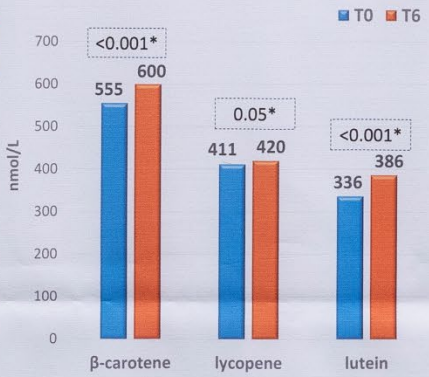

Figure 2. Changes in median β-carotene, lycopene, and lutein concentrations during AntioxObesity program
* Wilcoxon test: T6 vs. T0

Conclusions:
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.

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Occurrence of pesticides in fruit and vegetables – potential risk in aspect of consumers health

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INTRODUCTION

Consumption of fruit and vegetables contaminated with pesticide is one of the main routes of human exposure to hazardous chemicals. Special attention should be paid to substances which have toxic effects on the human health: carcinogenic, mutagenic, cytotoxic, teratogenic, neurotoxic, estrogenic or allergenic effects. Pesticide residues occurence depend on the type of commodity, chemical protection, the timing and number of treatments performed, the withdrawal periods and the disappearance rates of these substances in plants. Therefore, it is very important to monitor the pesticide residue levels in commonly consumed fruit and vegetables by recognized and reliable methods. Monitoring of pesticide residues in agricultural crops, the first link in the food production chain, in the European Union at the primary production stage is one of the main tasks of the official control providing valuable information about pesticide residue levels for futher dietary risk assessment.

AIM

The aim of the study was to evaluate pesticide residue levels in fruit and vegetables during a 5-year official control in Poland (2018–2022) and estimate potential consumers risk assessment.

MATERIAL AND METHODS

Scope of research

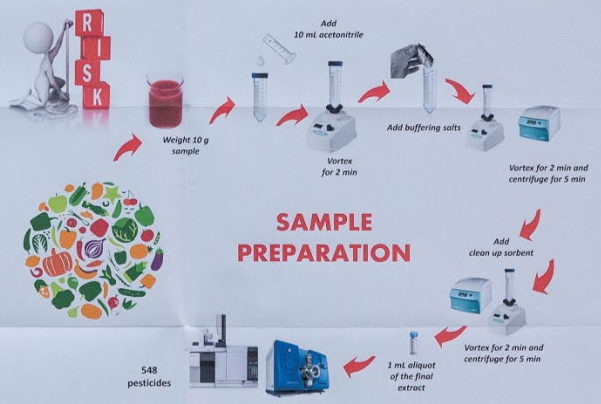
Fruit (574) and vegetable (1077) samples collected from Polish farmers (totally 1651 samples).
Active substances (a.s.) of acaricides, fungicides, herbicides and insecticides (548 a.s.).

Analytical method and quality assurance

Accredited multiresidue modified QuEChERS method (Quick, Easy, Cheap, Effective, Rugged and Safe) was used.
Qualitative and quantitative analysis was performed by gas/liquid chromatography/tandem mass spectrometry GC/LC-MS/MS and spectrophotometry. Laboratory has been accredited by Polish Centre of Acreditation (AB No 839) since 2007.

Risk assessment

Deterministic acute risk assessments of European subpopulations of children and adults calculated by EFSA PRIMo Pesticide Residue Intake Model with intake data from EU member states at the 97.5th percentile.
Input values: samples with residue levels above MRL (Maximum Residue Limit) x Large Portion of critical diet (g/person) x Body weight (kg)
Output values: % of toxicological reference value ARfD (Acute Reference Dose).



RESULTS

In 2018-2022, 55.3% of the overall 1651 samples were free from pesticides, 43.2% fell below MRL and 1.5% exceeded MRL (Fig. 1). In 246 samples (14.9%) one residue was detected. Multiple residues from two to eleven substances were found in 492 samples (29.8%) (Fig. 1). Cherries (sweet) had the highest number of pesticide residues (11): acetamiprid (0.07 mg/kg), captan (0.1), cyantraniliprole (0.03), cyprodinil (0.4), deltamethrin (0.009), fludioxonil (0.2), fluopyram (0.2), lambda-cyhalothrin (0.02), spirotetramat (0.09), tebuconazole (0.1), thiamethoxam (0.02). Pesticide residues were the most frequently detected in apples (9.3% of samples) and dill (6.7%) (Fig. 2). Out of the substances, 86 were detected (Fig. 3). The most frequently detected was acetamiprid (8.7% of detections) in sweet cherries (3.6%) in the range 0.005-6.0 mg/kg. The highest concentration was noted for thiacloprid in cabbage (6.0 mg/kg) and captan in apples (5.8 mg/kg). Non-compliant samples for pesticides non-approved* at EU level were reported for 3.3% detections in fruit and 11.9% in vegetables, mainly chlorpyrifos in dill and in cherries (sweet) (Fig. 3). Acute exposure results indicated that fruit and vegetables from Poland are safe for adults and children with %ARfD up to 70.9% for adults and 90% for children (Tab. 1). Exception was chlorpyrifos (114.2% ARfD) and in rocket (108.1% ARfD) which may adversely affect children health. However, the acute intakes are overestimated due they based on the worst case scenario with inputs: residues>MRL and the most cr

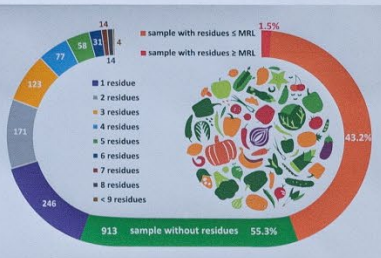


Figure 1. Number of samples without/ with one /multiple residues below and above MRL.

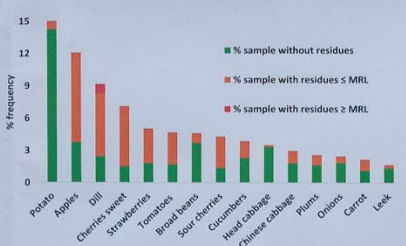


Figure 2. Frequency detection of pesticide residues in fruit and vegetables.

Table 1. Acute exposure of pesticide residues occurring in fruit and vegetable samples.

Commodity	Pesticide	HR (mg/kg)	MRL (mg/kg)	No. of times exceedances of MRL	ARfD	% ARfD	HQ ≤1 safe >1 risk
Apples	imidacloprid	0.062	0.01	6.2	0.08	2.2	safe
Brussels sprouts	flonicamid	1.55	0.6	2.6	0.025	14.4	safe
Celery	chlorpyrifos	0.068	0.01	6.8	0.005	21.8	safe
Cherries sweet	iprodion	0.036	0.01	3.6	0.06	0.7	safe
Chinese cabbage	chlorpyrifos	0.14	0.01	14	0.005	70.9	safe
Dill	chlorpyrifos	2.5	0.01	250	0.005	16.3	safe
	cyfluthrin	0.13	0.02	6.5	0.01	0.4	safe
	esfenvalerate	0.56	0.05	11.2	0.0175	1.0	safe
	prosulfocarb	1	0.05	20	0.1	0.3	safe
Garlic	chlorpyrifos	0.077	0.01	7.7	0.005	0.1	safe
Kale	chlorpyrifos	0.069	0.01	6.9	0.005	26.6	safe
Lettuce	chlorpyrifos	0.15	0.01	15	0.005	36.4	safe
Spinach	dimethoate	0.052	0.01	5.2	0.01	2.1	safe
Rocet	chlorpyrifos	0.142	0.05	2.84	0.005	34.5	safe
Tomato	pirimiphos methyl	0.185	0.01	18.5	0.1	2.9	safe

HR – highest residue, MRL – maximum residue level, ARfD – Acute Reference Dose, HQ – Hazard quotient (sum of flonicamid, TFNA and TFNG).

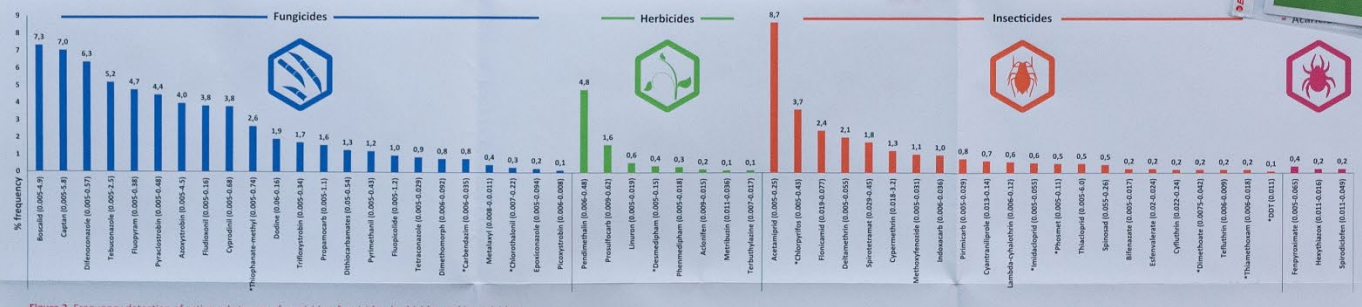


Figure 3. Frequency detection of active substances of acaricides, fungicides, herbicides and insecticides.

CONCLUSION

The 5-year survey from official control demonstated that Polish fruit and vegetables are safe for consumers.
The monitoring data were a key tool ensuring consumer protection and proved the effectiveness and high level of Polish control system.
Pesticide residues study should still be developed by extending the analytical scope for active substances and various species of fruit and vegetables.
Designing future monitoring programmes a more detailed and refined control is necessary to give scientific knowledge on pesticide residues in food.

The effect of technological processes on fungicide residues in berry fruit and dietary risk assessment

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INTRODUCTION

Fruit, as well as their processed products, should be present in human diet due to their health-promoting properties. The guidelines of nutrition experts recommend to consume a minimum of 400 g portion per day. Poland is a lider in the production of berries, which are extremely valued around the world.

Berry fruit group (black currants, raspberries and strawberries) is characterized by the content of valuable antioxidants, anthocyanins, vitamins, minerals and fiber. However, fruit plantations are susceptible to attack by fungal pathogens. For this reason, fungicides are repeatedly applied throughout the growth period, even at the fruiting stage.

Therefore, fruit in addition to essential and valuable nutrients, may contain residues which are a critical food quality and safety determinant. The technological processing is one of the ways that can change the residue levels and the indicator is the Processing Factor (PF).

