

# Validation of the hierarchical classification of food by the SENS\* nutrient profiling system using nutritionally adequate diets designed with individual diet modelling.

\*Système d'Etiquetage Nutritionnel Simplifié [Simplified nutritional labelling system]

Matthieu Maillot<sup>1</sup>, Nicole Darmon<sup>2</sup>

<sup>1</sup> MS-Nutrition, Marseille; <sup>2</sup> UMR NORT INRA/INSERM/AMU, Marseille

## INTRODUCTION

Nutrient profiling systems are expected to classify individual foods according to their contribution to healthy and nutritionally adequate diets.

The SENS is a 4-classes nutrient profiling system proposed as a basis for a simplified labelling system. It is derived from the SAIN, LIM system initially developed by the French Food Standard Agency.

## OBJECTIVE

Validating the SENS nutrient profiling system by examining its ability to classify foods in a hierarchical order, according to the foods' contribution to nutritionally adequate diets.

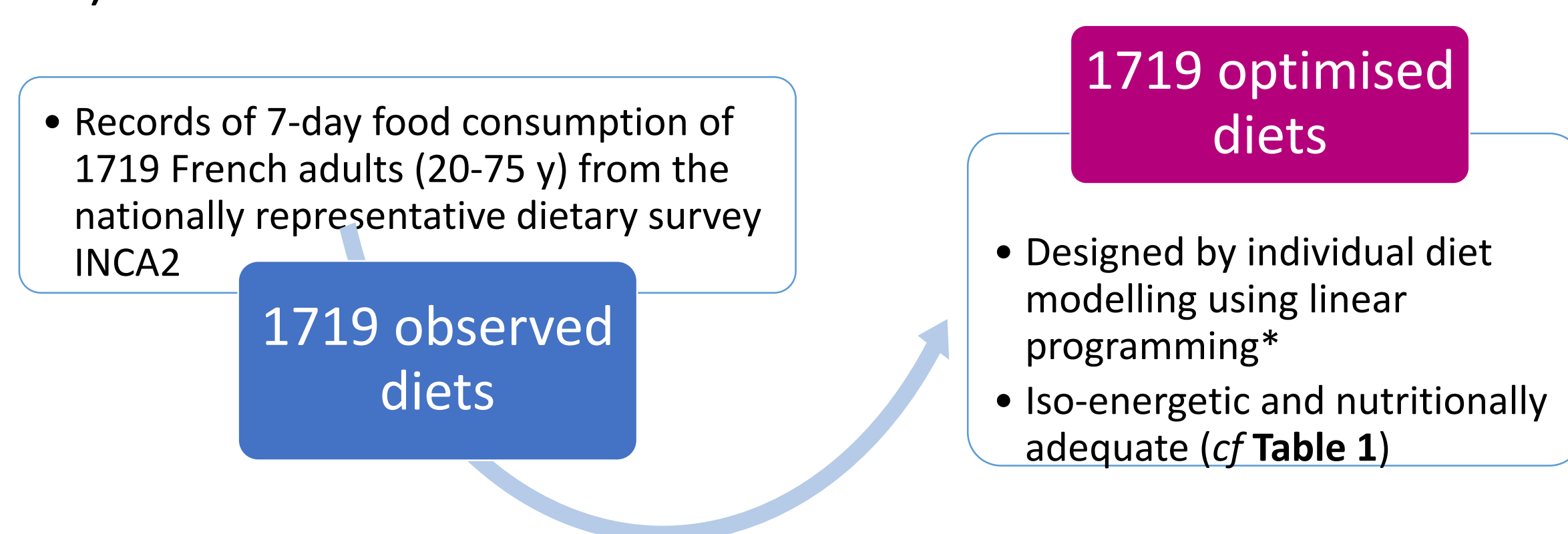
## MATERIALS AND METHODS

### Classification of foods according to the SENS nutrient profiling system

- The 1192 foods of the French food composition database were assigned into the 4 classes defined by the SENS (**Figure 1**).
- Foods were distributed into 4 classes, from the most (Class-1) to the least (Class-4) favourable profile.

