The Planet Health Conformity-Index: bridging the gap between nutritional and environmental sustainability in nLCAs

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1. Introduction

In order to enable consumers to make sustainable food purchases that equally account for health, the environment and planetary boundaries, we have developed the Planet Health Conformity Index (PHC) (Schade et al. 2023). Currently, it is impossible for consumers to identify the environmental and health benefits of food at the point of sale (Bunge et al. 2021), as existing labelling formats address either nutritional/health aspects (e.g. Nutri-Score) OR environmental aspects (e.g. Eco-Score, Climate-Score). Hence, if both mono-dimensional label types are shown together on one product, this would be disadvantageous from a communication perspective, as the label messages could be contradictory (e.g. a labelled product shows an A in the Nutri-Score, but only a D in the environmental label). This leads to the need for a new label metric that includes the multidimensionality of environment and health in one label. Consequently, this additional information would both satisfy an increasing request of consumers and facilitate the development of more sustainable food products (Green et al. 2023).

2. Methods

The PHC includes 18 nutrients and five environmental impacts (GWP, cropland use, freshwater use, N & P application) contextualized in the concept of planetary boundaries (Willet et al. 2019). In its function, the PHC examines whether a food product can offer sufficient nutrient supply while simultaneously preserving the planetary boundaries (Table 1, Figures 1-2). Six different algorithm designs were tested comprising the choice of capping and weighting and applied to 142 food products in the German market (incl. imported foods). Further, the results of the PHC were compared to a mass-based and energy-based functional unit. This abstract presents only a selection of the most important results.

3. Results and discussion

The different modes of summing the PHC showed the varying impact of the algorithm design. Applying the arithmetic mean emphasizes single extreme values even when capping and weighting was applied. Specifically single-food products can hardly include all important nutrients which is why the median offers a fairer opportunity of summing. It was found that a considerable amount of food products was rated as preserving the planetary boundaries when a mass-based unit was applied. Including nutrients into the calculation altered the outcome significantly with many of these products actually exceeding the planetary boundaries when nutrients were accounted for in the analysis (Table 2).

Compared to other nFU-approaches the new PHC is equipped with the following innovative features: 1) The nutritional strengths and weaknesses of food products are highlighted from an environmental planetary boundary-based perspective. Thus, the new score breaks down the mass-based specifications of the Planetary Health Diet (PHD) into corresponding specifications on a nutrient level. Hereby, nutrients were selected with a high public health relevance. 2) Due to its two-factorial design (environmental impact divided by nutrient AND environmental PHD-based allowance divided by nutrient) and the division of these two factors by each other, all units are truncated. Consequently, the new score is applicable to a broad set of nutritional-environmental questions – on level of single products, composed recipes, whole dishes, whole diets and/or whole consumption patterns. 3) Due to it´s nutrient-based approach, the new score can be easily adapted to the nutritional needs of specific individuals or population groups to evaluate the ecological compatibility of foods, recipes, diets, etc. context-specifically.

4. Conclusions

Nutritional functional units need to be harmonized with nutritional recommendations, the dietary background and the health status of the target population in order to generate optimal results. Further, data quality needs to be monitored precisely as nFU usually demands the inclusion of several data sources. Traditional food LCAs need to start introducing nutrients as the basic function of food into their FU.

5. References

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Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, ... & Murray CJ (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. The lancet, 393(10170), 447-492.

Table 2 Nutrient related planetary boundaries for Global Warming Potential (GWP): g CO2e per nutrient (LB=lower bound, UB=upper bound)