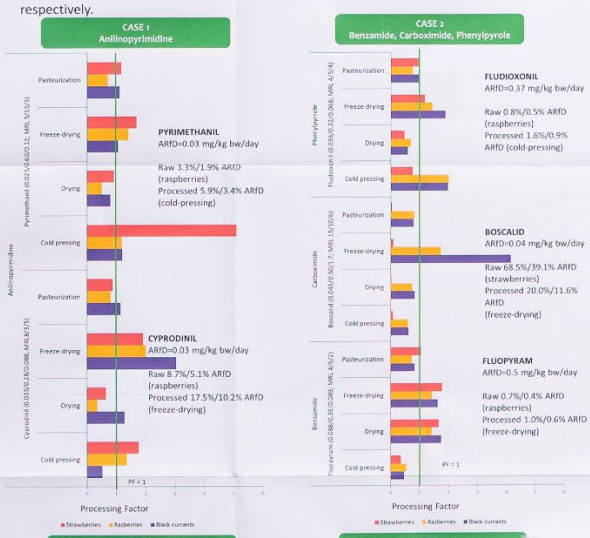
AIM

The aim of the study was to investigate the effects of four technological processes expressed as PF on ten fungicide residues, very often applied in berries, and application of calculated PF values to the dietary risk assessment for the most critical European subpopulations of children and adults.

METHODS

RESULTS

- Calculated PFs (120 combinations) ranged from 0.019 (boscalid/drying/strawberries) to 5.11 (pyrimethanil/cold pressing/strawberries). Average PF for black currants was 1.4, raspberries 1.1 and strawberries 1.2.
- The efficiency of technological processes was ranked as follows:
  - pasteurization PF=0.03 (boscalid /strawberries) to PF=1.31 (azoxystrobin/raspberries),
  - drying PF=0.019 (boscalid/strawberries) to PF=3.22 (difenoconazole/strawberries),
  - cold pressing PF=0.07 (boscalid/strawberries) to PF=5.11 (pyrimethanil/strawberries),
  - freeze-drying PF=1.08 (pyraclostrobin/strawberries) to PF=4.13 (boscalid/black currants).
- Azoxystrobin (strobilurin) indicated concentration of residues PF>1 after processing (PF=1.14-1.78).
- Short-term risk did not exceed the toxicological reference value %ARfD in all cases.
- The highest acute exposure was noted for boscalid (carbaimides) in raw strawberries: 68.5% children/39.1% ARfD adults and after PF application decreased below 20%/11.6% ARfD, respectively.



Processing Factors for groups of fungicides in berry fruit and the highest acute exposure %ARfD (children/adults)

Values given with each fungicide name in brackets are raw concentration levels and MRLs in mg/kg for black currants/raspberries/strawberries

CONCLUSION

- The calculated Processing Factors were helpful tool in risk assessment and provided more precise and reliable dietary intakes in diet of European consumers.
- The estimated short-term exposure showed that berry fruit sprayed with double dose of fungicides were safe for children's and adults' health.

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

UNIVERSITY OF LIVERPOOL

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1. Background & Objectives

- Children's fruit and vegetable (F&V) consumption is considerably below recommendations in both the UK [1] and France [2]
- Parents influence children's F&V intake and liking through their feeding style, practices, and the food they choose to purchase and make available [3]
- Recent studies like the HabEat research have revealed complex differences in the feeding practices and child eating behaviours between UK and France.
- However, understanding of these factors in infancy and toddlerhood has been limited by the lack of appropriate measurement tools
- Very few tools have been validated for children under two years, and even fewer allow for cross-age and cross-cultural comparisons.

Research Aims

1. 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) [4]
2. To extend their validation from 20-36 months to a younger age-range (6-19 months)

2. Methods

Steps followed in the translation and validation of the four questionnaires

Forward translation (n=2)

↓

Expert panel review (n=5): content validity, age suitability

↓

Back translation (n=1)

↓

Pilot (n=73): face validity, age suitability

↓

Validation (n=506) of **CEDQ** & **CFMQ** for **6- 36m** old children: factor structure, internal consistency, convergent validity, measurement invariance, construct validity

↓

Two-weeks test-retest reliability (n= 172)

Validation (n=248) of **FStrQ** & **FStylQ** for **20- 36m** old children: factor structure, internal consistency, convergent validity, construct validity

↓

Two-weeks test-retest reliability (n= 84)

3. Results

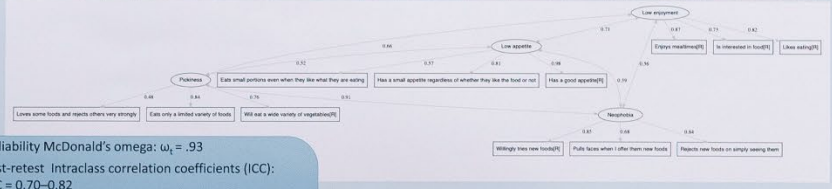
Eating Difficulties Questionnaire (CEDQ)

- 4-factor, 12 items model *(original model)*
- *Excellent model fit (CFI = .990 , TLI = .987, RMSEA = .042, SRMR =.055)*
- Construct validity through associations with F&V liking, frequency of consumption

Eating Difficulties sub-scales correlated negatively (Spearman rho) with F&V liking and frequency of consumption (n= 435)

Eating Difficulties Questionnaire	Vegetable liking	Vegetable frequency of consumption	Fruit liking	Fruit frequency of consumption
Neophobia	-.40***	-.24***	-.14**	-.02
Pickiness	-.65***	-.38***	-.18***	-.08*
Low appetite	-.20***	-.13**	-.13**	-.09*
Low enjoyment	-.35***	-.21***	-.18**	-.12**

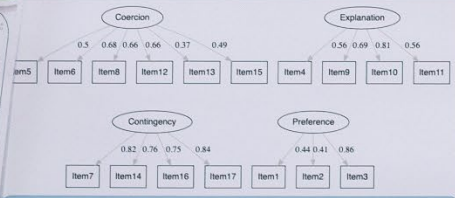
*p <.05, ** p < .01, *** p < .001



- Reliability McDonald's omega: ω_t = .93
- Test-retest Intraclass correlation coefficients (ICC): ICC = 0.70–0.82
- Convergent validity: Child food neophobia Scale (CFNS) [5], Children's Eating Behaviour Questionnaire (CEBQ) [6]
- Measurement invariance: Confirmed (strong) scalar invariance - children over 20m presented significantly (p<.001) more eating difficulties than 6-19month-old-children

Feeding Strategy Questionnaire (FStrQ)

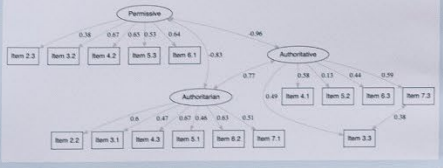
- 4-factor, 17 items model *(original model)*
- *Good model fit (CFI = .936, TLI = .923, RMSEA = .055 and SRMR =.054)*



- Reliability (ω_t= .88)
- Test-retest ICC= .62–.87
- Convergent validity: Parental Feeding Style Questionnaire (PFSQ) [7]

Feeding Style Questionnaire (FStylQ)

- 3-factor, 6 situations 16 items *(5 items removed)*
- *Marginally acceptable fit after model modifications (CFI = .906, TLI = .887, RMSEA = .059 and SRMR =.057)*



- Reliability (ω_t= .86)
- Test-retest ICC= .72-.83
- Convergent validity: Caregivers Feeding Style Questionnaire (CFSQ) [9]

- Construct validity through associations with children's F&V liking, frequency of consumption

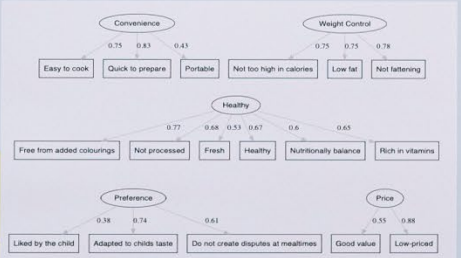
Parents' healthy food-buying motivations were positively correlated with vegetable consumption-liking, whereas accommodating children's preferences was negatively correlated with vegetable consumption-liking (n= 435) (Spearman rho)

Child Food motivation Questionnaire	Vegetable liking	Vegetable frequency of consumption	Fruit liking	Fruit frequency of consumption
Convenience	-.03	-.05	.01	-.01
Weight control	.02	-.11*	.01	-.12*
Healthy	.22***	.20***	.13**	.05
Preference	-.20***	-.20***	-.04	-.08
Price	.00	.02	.02	-.02

*p <.05, ** p < .01, *** p < .001

Child Food Motivation Questionnaire (CFMQ)

- 5-factor model, 17 items (*original factors "Natural" & "Health Control" loaded jointly under a single factor named Healthy)*
- Excellent fit *(CFI = .957 , TLI = .946, RMSEA = .044, SRMR =.055)*



- Reliability ω_t = .76
- Test-retest ICC= .63–82
- Convergent validity: Food Choice Questionnaire (FCQ) [8]
- Measurement invariance: Confirmed scalar (or strong) invariance – Parents of children over 20m buy foods based more on children's preferences (p<.001) and less based on convenience (p<.05) compared to parents of 6-19month-old-children

5. Discussion

- Established measurement invariance (CEDQ & CFMQ) allows meaningful comparisons between older (20-36m) and younger (6-19m) children as it ensures true change is measured instead of change in the assessment. Thus, researchers can reliably explore prospective relationships and developmental trajectories.
- As the FStrQ & FStylQ could only be validated for 20- 36m children, future research should develop an age specifc tool to measure feeding practices and styles in children under 19m
- The four questionnaires demonstrated good psychometric properties and can serve as valuable tools in future cross-cultural research between France and the UK to explore differences and similarities in child eating difficulties, parent feeding behaviours and food-buying motivations

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A FRESH LOOK AT FOOD ENVIRONMENTS IN SRI LANKA

What are we doing?

Scan for more information

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.

Understanding how food environments influence diet and nutrition requires understanding the *features*, as well as *people's experience* of the environment which will be very different depending on economic, social, and cultural factors.

How are we doing it?

The research integrates *three different participatory methodologies*, enhanced with visual and geographical display methods.

1. Needs assessment

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.

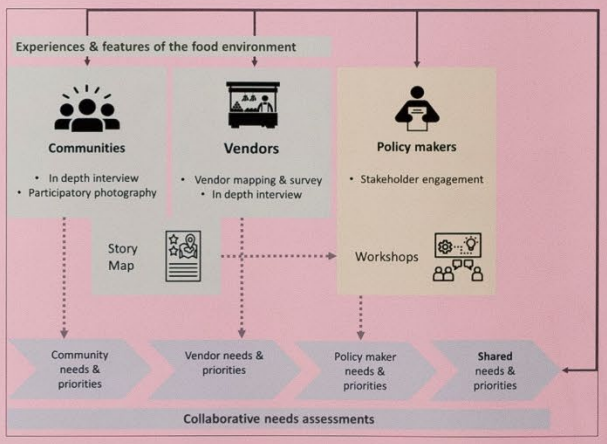
2. Lived experiences

Using qualitative and visual methods (photo voice) we will explore what is guiding choices related to fruit and vegetable consumption within the food environment through understanding people's *'lived experiences'*.

