Studying the environmental impact of different diet scenarios for the Netherlands with Optimeal®

Gerard Kramer, Marcelo Tyszler & Hans Blonk
Blonk Consultants, Gouda, the Netherlands

Introduction

Changing food patterns is one of the options to reduce the environmental impact[1]. In this respect, eating according to dietary guidelines or vegetarian and vegan diets are suggested options. **We propose an alternative approach that minimizes the changes to the current diet**, while improving its sustainability and nutritional adequacy. Our method enables the selection of small interventions with high impact. This is relevant for those who set guidelines for sustainable nutrition and policy makers.

Method

We used a **Linear Programming** tool **(Optimeal®)**[2] to find solutions that were **as close as possible to the current diet** in the Netherlands. Any change in the current diet contributed to a penalty (**Figure 2**). All solutions met a comprehensive set of dietary requirements (energy, macro- and micro-nutrients). As a metric for environmental impact we used a single score (*p*ReCiPe), based on the ReCiPe method[3], commonly used in Life Cycle Assessment (LCA). LCAs of all 207 included foods were modelled **Cradle to Grave** by ourselves.

Results & Discussion

The current average diet in the Netherlands does not meet all nutrient requirements. Therefore, the composition changes after initial optimization (**Table 1**). **The closest healthy diet had a similar environmental impact as the current diet** in the study group (women 31-50 years). Vegetarian and vegan diets had a reduced environmental impact, but required many changes (**Figure 1**). **The optimal solution for the same environmental target as the vegan diet needed less changes than any of the predetermined scenarios**. Savings are not only found by reducing meat (60% of savings), beverages and goodies, but also by making more sustainable choices within categories. Within the meat category both beef and chicken are reduced, and mainly pork products remain.

Conclusions

We introduce an **innovative and systematic way of developing healthy and sustainable diets**. It is possible to find less restrictive solutions than vegetarian or vegan diets that **satisfy all nutritional requirements and have less environmental impact** than the current diet. Most importantly, these are easier to achieve.

References

1) *Searchinger T, et al. (2013) Creating a Sustainable Food Future - World Resources Institute Report 2013–14: Interim Findings.*
2) *Tyszler M, Kramer G, Blonk H. Comparing apples with oranges: on the functional equivalence of food products for comparative LCAs. Int. J. Life Cycle Assess., Jun 5; 2014*
3) *Goedkoop M, Heijungs R, Huijbregts M, Schryver A De, Struijs J, Zelm R Van. ReCiPe 2008 A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and the endpoint level; First edition (revised). The Hague, The Netherlands; 2013*

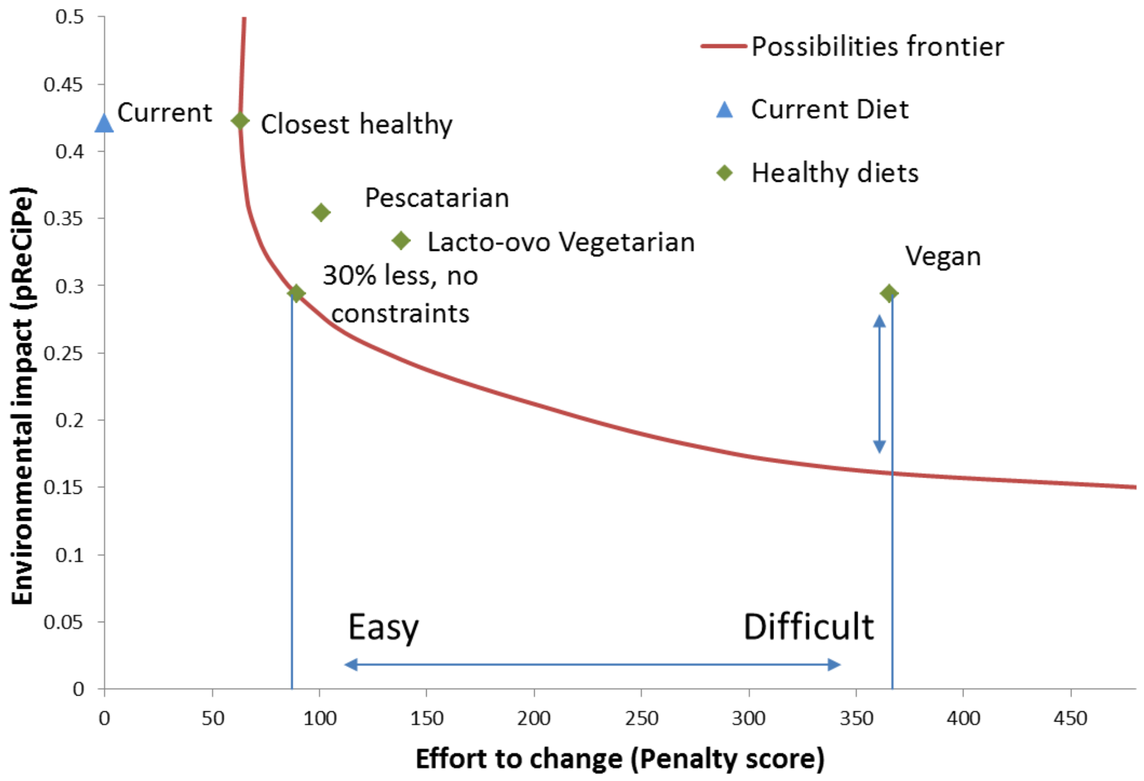

***Figure 1**: Environmental impact of diets in relation to the effort needed to change and reach adequacy. The possibilities frontier marks the border between adequate (healthy) and inadequate diets.*