### Modelling nutritionally adequate individual diets

- For each of the 1719 observed diet, an optimized diet (*i.e.* iso-energetic, nutritionally adequate and as close as possible from the subject's observed food choices) was designed with individual diet modelling.
- Each optimized diet fulfilled the WHO recommendations for proteins, total carbohydrates, free sugars (<10% of total energy), total lipids, saturated fatty acids (SFA, <10% of total energy), cholesterol and essential fatty acids), the Nordic recommendation for sodium, and the French recommendations for fibers, 10 vitamins, 9 minerals (**Table 1**).



\* Maillot et al. AJCN 2009, Individual diet modeling translates nutrient recommendations into realistic and individual-specific food choices

### Classification of foods by the SENS system: analysis of the hierarchy

- The contribution of foods from the four SENS classes to total energy was assessed before and after the optimisation process, for each individual diet.
- Hierarchy was tested with the hypothesis that Class-1 should increase, Class-2 increase or stagnate, and classes 3 and 4 decrease (more strongly for Class-4).

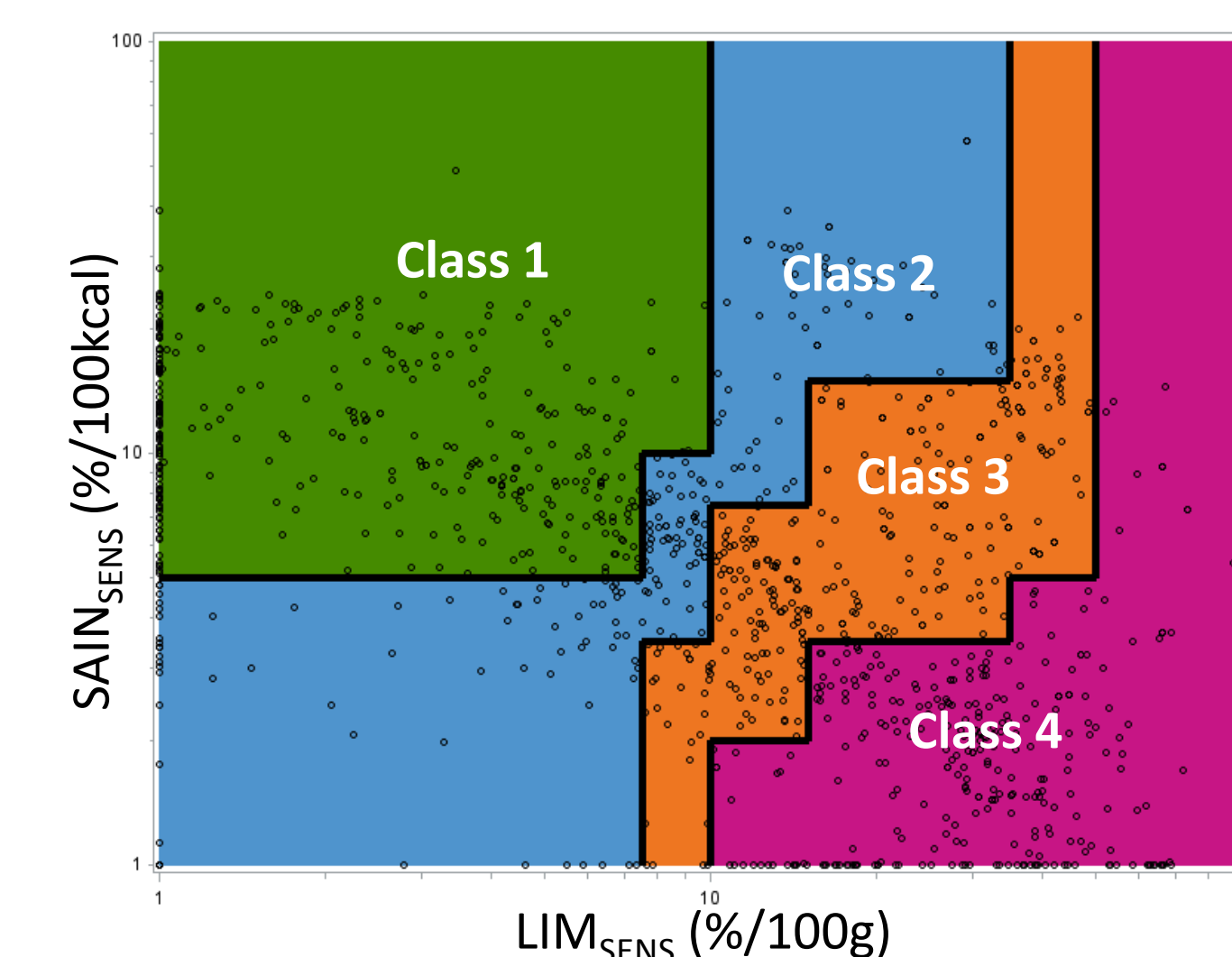


Figure 1. The four SENS classes

Table 1. Nutritional constraints reached in all optimised diets

Nutrients	Values	References
H2O, mL/d	≥ 2500 (H); ≥ 2000 (F)	EFSA
Proteins, g/kg/d	≥ 0.83	France
Total lipids, % energy	20 - 35	WHO
Total carbohydrates, % energy	50 - 75	WHO
Cholesterol, mg/d	≤ 300 or ≤ observed intake <sup>1</sup>	WHO
Alpha Linolenic Acid, % energy	2.5 - 9	WHO
Linoleic Acid, % energy	≥ 0.5	WHO
DHA +EPA, g/d	≥ 0.25	WHO
Omega-3, % energy	0.5 - 2	WHO
Polyunsaturated fatty acids, % energy	6 - 11	WHO
Saturated fatty acids, % energy	≤ 10 or ≤ observed intake <sup>1</sup>	WHO
Free sugar, % energy	≤ 10 or ≤ observed intake <sup>1</sup>	WHO
Sodium, mg/d	≤ 2759 (M) ; ≤ 2365 (W) or ≤ observed intake <sup>1</sup>	NNR <sup>2</sup>
Fibres, 10 vitamins, 9 minerals	≥ EAR <sup>3</sup> or ≥ observed intake <sup>3</sup> or ≥ RDA <sup>3</sup>	FRANCE