3. Mapping

These will be brought together with vendor type and location data using GIS software. This 'GIS mapping' will then be overlayed 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.

How does it all add up?



Exploring the needs and priorities at each level, we will identify *potential disconnects* between community, vendor and policy level perceptions. This will form the basis for developing agreed 'shared' needs and priorities going forward.

How will we identify entry points for intervention?

Through a series of workshops at community, vendor and policy level, we will share the findings from the needs assessments, lived experiences and mapping 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.

institute of development studies

CGIAR Fruit and Vegetables for Sustainable Healthy Diets

COLOMBO URBAN LAB

EXPLORATORY CONSULTATION TO EVALUATE AVAILABILITY OF FRUIT AND VEGETABLE CONSUMPTION DATA IN AIAM5 MEMBER COUNTRIES

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(1) AIAM5 - Global Alliance for the Promotion of Fruit and Vegetable Consumption "5 a day", (2) Asociación para la Promoción del Consumo de Fruta y Hortalizas "5 al día". España, (3) Fundación 5 al día Venezuela. Venezuela, (4) International Food Policy Research Institute (IFPRI), Washington, DC, USA , (5) Corporación 5 al día Chile. Chile, (6) Brasil Ministério da Saúde. Instituto Nacional de Cáncer (INCA). Brasil, (7) Instituto de la Nutrición de Centroamérica y Panamá INCAP. Guatemala, (8) Instituto de Nutrición y Tecnología de los Alimentos Universidad de Chile. Chile, (9) Fundación 5xDía, A.C. México

INTRODUCTION

The United Nations declared 2021 as the International Year of Fruits and Vegetables (IYFV). As part of this, the Global Alliance for the Promotion of Fruit and Vegetable Consumption "5 a day" (AIAM5) conducted an exploratory consultation to collect information on the consumption of fruits and vegetables (F&V), recommendations, and policies to promote the consumption of these dietary essentials from its 32 member countries worldwide.

OBJECTIVE

To collect information on fruit and vegetable (F&V) intake from AIAM5's member countries worldwide to contribute to the IYFV action plan.

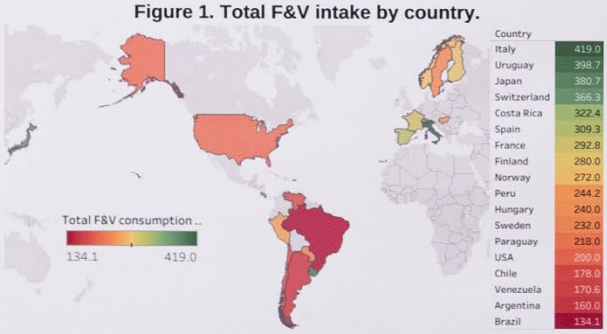
METHODOLOGY

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. Italy had the highest consumption with 461 g followed by Uruguay with 399 g, while Argentina (160 g) and Brazil (134 g) were among the ones that reported the lowest (Figure 1).

Figure 1. Total F&V intake by country.



Among those countries with a higher percentage of consumption: ≥ 5 portions/day, Costa Rica (35.9%), New Zealand (32.5%), Canada (28.6%) and Finland (26.8%) stand out (Figure 2). 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 (Figure 3).

Figure 2. Percentage of the population that consumes at least 5 servings of F&V daily.

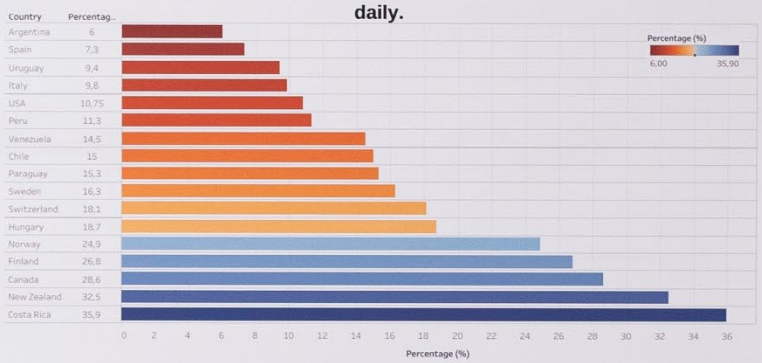


Figure 3. Expenditure and percentage of the food basket of the F&V according to country.

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 "≥ 5 portions/day" (n = 19), and specific recommendations for F&V separately were ≥ 3 portions for fruits and ≥ 2 for vegetables. 18 countries included 100% juices specifying "no added sugar" and limiting their consumption to ≤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 increases inequalities.

REFERENCES

SALSA Questionnaire: A tool to assess people's barriers and facilitators for following a sustainable and healthy diet (SHD)

Júlia Muñoz, Irene Cussó, Elena Carrillo

1. Introduction

Changing current diets is imperative to overcome the multiple burdens they are currently posing to environmental degradation and the population's health(1). Modifying food behaviour is complex and requires interventions carefully designed to attain the particularities of each person for following a SHD(2).

2. Objective

To create the SALSA questionnaire to enable the comprehensive assessment of barriers&facilitators individuals experience when following a SHD.

3. Methodology

Scoping review(3)
Systematic Review + Consultation exercise

1. **Item generation**

Survey to experts (n =9)
Workshops with citizens
(n = 14)

2. **Content validity**

Cognitive interviews
(n = 5)

3. **Pre-testing**

Full responses
(n = 579)

4. **Survey administration**

-Item reduction
-Extraction of factors
-Test of dimensionality
-Test of reliability

5. **Psychometric analysis**

4. Results

57 items

38i modified, 3i erased, 3i unified, 1i split
55 items

13i modified
55 items

44 Items
Sustainable diets (21i)
Protein sources (16i)
Processed/fresh food (8i)
Just foods (6i)
Seasonal and local (4i)
3 Dimensions
Food literacy (22i)
Personal factors (8i)
External factors (14i)

5. Implications

The SALSA questionnaire will allow the assessment and development of tailored interventions that effectively promote SHD by enhancing facilitators and overcoming barriers.

1) Willet et al. (2019); 2) Fanzo et al. (2021); 3) Muñoz et al. (under review)

psitic

GRoW
Global Research on Wellbeing

Are children < 8 years less sensitive to sour taste?

Introduction

Fruit consumption often stays below recommended intake. We investigated sour taste sensitivity in a wide range of children to gain insight in taste acceptance of sour fruits. Sour taste preference might be influenced by taste sensitivity. Few studies have focussed on sour taste sensitivity in children.

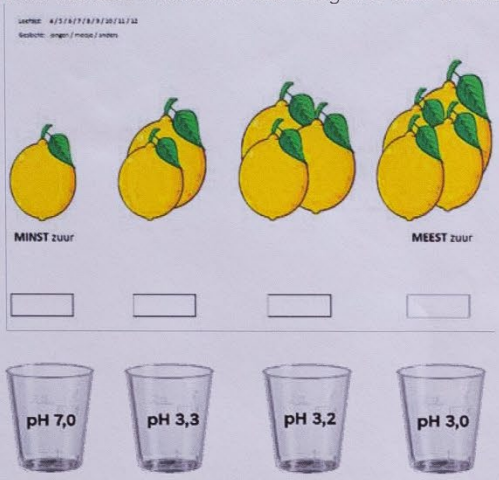
Methods

Children who visited a public science day in the Netherlands in May 2023 were recruited to join this test. Each child was seated in one of nine individual mobile test rooms (fig 1). The test started with an oral instruction. Parents or other adults who accompanied the children during the public day, were, if available and interested, allowed to stimulate the children in doing the test.

Fig.1: The research setting on public science day with 9 mobile test rooms.

Four beverages were prepared with tap water and citric acid, presented in random order and the children were asked to rank these from least to most sour.

A4 form was used in which the four categories were visualized:



Baseline results

We recruited a group of 468 children with a mean age of 8 years old and 50,9% were girls (table 1). The distribution of boys and girls was comparable among all age groups (fig 2).

Table 1. Main characteristics of the participants

Number of boys (%)	230 (49.1%)
Number of girls (%)	238 (50.9%)
Mean age (± SD) in years	8.6 ± 2.1

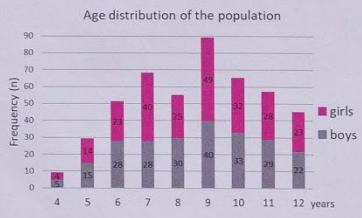


Fig 2. Distribution of age in numbers for boys and girls in categories of age (years)

Key findings

In total 38,5% of the children ranked all beverages correctly (table 2). Water (pH 7,0) was most often ranked correctly (90,2%). It seemed most difficult to rank the beverages with pH 3,3 and pH 3,2 correctly (38,5% ranked correctly).

Table 2. Result of the rank order test (number of children who correctly ranked one or more beverages)

Correctly ranked beverages	N correctly ranked (%)
All beverages	180 (38,5%)
pH 7,0 and pH 3,0	306 (65,4%)
pH 3,3 and pH 3,2	180 (38,5%)
pH 3,2 and pH 3,0	191 (40,8%)
pH 7,0	422 (90,2%)
pH 3,3	224 (47,9%)
pH 3,2	223 (47,6%)
pH 3,0	333 (71,2%)

To assess differences in sour sensitivity, children were divided in three age groups. The children of 4-7 years old (n=157), significantly (p<0,05) ranked all beverages or two of the beverages less frequently correct compared to the middle and the older age group (fig 3). There was no significant difference in correct ranking between middle and the older age group.

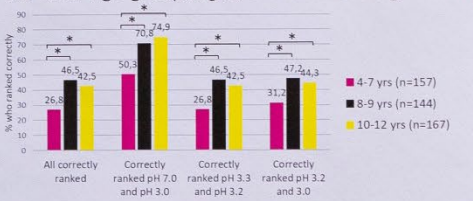
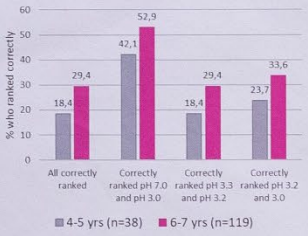


Fig 3. Result of the rank-order test aged 4-7 years, 8-9 years, 10-12 years (% of children who ranked 2 or all beverages correctly)



The sour sensitivity in the youngest age group was both lower for children in the age of 4-5 years as well as in the age of 6-7 years old (p<0,05) compared to the older groups (fig 4). There was no significant difference in correct ranking between age 4-5 years old and 6-7 years old children.

Fig 4. Result of the rank-order test aged 4-5 years, 6-7 years (% of children who ranked 2 or all beverages correctly)

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.

Limitations of this study

1) It is unclear if younger children were less sensitive or if the ranking task was too difficult in the study setting.