	Current	Closest healthy	Pescatarian	Lacto-ovo vegetarian	Vegan	30% less
Food groups	*g/day*	*g/day*	*g/day*	*g/day*	*g/day*	*g/day*
Potatoes, pasta, rice, etc.	136	136	136	136	217	136
Bread	145	145	145	145	163	145
Vegetables	139	200	200	200	422	200
Fruit	124	200	200	200	200	200
Dairy	334	313	334	312	0	280
Cheese	38	9	22	21	0	15
Meat	91	83	0	0	0	28
Fish	18	41	80	0	0	40
Egg	11	11	11	50	0	11
Oils, fats, fat spreads	27	27	27	25	22	27
Nuts, seeds	7	11	12	38	2	12
Beverages	1451	1483	1451	1565	1828	1404
Legumes	4	42	92	107	120	70
Meat replacers	0	0	86	50	0	0
Water	794	794	794	794	794	794
Goodies	208	300	142	129	167	259
Environmental indicators						
GHGe ((kg CO2eq)	4	3.6	3.1	2.7	2.4	2.5
Fossil Energy (MJ)	32	36	36	30	31	28
Land Use (m2*a)	4	3.8	2.7	3.1	2.4	2.4
ReCiPe (Pt)	0.42	0.42	0.35	0.33	0.29	0.29
Penalty	0	63.0	100.8	138.2	365.5	89.4

***Table 1**: Quantities of foods in diets and associated environmental indicators and penalty score. Amounts in grams per day for a female of 31-50 years.*

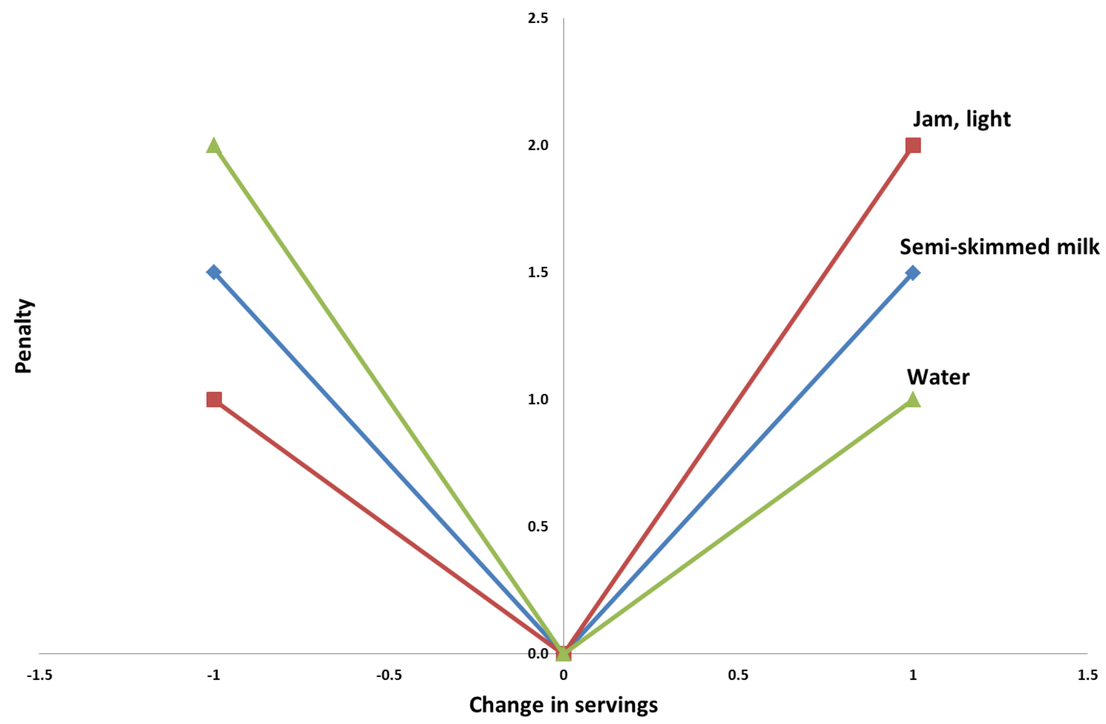

***Figure 2**: Penalty function for 3 products, illustrating that the penalty for increasing or decreasing a serving is directional and depends on popularity*

optimeal
defining sustainable nutrition