Boundary transgression		<0,5			1			2			4			>4		
Label		A	LB	UB	B	LB	UB	C	LB	UB	D	LB	UB	E	LB	UB
Energy	per 100kcal	38	36	41	76	72	82	152	143	164	304	286	329	304	286	329
Protein	per g	10	10	11	21	20	22	42	39	45	83	78	90	83	78	90
SFA	per g	35	33	38	71	67	76	142	133	153	283	266	306	283	266	306
MUFA+PUFA	per g	18	17	19	35	33	38	71	67	76	142	133	153	142	133	153
Sugar	per g	15	14	16	30	29	33	61	57	66	122	114	132	122	114	132
Fiber	per g	25	24	27	51	48	55	101	95	110	203	191	219	203	191	219
Vitamin B1	per mg	634	596	685	1268	1192	1370	2537	2385	2740	5074	4769	5479	5074	4769	5479
Vitamin B2	per mg	544	511	587	1087	1022	1174	2174	2044	2348	4349	4088	4697	4349	4088	4697
Vitamin B6	per mg	507	477	548	1015	954	1096	2029	1908	2192	4059	3815	4384	4059	3815	4384
Folate	per g	2.5	2.3	2.7	5.0	4.7	5.4	10.7	9.5	10.9	20.2	19.0	21.9	20.2	19.0	21.9
Vitamin B12	per µg	190	179	205	381	358	411	761	715	822	1522	1431	1644	1522	1431	1644
Vitamin C	per mg	7	7	7	14	13	15	28	26	30	55	52	60	55	52	60
Vitamin D	per µg	152	143	164	304	286	329	609	572	658	1218	1145	1315	1218	1145	1315
Vitamin E	per mg	54	51	59	109	102	117	217	204	235	435	409	470	435	409	470
NaCl	per g	203	191	219	406	382	438	812	763	877	1624	1526	1753	1624	1526	1753
Calcium	per mg	0,8	0,7	0,8	1,5	1,4	1,6	3,0	2,9	3,3	6,1	5,7	6,6	6,1	5,7	6,6
Magnesium	per mg	2,2	2,0	2,3	4,3	4,1	4,7	8,7	8,2	9,4	17,4	16,4	18,8	17,4	16,4	18,8
Iron	per mg	51	48	55	101	95	110	203	191	219	406	382	438	406	382	438
Zinc	per mg	76	72	82	152	143	164	304	286	329	609	572	658	609	572	658
Iodine	per µg	3,8	3,6	4,1	7,6	7,2	8,2	15,2	14,3	16,4	30,4	28,6	32,9	30,4	28,6	32,9

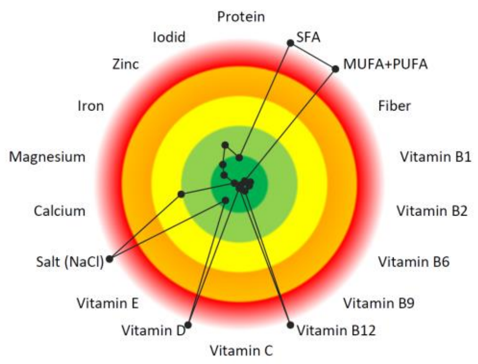

Figure 1 Single PHC Factors (GWP) per nutrient for Bananas from Ecuador

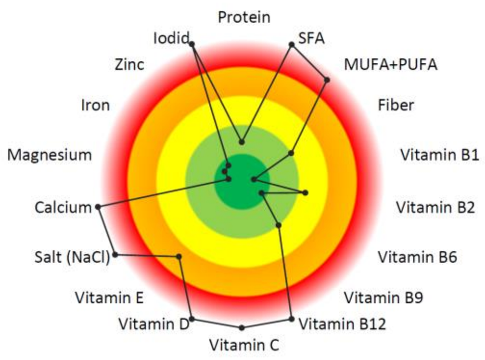

Figure 2 Single PHC Factors (GWP) per nutrient for Paddy Rice from Italy

Table 1 Food-specific Planetary Boundary Conformity Label (Mass- and energy-based) and PHC Scores for GWP (Selection from the 142 foods analysed)

Product	Prod. Coun-try	PB con-formity-label, mass-based, per 100g	PB con-formity-label, energy-based, per 100 kcal	PHC Median un-capped	PHC Median capped at PB con-formity factor 4 (D<E)	PHC Median capped at PB con-formity factor 4 with nutri-tional wei ghting
Wheat	DE	A	A	A	A	A
Potatoes	DE	A	A	A	A	A
Paddy Rice	**IT**	C	B	D	D	D
Sugar, from sugarbeet	DE	A	A	E	E	D
Lettuce, open field	DE	A	C	A	A	A
Spinach, open field	DE	A	B	A	A	A
Onions, open field	DE	A	C	C	C	B
Tomato, unheated GH	NL	B	E	D	D	D
Oranges	ES	A	A	A	A	A
Bananas	**EC**	A	A	B	B	B
Apples	DE	A	A	C	C	C
Grapes	DE	A	A	B	B	A
Wine	DE	A	A	E	E	D
Beer	DE	A	A	C	C	C
Sunflower seed	HU	B	A	A	A	A
Sunflower seed Oil	NL	B	A	E	E	D
Palm Oil	ID	E	B	E	E	D
Almonds	USA	C	A	B	B	B
Walnuts	FR	C	A	A	A	A
Sesame seed	IN	C	A	A	A	A
Groundnuts	AR	E	C	C	C	C
Dates	TU	C	B	E	D	D
Meat, Chicken	DE	B	B	C	C	C
Meat, pig	DE	C	C	C	C	C
Meat, Cattle	DE	E	E	E	E	D
Eggs	DE	B	B	A	A	A
Milk	DE	C	D	D	D	D
Butter, Ghee	DE	E	D	E	E	D