2) Performing only sour sensitivity misses important information to define stategies in the acceptance of sour food.

Future research- discussion

Future studies using research settings such as a public event could be a good opportunity to test a broad group of children. In future studies we would like to take into account to:

1) Confirm understanding of ranking by pre-test

2) Adjust for the variation in guidances / support of accompanying adults

3) Collect data to investigate the link between sour sensitivity and sour preference

4) Collect additional information such as childrens food preferences

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Better nutrition among refugee households with home gardens; Omugo settlement, Uganda.

Authors: Julia Glaser, Katherine Pittore, Marlene Roefs

Background and Objectives

In Uganda's West Nile region, refugees from South Sudan and the Democratic Republic of the Congo who have been affected by forced displacement, live in several refugee settlements. The nutrition and income generation intervention (NIGI) aimed to achieve healthier lives and more resilient livelihoods for refugees in the Omugo refugee settlement. The project sought to support refugees, and those living in the surrounding host community to grow vegetables, which are often completely absent in their diets.

The project supported refugees with a series trainings on agronomic practices, ongoing agronomic support and inputs including improved seeds for tomato, peppers, onions, eggplant, and watermelon as well as indigenous green leafy vegetables such as spider plant and okra well as basic farming equipment (hoe, watering can).

Objective: 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. While the project also provided support to the host community, the results presented here are only for those living in the refugee settlement area.

Methodology

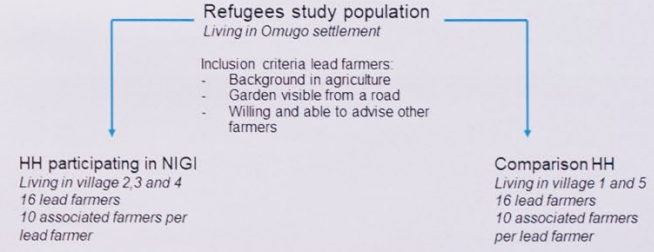
The nutrition and income generation intervention (NIGI)

Data was collected using the Resilience Index Measurement and Analysis (RIMA) survey, developed by the FAO and was collected in June and July 2021, a time of covid related lock-downs in Uganda.

Figure 1. Location of Omugo refugee settlement in Uganda

Figure 2. Image of the nutrition information provided by the project, with a home garden in the background

Figure 3. Sampling strategy and inclusion criteria for participation in the study (refugee community only)



Results

Refugee households who participated in NIGI were much more likely to produce and consume "other vegetables" and "orange fruits". The orange fruits were unexpected they were not promoted by the project, but might be explained by a synergy between the nutrition messages and a government programme promoting fruit trees. Also interesting is the increased consumption of cereals, which might relate to increased income from vegetable sales or increased food in the household allowing rations from the World Food Program to last longer.

Table 2. The odds of HHs participating in NIGI consuming a food group in the previous 24h compared to the comparison group using generalized linear mixed models

	N	AIC	OR (CI 95%)	P-value
Cereal	340	1661	2.576 (1.428, 4.646)	0.002*
White tubes	340	1515	0.368 (0.103, 1.316)	0.124
Pulses	340	1677	1.137 (0.449, 2.592)	0.759
Orange vegetables	340	1655	0.896 (0.304, 2.640)	0.842
Green leafy vegetables	339	1497	1.043 (0.274, 3.969)	0.950
Other vegetables	341	1598	2.187(1.238, 3.862)	0.007*
Orange fruit	339	1823	6.229 (1.894, 20.483)	0.003*
Other fruits	339	1890	1.440 (0.466, 4.453)	0.525
Animal products	348	1552	1.203 (0.396, 3.649)	0.744
Oil and sugar	347	1648	2.474 (0.728, 8.401)	0.146

*Significant after α is adjusted for multiple testing using BH method

Home production of fruit and vegetables, previous 12 months

The results show that NIGI participants produced almost four times more vegetables; an average of 40 kg for participating households in the previous year compared to 10 kg for non-participating households. Participating households also grew a greater variety of vegetables and were more likely to earn money from selling the surplus.

Table 3. Mann-Whitney U test comparing HH production of fruit and vegetables in the previous 12 months

	Comparison HHs		HH participating in NIGI		
	N	Median (Q3-Q1)	N	Median (Q3-Q1)	p-value
Number of different fruit and vegetable types	175	2.0 (2.0)	174	3.0 (3.0)	<0.001*
Volume fruit and vegetables produced (KG)	175	10.0 (35.0)	174	40.0 (71.50)	<0.001*
Money earned from fruit and vegetable production (UGX)	175	0 (0.0)	174	0.0 (44625.0)	<0.001*

*Significant after α is adjusted for multiple testing using Bonferroni method

Conclusions

The project was able increase household dietary diversity and 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.

Acknowledgements

The data presented here was collected by a team of enumerators from the RIMA team of the FAO, led by Paul Opio. The NIGI project was implemented by a team of dedicated staff led by Molly Adokorach Molly, supported by Wageningen University Uganda Office; as well as a team from East West Seeds Knowledge Transfer Foundation led by David Baguma. We would also like to thank the Office of the Prime Minister in Uganda for their support as well as the respondents who took time to participate in our survey.

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NUTRITIONAL IMPACT OF NO-ADDED SUGAR FRUIT PUREE CONSUMPTION AT DIFFERENT EATING OCCASIONS: A MODELLING STUDY ON FRENCH CHILDREN

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INTRODUCTION

The insufficiency consumption of fruits among French children may contribute to inadequate intakes of nutrients such as fibers. On the other hand, the consumption of **high-sugar and high-fat foods (HSHFF)**, frequently offered at snack, should be limited. **No-added sugars fruit puree (NASFP)** appears as a complement of fresh fruits to reach the recommended 2 daily servings of fruits.

OBJECTIVE

Evaluate the nutritional impact among French children of consuming a portion of NASFP on four different eating occasions, together with or without the substitution of sweetened foods.

MATERIAL AND METHODS

DATA INCA3
French national survey

MODELLING NASFP was added on each recall and each eating occassion to reach one standard serving size*

**median consumed quantity in INCA3 depending on eating occasion and age*

1,934 Children
1-3 yo, 4-6 yo
7-10 yo, 11-14 yo
or 15-17 yo

4 eating occasions

NASFP (added item)
standard serving size:
90 or 100 g

HSHFF (substituable items)
soft drinks, 100% fruits juice, pastries, biscuits, dairy desserts, ice cream, chocolate and confectionnary
(list given by public health authorities)

X g of Food 1
Y g of Food 2
Z g of Food 3
...
...
...
...
x 2 or 3 recalls per children

Breakfast →
Lunch →
Snack →
Dinner →

ADDITION : From 0 to 1 standard serving size

or

SUBSTITUTION : From 0 to 1 standard serving size
From 0 to the serving size of added NASFPD
If several items, removed in equal proportions

ANALYSIS

Comparisons between observed and modeled diets :

1. **By eating occasion**: energy, free sugars, SFAs intakes and Mean Adequacy Ratio (MAR, an indicator that estimates the average content of 23 essential nutrients expressed as a percentage of daily recommended intakes (DRI))
2. **Daily, after each simulated eating occasion** (others remain unchanged): percentage of children meeting the DRI

RESULTS

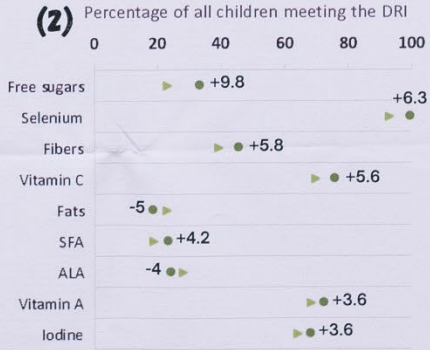
Simulated diets were more nutrient-dense thanks to :

- ↗ an increase in nutrients to favour from the addition of NASFP
- ↘ a decrease in calories from nutrients to limit (especially free sugars) from the remove of HSHFF in the substitution step

(1) 15-17 yo

		OBSERVED	ADDITION	SUBSTITUTION
Average MAR (%) ↗	Breakfast	28.6	+4.2	+1.4
	Lunch	39.9	+3.9	+2.9
	Snack	15.0	+5.5	+3.7
	Dinner	40.0	+3.7	+2.8
Average free sugars (% of energy) ↘	Breakfast	25.1	-5.8	**-10.9**
	Lunch	6.14	-0.6	-3.0
	Snack	31.6	-10.8	**-16.9**
	Dinner	7.52	-0.6	-3.4

(2) Percentage of all children meeting the DRI



SUBSTITUTION at **snack**
▸ before ● after subsitution
only differences higher than 3 points are representend

The benefits of substitution were more pronounced among individuals less inclined to consume fruit puree, such as teenagers (15-17 yo). The decrease in free sugars was even greater with substitution at **breakfast** and **snack** thanks to the decrease of HSHFF **(1)**

Best improvements in DRI adequacy were observed for free sugars, selenium and fibers **(2)**

CONCLUSION

Promoting no-added sugars fruit puree in replacement of sweetened products, especially at breakfast and snack, is a promising strategy to improve the nutritional quality of French children's diet through a better adherence to nutritional guidelines.

Adherence to the Mediterranean Diet Among Pregnant Women in Jersey

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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 establis the Mediterranean diet score and pregnancy outcomes for a mother and child across aMED score levels.

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.

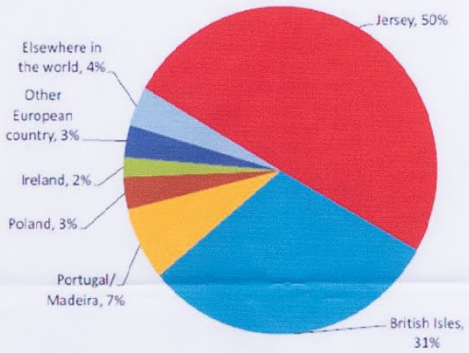
The period of time the mothers had lived on the island was used to split the groups for Native and the UK, women who had lived on the island less than 10 years (Europe <10y on the island) and women who had lived on the island more than 10 years (Europe ≥10y on the island). Advanced statistical software 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 were several differences in aMED scores among the three groups of women; however, these differences were not statistically significant. These findings imply that tailored pre-pregnancy dietary advice may be beneficial, not only for specific ethnic groups but for all women. 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.



