**Supplementary material A2 Mixed Integer Linear Programming (MILP) models**

This appendix shows how various types of optimisations can be performed by interchanging the performance indicators in (1), (2), (3). For example, the model

minimise (2) *length*

subject to restrictions

(1) *Pn* ≥ 0.80 for all nutrients *n*

(3) *coveragen* ≥ 0.80 for all nutrients *n*

(4) The food list should not contain overlapping items.

generates the shortest food list with *coveragen* ≥ 0.80 and *Pn* ≥ 0.80 for all nutrients.

In case the objective is to generate a list of at most 60 items of which the lowest among the *N* values of *Pn* is as high as possible the following model applies:

maximise *min\_Pn*

subject to restrictions

(1a) *Pn* ≥ *min\_Pn* for all nutrients *n*

(2) *length* ≤ 60 for all nutrients *n*

(4) The food list should not contain overlapping items

in which *min\_Pn* is the lowest among the *N* values of *Pn*. This is a so-called maxmin model(1).

In case the objective is to generate lists of which the minimum*n*() is as high as possible it can be useful to apply an iterative improvement procedure on the generated lists. This improvement procedure aims to improve the minimum*n*() by adding lower bound constraints with respect to the *Pn* of the nutrient that has lowest .We will demonstrate this with an example in which food lists of *length* 20 are generated with the following model and *pj,n* = :



subject to restrictions



(4)    The food list should not contain overlapping items.

The  of the resulting food list ranges from 60.5%-78.7%, so minimum*n*() = 60.5%. The nutrient with lowest  is polyunsaturated fat. In the food list the *P*polyunsaturatedfat is 0.586. Therefore we add nutrient specific constraint (5a)

(5a) *P*polyunsaturatedfat ≥ 1.01∙0.586 = 0.592

to the model, generate a second food list, and calculate its values of . It turns out that the of this second food list ranges from 61.0%-76.6%, so minimum*n*() = 61.0%, which is higher than that of the initial food list. Again the nutrient with lowest  is polyunsaturated fat. In the second food list the *P*polyunsaturatedfat is 0.597. Therefore we add nutrient specific constraint (5b)

(5b) *P*polyunsaturatedfat ≥ 1.01∙0.597 = 0.603

to the model, generate a third food list, and calculate its values of . It turns out that the of this third food list ranges from 63.6%-78.0%, so minimum*n*() = 63.6%, which is higher than that of the second food list. Now mono- and disaccharides has lowest . In the third food list the *P*mono-anddisaccharides = 0.548. Therefore we add nutrient specific constraint (5c)

(5c) *P*mono-anddisaccharides ≥ 1.01∙0.548 = 0.553

to the model, generate a fourth food list, and calculate its values of . It turns out that the minimum*n*() of this fourth food list does not exceed 63.6%, and therefore we stop the iterative improvement procedure.

1. Claassen GDH, Hendriks THB & Hendrix EMT (2007) *Decision science : theory and applications*. Wageningen: Wageningen Academic Publishers.