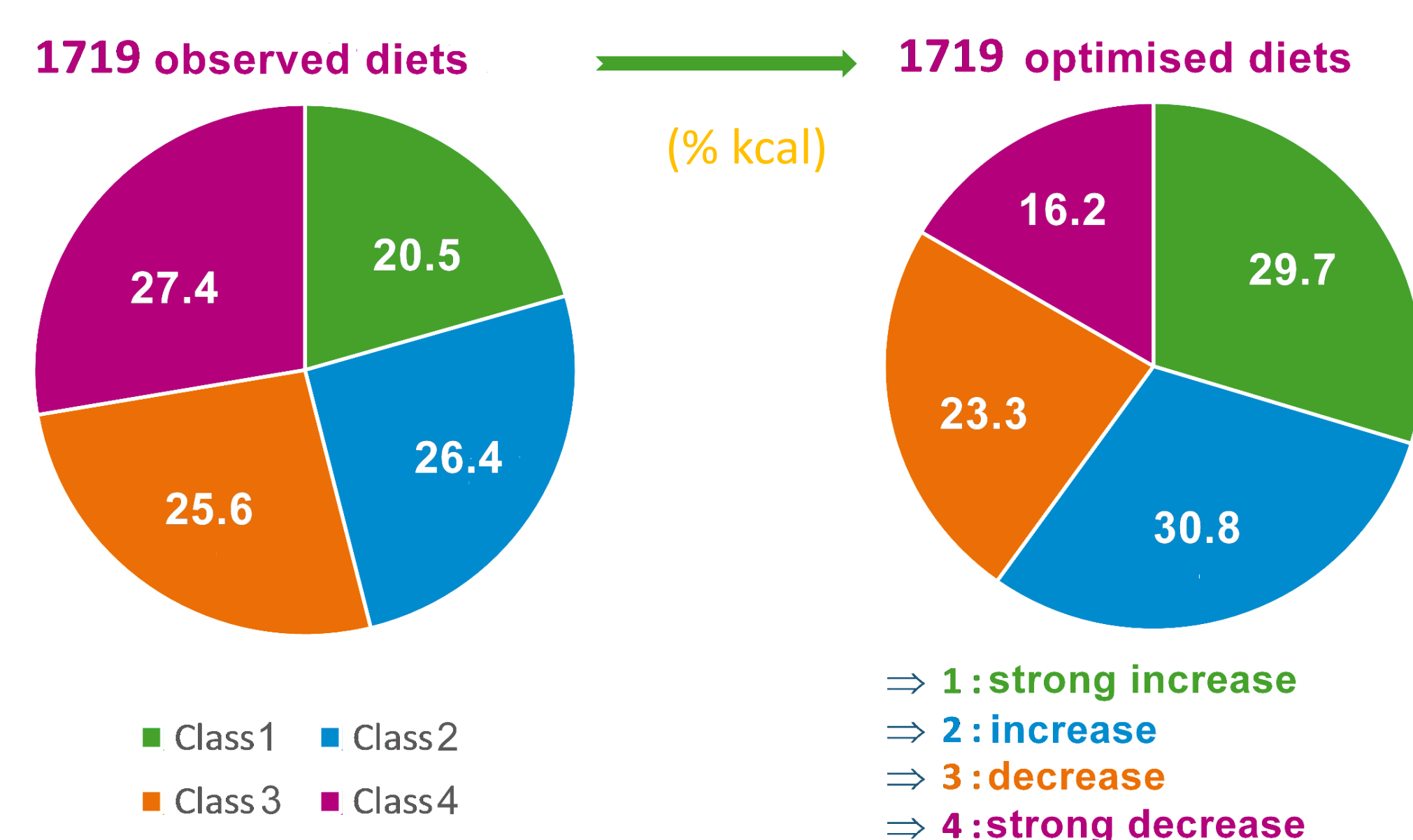
<sup>1</sup> Observed intake was used as a maximum limit when it was inferior to the recommendation.

<sup>2</sup> Nordic Nutrient recommendations

<sup>3</sup> The value of the constraint (minimal nutrient quantity imposed in the model) depended on the observed intake of this nutrient: EAR if observed intake < EAR; observed intake if EAR < observed intake < RDA and RDA if observed intake > RDA.