Mediterranean diet score distribution for women before and during pregnancy

Characteristics	all	Length of time living on the island			p
		Native and British	European ≥ 10y on the island	European < 10y on the island	
Before pregnancy					
aMED score, (-)	3.0 (2.0; 4.0)	3.0 (2.0; 4.0)	3.0 (2.0; 4.5)	3.0 (3.0; 4.0)	0.749
Low, *n* (%)	47 (58.0)	31 (56.4)	8 (66.7)	8 (57.1)	0.500
Medium, *n* (%)	28 (34.6)	18 (32.7)	4 (33.3)	6 (42.9)	
High, *n* (%)	6 (7.4)	6 (10.9)	0 (0.0)	0 (0.0)	
During pregnancy					
aMED score, (-)	3.0 (2.0; 4.0)	3.0 (2.0; 4.0)	2.0 (1.0; 3.5)	4.0 (3.0; 5.0)	0.158
Low, *n* (%)	31 (62.0)	21 (65.3)	6 (75.0)	4 (40.0)	0.216
Medium, *n* (%)	16 (32.0)	9 (28.1)	1 (12.5)	6 (60.0)	
High, *n* (%)	3 (6.0)	2 (6.25)	1 (12.5)	0 (0.0)	

Data are presented as the median and interquartile range or number (%). $p<0.05$ represents a significant difference between the time on the island groups (Kruskal-Wallis test or ANOVA with Tukey posthoc test).

Characteristics of the babies and the aMED score levels of the mothers

Characteristics	aMED score before pregnancy			p
	Low	Medium	High	
For gestational age				
Gestational age, weeks	40.0 (39.0, 41.0)	40.0 (39.0, 40.0)	41.0 (40.0, 41.4)	0.077
1-min Apgar score	9.0 (9.0, 9.0)	9.0 (8.5, 9.0)	8.5 (8.0, 9.0)	0.773
5-min Apgar score	9.0 (9.0, 9.0)	9.0 (9.0, 10.0)	9.0 (9.0, 10.0)	0.772
Ponderal Index, g/cm^3	2.5 (2.2, 2.8)	2.4 (2.2, 2.5)	2.3 (2.2, 2.4)	0.657
Weight, g	3570.0 (3170.0, 3860.0)	3467.5 (3257.5, 3842.5)	3542.5 (3255,0, 3775,0)	0.989
Weight, centile	64.5 (31.0, 85.0)	46.0 (29.0, 78.5)	55.5 (35.0, 80.0)	0.835
Weight [z-score]	0.4 (-0.4, 1.0)	-0.11 (-0.56, 0.8)	0.1 (-0.4, 0.8)	0.937
Length, cm	52.0 (50.0, 54.5)	52.8 (51.3, 54.5)	53.0 (53.0, 54.0)	0.334
Length, centile	86.0 (50.0, 98.0)	91.5 (55.5, 97.5)	95.0 (95.0, 95.0)	0.579
Length [z-score]	1.1 (0.0, 2.2)	1.4 (0.0, 2.0)	1.6 (1.6, 1.6)	0.521
Head circumference, cm	34.4 (33.0, 35.0)	34.0 (33.5, 35.8)	35.0 (34.5, 35.0)	0.544
Growth percentile, %	61.9 (28.0, 76.6)	45.2 (18.8, 67.1)	50.4 (18.6, 62.4)	0.410
At the follow-up				
Weight, kg	10.1 (9.2, 10.9)	10.1 (9.2, 11.5)	9.6 (9.0, 10.0)	0.248
Weight, centile	67.8 (34.8, 85.1)	69.3 (43.2, 95.9)	61.6 (55.4, 67.5)	0.773
Length, cm	76.5 (75.0, 78.5)	77.0 (74.5, 79.0)	75.5 (72.0, 81.0)	0.859
Length, centile	69.6 (45.7, 85.3)	73.1 (42.9, 87.4)	51.4 (31.4, 98.2)	0.904

Data are presented as the median and interquartile range (IQR). $p<0.05$ represents a significant difference between the aMED score groups (Kruskal-Wallis test or ANOVA with Tukey posthoc test).

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UNIWERSYTET WARMIŃSKO-MAZURSKI W OLSZTYNIE

Ministerstwo Edukacji i Nauki

UNIVERSITY OF WARMIA AND MAZURY IN OLSZTYN

EGEA 9 edition International conference

Betalains-rich products inhibit sodium-dependent glucose co-transporter 1-mediated glucose uptake by intestinal epithelial cells

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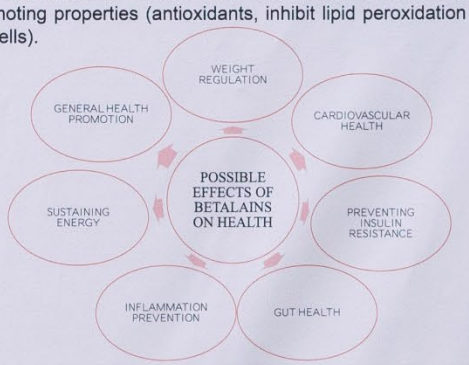
Introduction

Betalains are the natural well-soluble pigments in water that can be divided into two groups: the first group is red-violet betacyanins, and the second is yellow-orange betaxanthins. Betalains are not common pigments in the world of plants, but due to their properties, they are widely used in food production as a source of natural red colour. These compounds may be found in beet leaves, prickly pear, pithaya, ulluco, amaranth, red beetroot, in the flowers of plants of the *Coryophylales* family and inedible mushrooms: *Amanita*, *Hygrocybe* and *Hygrosporus*. Numerous studies have shown that betalains have several health-promoting properties (antioxidants, inhibit lipid peroxidation and protect red blood cells).



Objectives

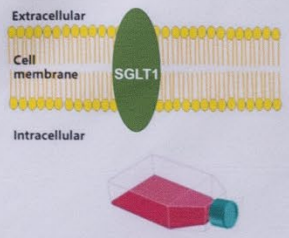
The study focused on the regulatory mechanism of dietary glucose absorption. We aimed to clarify the effects of six different betalains-rich products (red beetroot, yellow and red prickly-pear, yellow and red pitaya, and Swiss chard) on sodium-dependent glucose co-transporter (SGLT) 1-mediated gastrointestinal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

Materials and methods

EXTRACTION

DETERMINATION OF THE BETALAIN PROFILE BY LC-TOF-MS/MS

DETERMINATION OF SODIUM-DEPENDENT 2-NBDG UPTAKE



Results

Table 1. Betacyanins and betaxanthins identified in betalain-rich products

No	Compounds	R_t [min]	MS [m/z]	MS/MS [m/z]
	BETACYANINS			
1	phyllocactin	2.1	637	551/389
2	2'-apiosyl-betanin	2.2	683	551/389
3	2-decarboxy-betanin	2.5	507	345
4	betanidin derivative	2.5	651	389
5	2,15,17-tridecarboxy-neobetanin	2.5	417	255
6	betanidina	2.5	389	345
7	2,15,17-tridecarboxy-betanin	2.5	419	257
8	17-decarboxy-neobetanin	2.5	505	343/297
9	2-decarboxy-isobetanin	2.6	507	345
10	hyllocerenin	2.6	695	551/389
11	2'-apiosyl-phyllocactin	2.6	769	683/551/389
12	2,17-bidecarboxy-betanin	2.6	463	301
13	6'-O-malonyl-2-descarboxy-betanin	2.7	593	549/507/345
14	isohyllocerenin	2.7	695	551/389
15	betanidin 5-O-β-sophoroside	2.7	713	551/389
16	2'-apiosyl-isobetanin	2.7	683	551/389
17	2,17-bidecarboxy-isobetanin	2.7	463	301
18	2,17-biedecarboxy-neobetanin	2.7	461	299 / 255
19	2,15,17-triddecaboxy-isobetanin	2.7	419	257
20	2-decarboxy-neobetanin	2.7	505	343/297
21	6'-O-malonyl-2-descarboxy-isobetanin	2.8	593	549/507/345
22	15-decarboxy-betanin/isobetanin	2.8	507	345
23	isohyllocerenin	2.8	637	593/551/345
24	isobetanidin derivative	2.8	651	389
25	2'-apiosyl-isophyllocactin	2.8	769	683/551/389
26	prebetanin	2.8	631	551/389/345
27	17-decarboxy-betanidin	2.8	345	301
28	betanin	3.5	551	389
29	17-decarboxy-betanin	3.5	507	345
30	isobetanidyn	3.5	389	345
31	15-decarboxy-neobetanin	3.5	505	343
32	isoprebetanin	3.5	631	551/389
33	neobetanin	3.5	549	343
34	17-decarboxy-isobetanidin	3.5	345	301
35	isobetanin	3.7	551	389/345
	BETAXANTHINS			
1	vulgaxanthin I	2.2	340	323/277
2	phenylalanine-betaxanthin	2.2	359	315
3	aminobutyric acid-betaxanthin	2.2	297	251
4	isoindicaxanthin	2.3	309	291
5	aminobutyric acid-isobetaxanthin	2.3	297	251
6	alanine-betaxanthin	2.4	283	265/237
7	indicaxanthin	2.6	309	291
8	vulgaxanthin IV	2.6	325	281
9	3-methoxytyramine-betaxanthin	3.5	361	317
10	histamine-betaxanthin	3.5	305	261
11	3-methoxytyramine-isobetaxanthin	3.6	361	317
12	valine-betaxanthin	4.7	311	267

Table 2. The numer of identified betalains in betalain-rich products

	red beetroot	swiss chard	red prickly pear	yellow prickly pear	yellow pitaya	red pitaya
THE NUMBER OF IDENTIFIED COMPOUNDS	22	12	15	17	23	23
DOMINANT COMPOUND	Betanin			2.17-biedecarboxy-neobetanin	6'-O-malonyl -2-decarboxy-isobetanin	

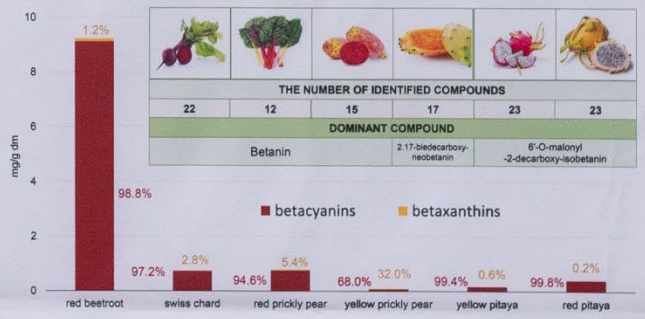


Fig. 1.The concentration and contribution of betalains in betalain-rich products.

Fig. 2.The effects of betalains-rich products on Na+-dependent 2-NBDG uptake by Caco-2 cells.

Conclusion

The inhibitory effects of betalains-rich products on SGLT1-mediated glucose uptake may contribute to the suppression of increased postprandial blood glucose level.

NATIONAL SCIENCE CENTRE POLAND

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CONSUMER KNOWLEDGE AND SENTIMENT OF FRUIT AND VEGETABLE DIETARY GUIDELINES

HYPOTHESIS

Do people know what they should be eating and more importantly, do they even care about fruit and vegetable consumption?

The scientific and government communities agree fruits and vegetables are the backbone of any healthy diet. The World Health Organization recommends adults consumes 400g of fruits and vegetables daily. Despite this clear mandate and extraordinary efforts by agencies around the world, people have under consumed fruits and vegetables for decades. Consumer knowledge and sentiment of fruit and vegetable dietary guidelines play a crucial role in determining individuals' dietary choices and overall health. Therefore, we tested the hypothesis that adults and teens are unaware of the dietary guidelines which is why they are not meeting them daily.

METHODOLOGY

Online Quantitative Survey
- Confidence level of 95% with a 4% margin of error

Markets
- China, Brazil, Germany, United Kingdom and United States

Respondents For Each Market
- Adult (18+) n=500 (primary or shared responsibility for household food and drink shopping)
- Teens(13 – 17) n=200

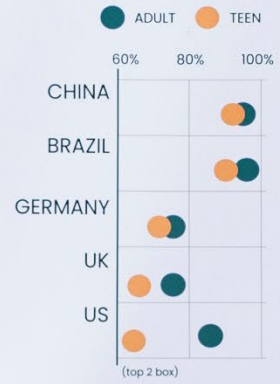
RESULTS

Respondents **valued and appreciated** the powerful role fruits and vegetables play in their lifestyle.

HOWEVER

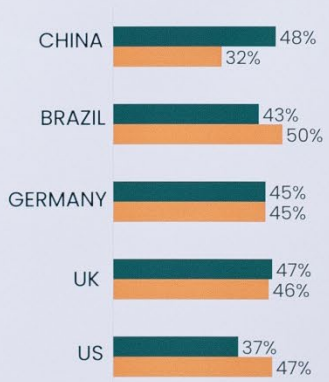
Low detailed **knowledge** of and adherence to the **dietary guidelines** for fruits and vegetables.

Importance of Eating F&V To Maintain Lifestyle



Note - Q : How important do you believe eating fruits and vegetables is to maintaining your lifestyle?

% Stating Habit As Reason For Eating Fruits & Vegetables

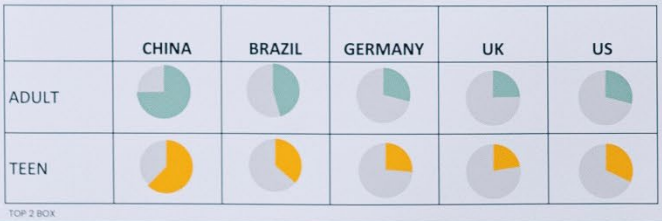


Note – Q :Why do you eat fruits and vegetables? Select all that apply
Habits was one of the selections and they are an indicator of norming and consistency of behavior.

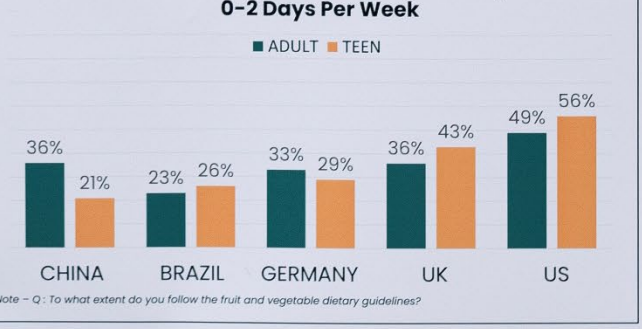
Avg Perceived Recommended Daily Fruit & Vegetable Serving

Note – Q : How many daily servings of fruits and vegetables are recommended for a healthy diet?
Illustrative of the number of recommended daily servings on average. Benchmark servings from Chinese Nutrition Society (China) World Health Organization (Brazil), Deutsche Gesellschaft für Ernährung e.V. (Germany), National Health Service (UK), American Heart Association (US)

% Confident Eating Enough Fruits & Vegetables



% Following Dietary Guidelines Only 0-2 Days Per Week



Note – Q : To what extent do you follow the fruit and vegetable dietary guidelines?

DISCUSSION

- The positive sentiment and clear rational for why fruits and vegetables matter are strong across the markets tested.
- Continued education on the guidelines is critical as it's not intuitive
- Future work across stakeholders should reinforce guidelines and remove barriers – seen and unseen – to build long-term usage

ACKNOWLEDGEMENT

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Research conducted by the IFPA Global Insights department

Lauren M. Scott: International Fresh Produce Association LSCOTT@FRESHPRODUCE.COM

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DIET, FRUIT & VEGETABLES, AND ONE HEALTH: WHAT CONTRIBUTIONS?
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Gender differences in the eating behaviors of an Italian population of children participating to the nutrition education program MaestraNatura

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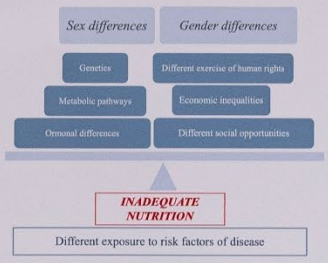
Center for Gender-specific Medicine, Istituto Superiore di Sanità, Italy

Background

Dietary habits are acquired through a gradual process that begins early in life and is strongly influenced by individual biological component and by many external factors such as family and socioeconomic contexts.

Gender is an important factor influencing lifestyle, food preferences and, consequently, the onset and course of chronic diseases.



Aims

This study assessed the eating habits and the adherence to the principles of the Italian Dietary Guidelines (IDG) of 11-13 years old children and their parents, to evaluate possible influences of gender and family context on their eating choices and behaviors.

Conclusions

Italian children show gender differences in eating behaviors. Thus, preventive nutrition education strategies, involving school and family, and specifically addressed to F and M, are needed to make children aware of the importance of a healthy lifestyle and to correct inadequate eating habits.

Results

The questionnaire showed an average degree of adherence to the principles of the Italian Dietary Guidelines (IDG) for both children and parents, with a similar distribution in male (M) and female (F). [Fig.1-2-3]
Although, in student's group there is a significant difference in high adherence score (F>M). [Fig.1B]

Analysis of individual children's responses revealed differences between F and M in daily consumption of fruits and vegetables (F>M) and at least 2-3 servings of cereals (M>F), habit of eating breakfast at least 5 days a week (M>F), and consumption of carbonated/sweetened beverages (M>F). [Fig.4]

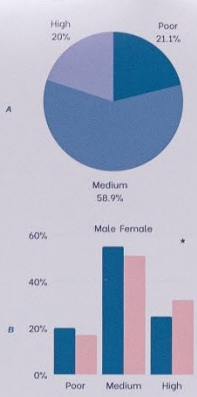


Fig.1: STUDENT's adherence to the IDG (A) and gender differences (B)

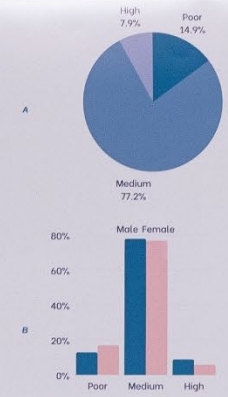


Fig.2: CHILD's adherence to the IDG (A) and gender differences (B)

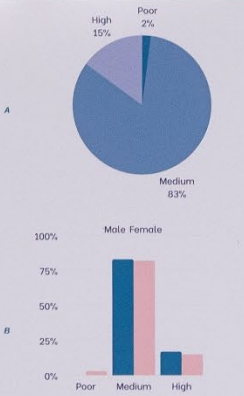


Fig.3: PARENT's adherence to the IDG (A) and gender differences (B)

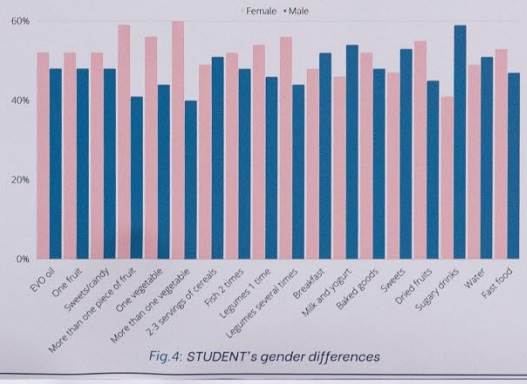


Fig.4: STUDENT's gender differences

Methods

390 questionnaires (50% F) completed by students (STUDENT), 145 (70% F) completed by parents (PARENT), and 290 (45% F) completed by parents reporting on their children's habits (CHILD) were collected from 25 secondary schools located in 6 Italian regions (Lazio, Basilicata, Campania, Tuscany, Marche, and Umbria) participating in the MaestraNatura nutrition education program and analyzed according to the principles of the Italian Dietary Guidelines.

"Project realized with technical and financial support of the Italian Ministry of Health - CCM"

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CENTRO DI RIFERIMENTO MEDICINA DI GENERE

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

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Self-monitorYourDiet

××××× ×

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.

Aim: This study tested a food self-monitoring diary to improve fruit and vegetable consumption and adherence to dietary recommendations.

Participants: 49 Polish females aged 21.3 years (SD 2.2).

Methods:

In order to monitor food consumption day by day, a food diary, so-called Self-monitorYourDiet® was used (Table 1).

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 respondents were asked to keep a food diary for two consecutive months (M1, M2).

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 to recommendations (Table 2) – for:

fruit: ≥once a day
vegetables: ≥3 times/day
F&V: ≥5 times/day
dairy foods: ≥2 times/day
whole grains: ≥once a day
fish/seafood: ≥2 times/week
legumes/nuts/seeds: ≥once a week
meat products: ≤5 times/week
sweets/sugar/honey: ≤once a week
sweetened/energy drinks: ≤once a week
fast foods: ≤once a month
alcohols: ≤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 (Figure 1).

When looking at fruit and vegetables separately, there were no significant differences between M1 and M2 for the proportion of respondents following recommendation for fruit (51% vs. 57%, p>0.1, respectively) or vegetables consumption (8% vs. 6%, p>0.1, respectively).

Considering consumption of **fruit and vegetables together**, there was a **significant increase** (p<0.0001) in the percentage of respondents, **from 2% in M1 to 51% in M2,** who followed the dietary recommendations for fruit and vegetables consumption.

Table 1. Sample record of a subject Self-monitorYourDiet®

Foods recommended for consumption and foods with limited consumption

Control the frequency of the food consumption every meal/eating episode (or at least every day) and check adherence to recommendations.

A minimum or a maximum frequencies are indicated.