## RESULTS

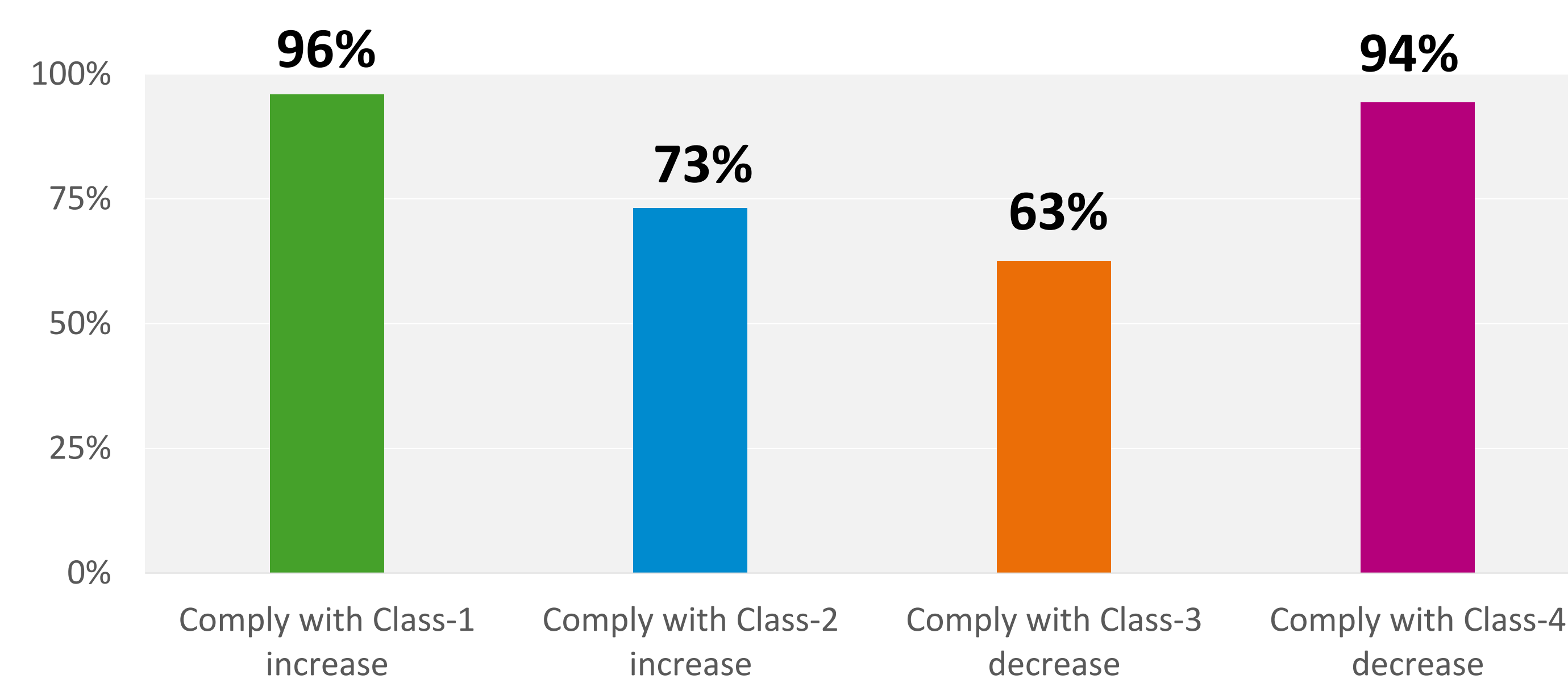
### Average contribution to total dietary energy of foods from the four SENS classes, BEFORE and AFTER nutritional optimisation



On average, the optimization induced:

- a 9.2 points increase of energy from Class-1 foods (20.5% vs 29.7% in observed vs optimized diets,  $p < 0.001$ ),
- a 4.4 points increase from Class-2 foods (26.4% vs 30.8%,  $p < 0.001$ ),
- a 2.3 points decrease from class-3 foods (25.6% vs 23.3%,  $p < 0.001$ )
- and a 11.2 points decrease from Class-4 foods (27.4% vs 16.2%,  $p < 0.001$ ).

### Percentage of diets complying with the hypotheses of energy optimisation-induced increase for classes 1 and 2 and decrease for classes 3 and 4.



The optimization-induced increase of energy from Class-1 and Class-2 was verified for 96% and 73%, respectively, of the adult sample ;

The optimization-induced decrease of energy from Class-3 and Class-4 was confirmed for 63% and 94%, respectively .

## CONCLUSION

- The shift in food intakes needed to reach nutritional adequacy -substantial increase, moderate increase, moderate decrease and important decrease of foods from classes 1, 2, 3 and 4 respectively- followed a hierarchical progression according to the four SENS classes.
- The SENS nutrient profiling system is a relevant tool to classify foods in a hierarchical way according to their contribution to nutritionally adequate diets, suggesting that it could be useful in the context of simplified nutritional labelling in Europe.