Day	Vegetables without vegetables preserved in vinegar, salt or sugar	Fruit without jam, candied fruit, etc.	Dairy foods e.g. milk, yogurt, kefir, cottage cheese, cheese	Whole grains e.g. buckwheat grain, wholemeal wheat and rye bread, wholemeal pasta, oat flakes	Fish and seafood e.g. baked, cooked, stewed	Legumes, nuts and seeds e.g. lentils, peas, soybeans, beans, various nuts, pumpkin seeds, sunflower seeds	Meat products various types of meat, sausages,	Sweets, sugar and honey, including highly sweetened jams, ice cream, candied fruit, etc.	Sweetened beverages and energy drinks e.g. with sugar, glucose-fructose syrup, artificially sweetened	Fast foods e.g. hot-dogs, hamburgers, chips, French fries, pizza, tortilla, deep-fried foods	Alcohols e.g. wine, beer, alcohol drinks, vodka, brandy
Month: October 2019	Mark × every time after the food consumption										
1	×××	×××	×	×	×	×	××			×	×
2	×	×××	×	××			×××	×			
3	××	××××	××				×××				
4	×××	×××	××	×	×		×				×
5	××	×××	××	×	×		×××	×			
6	×××	××××	×	××			×××			×	
7	×	××××	××	×		×	×××	×			
8	××	×××	×	××	×	×	××				×
9	×××	×××××	××			××	×××				
10	××××	×××	×××	×	×		×				
11	××	××××	×	××			××	×		×	
12	×××	××××	××			××	××××				
13	×	×××	××	×××		×	××				
14	××	××××	×				×××	×			
15	×××	××	××	×	×		×				
16	×	×××		×			×××				
17	×××	××××	×				×××	××			×
18	×	×××	××	××		××	××				
19	×××	×××××	×				×××	×		×	
20	××	×××	×××	××			×××				
21	×××	××××	××		×	×	×				×
22	×××	×××	×	××		××	×××	×			
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24	×××	××××	×	××			××				
25	××	××	××	×	××		×	×		×	
26	×	××××	×	××			×				×
27	×××	×××	×××				×××				
28	×	××	×	×	×		×			×	
29	×××	××××	××			××	××				
30	××	×××	×	××			×××	×			
31	×××	××	×××	×	××		×				
	Recommendations										
	Minimum 3 times a day	Minimum once a day	Minimum 2 times a day	Minimum once a day	Minimum 2 times a week	Minimum once a week	Maximum 5 times a week	Maximum once a week	Maximum once a week	Maximum once a month	Maximum once a month
	Calculations carried out by a researcher										
	71/31=2.29	104/31=3.35	49/31=1.58	34/31=1.10	13/31=0.42	16/31=0.52	65 /31=2.10	11/31=0.35	0/31=0	6/31=0.19	5/31=0.16
Points	0	1	0	1	1	1	1	0	0	1	0

Sum of points: 7 points, including additional 1 point for consumption frequency of vegetables and fruit in total (2.29 + 3.35 + 5.64 (>5 times a day); 1 point assigned)

Table 2. Scoring for a calculation of the Adherence Score to dietary recommendations (AdhS) included in Self-monitorYourDiet®

Foods	Recommendation	Cut-off for scoring (times/day)	Scoring (points)	
			Yes	No
1. Vegetables	Minimum 3 times a day	3.0	1	0
2. Fruit	Minimum once a day	1.0	1	0
3. Dairy foods	Minimum 2 times a day	2.0	1	0
4. Whole grains	Minimum once a day	1.0	1	0
5. Fish and seafood	Minimum 2 times a week	0.29	1	0
6. Legumes, nuts and seeds	Minimum once a week	0.14	1	0
7. Meat products	Maximum 5 times a week	0.71	1	0
8. Sweets, sugar and honey	Maximum once a week	0.14	1	0
9. Sweetened beverages and energy drinks	Maximum once a week	0.14	1	0
10. Fast foods	Maximum once a month	0.03	1	0
11. Alcohols	Maximum once a month	0.03	1	0
12. Vegetables and fruits in total	Minimum 5 times a day	5.0	1	0
Range of the Adherence Score to dietary recommendations: 0-12 points				

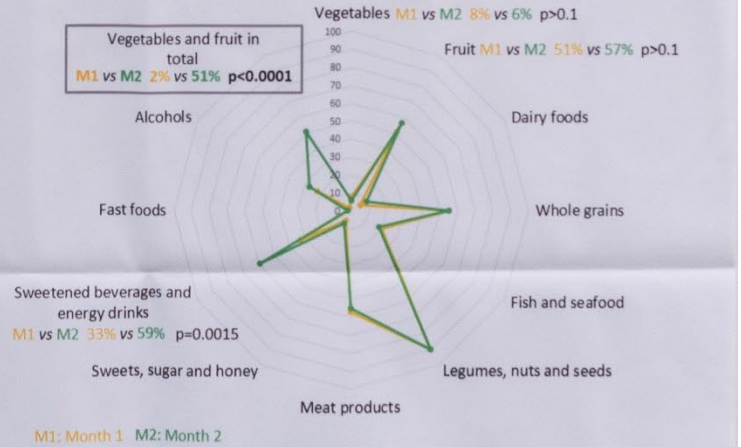

Figure 1. Percentage of subjects (%) who met recommendations

Conclusions:

The diary, based on the user's own activity, can be useful to monitor the user's food consumption on a daily basis including fruit and vegetable consumption.

This allows us to recommend the use of the "Self-monitorYourDiet®" diary in nutritional counselling 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 (2.666.666 euros)

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Ministerstwo Edukacji i Nauki

Nudging Food Service Users to Choose Fruit- and Vegetable-rich Items: Five Field Studies from Canada

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Nudge and Health behaviour change

- What is Nudge?
  - Subtle changes to any aspect of the choice architecture that alters people's behaviour in a predictable way *without forbidding any options or significantly changing their economic incentives (Thaler & Sunstein, 2008)*
- *Difference from traditional information / educational campaigns*
  - We do not try to convince about advantages or resort to emotions (e.g., health benefits, fear appeal)
  - Nudge is about presenting options such that access and choice of the target option becomes easy and natural
  - But freedom to choose existing alternatives needs to be respected
    - E.g., Opt out if you don 't want; otherwise, everybody is in.

Applying nudge concept to promote vegetables in mass eating venues

- Limitations of lab studies for nudge studies for healthy eating
- Ideal context: young adults in university dining halls and cafeterias
  - Weight gain and unhealthy eating habits away from home
- Motivation for university food services to participate
  - Pressure from parents and government for healthy eating
  - Has to be at least revenue-neutral
- Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) funding
- University of Guelph Hospitality Services' cooperation
- Semester-long field studies on dining halls and cafeterias over 3 years
- Sales data as the DV

Methods: Reduce effort for choosing FV-items

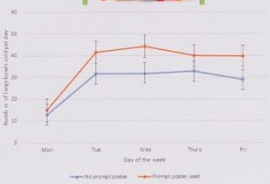
- Point-of-purchase reminder
  - **Study 1: Promote kale/spinach added to smoothies**
  - **Study 2: Sale of whole fruits from baskets**
- Combination of sizing and point-of-purchase reminder (poster)
  - **Study 3: Sale of larger size bowls at a stir-fry grill**
- Altering the proximity of healthier option
  - **Study 4: Sale of sandwiches containing spinach**
- Combination of sizing and proximity of large vs. small sized plates and serving spoons
  - **Study 5: Sale of self-serve items in a salad bar**

Study 3: Nudging for "large bowl" at Mongolian Grill

- Current set-up
  - Pick up a bowl
  - Self-serve vegetables and noodle on a bowl
  - Hand over the bowl to the server and inform a preferred protein (beef, chicken, pork or tofu)
  - All the ingredients are stir-fried and returned to you
- Idea for nudging
  - The majority of customers choose a medium-sized bowl (18.75 oz) over a large bowl (28 oz)
  - Selection of a large bowl would increase the amount of vegetables self-served and consumed (but not protein)
  - The price difference between medium and large bowl is not large ($8.47 vs. $10.47)
  - Combination of Sizing and Prompting

Study 3: Results

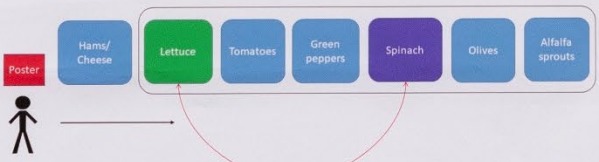
- Design
  - Baseline (previous 2 semesters): No poster
  - Intervention (2 semesters): Prompting poster placed
- Analysis
  - DV: Number of large bowls sold daily
  - Subjected to a 2 (Prompt for large bowl: absent vs. present) by 5 (DW coding) ANOVA
  - Semester (Fall vs. Winter), Week number (1-12) and number of small bowls sold daily entered as covariates
- Results
  - Main effect of prompting ($F(1, 221) = 29.66, p < .001$)
  - Significantly more large bowls were sold when reminder poster was present vs. absent ($M = 36.12$ vs. 27.51, $p < .001$)
  - About 28.6% more large bowls were sold per day due to reminder poster



Study 4: Deli sandwiches

- "Implicit" default veggie for sandwiches is lettuce
- Spinach is rarely chosen although available for sandwiches
- Target: Spinach as a more nutritious alternative to lettuce
- A poster displayed in the deli section in Weeks 4-12

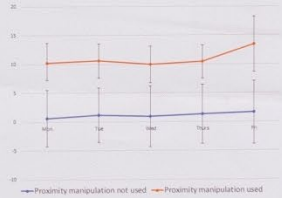
Schematic view of Deli sandwich station



Weeks 1-3 (control)
Weeks 4-12 (intervention): ***proximity*** of spinach enhanced

Study 4: Results

- DV: # of sandwiches with spinach
- DV subjected to a 2-way ANOVA (poster by DW coding) with # of sandwiches sold daily as a covariate
  - *A significant covariate effect of # sandwiches sold ($F=8.79$, $p=.005$)*
  - *A significant main effect of Poster ($F = 60.50$, $p<.001$)*
- Marginal means of DV
  - No poster: 1.23
  - Poster used: 10.91 (about 10% of sandwiches sold daily)



Appetite

Nudging food service users to choose fruit- and vegetable-rich items: Five field studies

Study 5: Nudging in Salad bar

- Predominant FV-rich foods
- Plate size: Medium (8 inch) vs. Large (10.5 inch)
- Serving spoon size: Small vs. Large
- 60 days during a summer semester were randomly assigned to the 2 (plate size) by 2 (serving spoon size) ANOVA
- 8 days were removed due to mix-up
- DV: Total grams of salad bar items sold daily
- No significant effect of nudging observed.

Summary

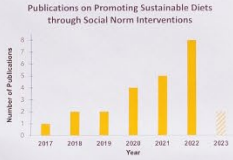
- Nudging yielded promising results for FVs in Canadian university cafeterias
  - Tactics intended to reduce customers' effort to reach and choose FV-rich items
  - Prompting customers about healthy options **on the point-of-choice**
  - About 10-29% increase in the choice of target FV-items
  - Once placed, nudging works every day!
- Limitations
  - Aggregate sales data
  - "Who is being nudged and who is NOT being nudged?"
  - Does "repeatedly being nudged" lead to the formation of habit?
- Collaboration with **food service managers** to study food choice
  - *Gatekeepers* for any interventions for mass-eating contexts
  - Their own agenda: At least revenue-neutral

Evidence on the **effectiveness of social norm interventions** to **shift diets** is **limited** and **mixed**.

The Problem

Interest in social norm interventions to encourage more sustainable diets has increased rapidly in recent years.

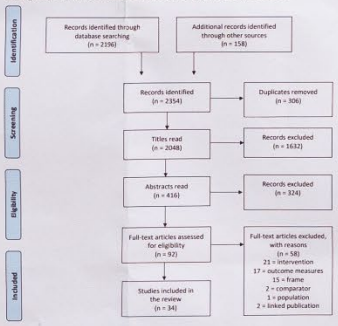
We need to synthesise the growing evidence base to identify knowledge gaps and direct future research.



Methods

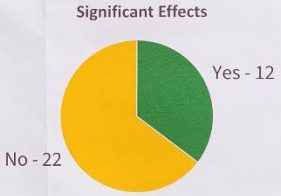
1. Collaboration for Environmental Evidence (2018) guidelines for evidence synthesis were followed.
2. Database search: PsychINFO, Scopus, GreenFile, Medline, Embase, ProQuest, Google Scholar. We included grey literature to reduce the risk of publication bias.
3. Title and abstract screening, full text review, and critical assessment for risk of bias were performed by two independent reviewers.

PRISMA diagram depicting the progressive stages of the literature search process

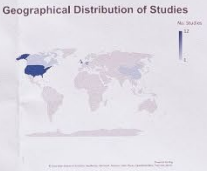


Key Results

- We identified 24 papers and 34 studies which met our selection criteria (62% peer-reviewed/38% grey literature).
- Only 35% of studies reviewed reported finding a significant effect of the intervention.



- The vast majority of studies took place in Europe (48%) and North America (42%). No studies were conducted in primarily Spanish-speaking countries.



Eligibility screening criteria (PICO-FS)

PICO-FS CRITERIA	INCLUDE IF	EXCLUDE IF
Population	Free-living adults; aged > 18 years; All age, gender, religion, ethnicity and social groups.	Participants are receiving in-patient care or are institutionalised (e.g., severely ill patient groups who are not representative of the general population); Lab-based animal studies.
Intervention	The study tests the effectiveness of social influence and/or access to shift consumers to eat more plant-based foods, or to reduce animal-based consumption overall.	The study only investigates perception of norms, or antecedents/predictors of intentions/behaviour change.
Comparator	Original randomized controlled trials, quasi-experiments or pre-positive studies comparing a measures of two groups where norm manipulation is delivered between the two.	Studies without an intervention or change (natural or non-made); qualitative studies, reviews or meta-analyses; protocol or methods only papers.
Outcomes	The study includes a group comparison of intentions or actual change in selection, purchasing, or consumption of a meat (red) food product.	The study only has physiological measures (e.g., weight loss, blood pressure); and no intentions or change in dietary behaviours.
Frame	The study includes some sort of climate framing. Composite interventions including delivered appeals are eligible.	The study only focuses on human health benefits or animal welfare.
Study Setting	The study focuses anywhere where food is purchased or eaten outside the premises (e.g., supermarkets, shops or online ordering platforms). Lab-based research settings).	The study focuses on in-home food preparation and consumption or in a school-based study targeting children.

Recommendations:

- Social norms might be better utilized as part of multi-component interventions than on their own.
- Ensuring that normative information and referent groups are salient could improve intervention effectiveness.
- Research in populations and collectivist cultures outside Europe and North America will help fill knowledge gaps.

Future Directions:

- Meta-analysis to integrate findings and assess the overall effect size of norm-based interventions
- Exploratory analysis to investigate underlying mechanisms and moderators which might influence effectiveness

Research and Policy Implications

- Inform future research practices to carry out more impactful, well-designed behavioural interventions.
- Prioritise the most effective strategies when designing policies to improve personal and planetary health through diet change.

Can Social Influence and Norms Promote Sustainable Diets?

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

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1 Introduction

- 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**

1) variation in energy density (ED, kcal/g) predicts preference for different vegetables but not different fruit;

2) preference for different fruit is predicted by sweetness;

3) these associations are observed in foods when grouped according to their botanical classification, rather than culinary use.

- Relatedly, 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).

Objectives

To examine whether in **both diet groups** (omnivores vs. vegans and vegetarians),

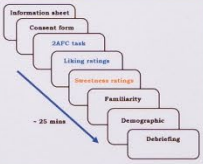
- Both sweetness and ED predict preferences for botanical vegetables;
- Sweetness predicts preferences for botanical fruit.

2 Methods

2 diet groups

UK omnivores (n=39) vs. vegetarians and vegans (n=38)

3 food groups



1) Fruit group

fruits (n= 13) with the same botanical and culinary classification;

2) Fruit used as vegetables group

botanical fruits (n= 11) treated as vegetables for culinary purposes;

3) Vegetables group

vegetables (n=12) with the same botanical and culinary classification.

Fruit group

n	Food name	ED (kcal/g)
1	Watermelon	0.34
2	Strawberries	0.39
3	Orange	0.43
4	Blueberries	0.45
5	Nectarine	0.45
6	Pineapple	0.45
7	Pear	0.48
8	Apple	0.55
9	Cherries	0.55
10	Kiwi	0.55
11	Mango	0.63
12	Grapes	0.66
13	Banana	0.9

Fruit used as vegetables group

n	Food name	ED (kcal/g)
1	Cucumber	0.11
2	Tomato	0.17
3	Courgette	0.2
4	Green pepper	0.2
5	Aubergine	0.23
6	Baby corn	0.28
7	Green beens	0.31
8	Mange tout bean	0.36
9	Baby sugar snaps	0.38
10	Squash	0.42
11	Sweet corn	0.8

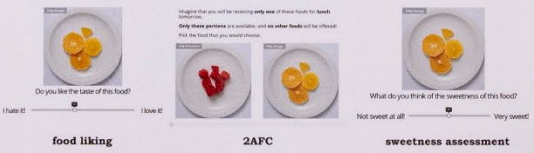
Vegetables group

n	Food name	ED (kcal/g)
1	Celery	0.1
2	Lettuce	0.14
3	Spinach	0.29
4	Asparagus	0.29
5	Beetroot	0.31
6	Cauliflower	0.35
7	Broccoli	0.38
8	Carrot	0.42
9	Brussel sprout	0.51
10	Parsnip	0.77
11	Potato	0.91
12	Sweet potato	0.99

2 measures assessing food preferences

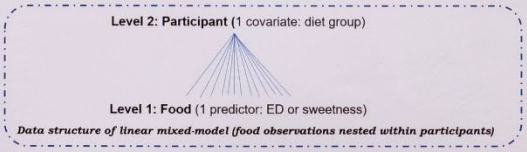
1) Food liking ratings (0-100)

2) Two-alternative forced choice task (2AFC)



food liking **2AFC** **sweetness assessment**

Data analysis - Linear mixed-models



Data structure of linear mixed-model (food observations nested within participants)

- **Model 1 & 2:** Liking/Food choice – Diet group + sweetness for foods in **Fruit group**
- **Model 3 & 4:** Liking/Food choice – Diet group + sweetness for foods in **Fruit used as vegetables group**
- **Model 5 & 6:** Liking/Food choice – Diet group + ED for foods in **Vegetables group**
- **Model 7 & 8:** Liking/Food choice – Diet group + sweetness for foods in **Vegetables group**

3 Results

We observed the same pattern in omnivores and in vegetarians and vegans.

- Sweetness predicts food preference for **botanical fruit** (both **Fruit group** and **Fruit used as vegetables group**).
- Both sweetness and ED predict preferences for **botanical vegetables** (**Vegetables group**).

Model	Food preference		Effect	Estimate	95%CI	t value	p value
1	Liking	1	Diet group	<0.01	[-0.20, 0.20]	0.02	988
		2	Sweetness	0.49	[0.37,0.71]	8.02	< 001
		3	Diet group*sweetness	-0.03	[-0.19, 0.14]	-0.30	762
2	Food choice frequency	1	Diet group	<0.01	[-0.13,0.12]	-0.10	920
		2	Sweetness	0.33	[0.22,0.45]	5.62	< 001
		3	Diet group*sweetness	0.05	[-0.11, 0.22]	0.61	541
3	Liking	1	Diet group	0.10	[-0.11, 0.31]	0.91	363
		2	sweetness	0.41	[0.28,0.53]	6.53	< 001
		3	Diet group*sweetness	-0.09	[-0.26, 0.08]	-1.04	298
4	Food choice frequency	1	Diet group	0.01	[-0.12,0.15]	0.20	841
		2	sweetness	0.26	[0.15,0.36]	4.87	< 001
		3	Diet group*sweetness	0.07	[-0.08, 0.21]	0.89	376

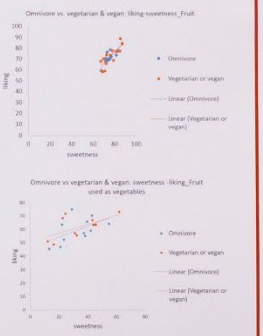
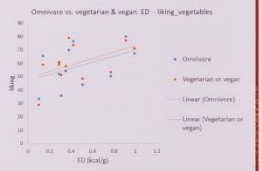


Table 1. Statistics of linear mixed model when modelling sweetness and Diet group on food preference for botanical fruit groups (Fruit group and Fruit used as vegetables group)

Model	Food preference		Effect	Beta	95%CI	t value	p value
5	Liking	1	Diet group	0.08	[-0.12, 0.28]	0.82	414
		2	ED	0.22	[0.14,0.31]	5.10	< 001
		3	Diet group*ED	0.01	[-0.11, 0.13]	0.19	846
6	Food choice frequency	1	Diet group	0.01	[-0.11,0.13]	0.23	820
		2	ED	0.19	[0.06,0.32]	2.96	003
		3	Diet group*ED	0.12	[-0.06, 0.30]	1.26	208
7	Liking	1	Diet group	0.07	[-0.12, 0.27]	0.74	461
		2	sweetness	0.30	[0.20,0.40]	5.90	< 001
		3	Diet group*sweetness	-0.02	[-0.16, 0.12]	-0.23	820
8	Food choice frequency	1	Diet group	< 01	[-0.13,0.13]	0.02	984
		2	sweetness	0.17	[0.07,0.26]	3.43	< 001
		3	Diet group*sweetness	0.09	[-0.04, 0.22]	1.31	190



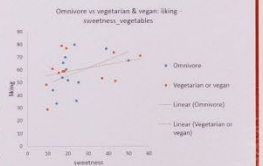


Table 2. Statistics of linear mixed model when modelling ED (or sweetness) and Diet group on food preference for Vegetables group

4 Conclusions

- 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.
- **Food with the same botanical origins may share similar underlying driver(s) of developing food preference**.
- **Implications: 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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