The Road to Healthy Eating: a new method based on graph theory

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The **Road** to Healthy Eating:
a new **method** based on **graph theory**

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Background:

- healthy diets are defined, which could lower the burden of disease and provide targets for populations.

- these target diets are far removed from current diets, so at best, the population is expected to move slowly along a trajectory.

Objective: **characterize** the different possible **trajectories** toward a **target diet** and identify the **most efficient one** for health.

Methods:

- A **new method** developed using **graph theory**

- A graph with all stepwise change trajectories toward a target healthy diet

- Trajectories all avoiding the risk of nutrient deficiency

- Identified and characterized the trajectory with the highest value for **long-term health**

- The best trajectories were found using the **Dijkstra algorithm** with the Health risk criteria based on epidemiological data.

Results:

- Trajectories that were rather **similar** for males and females regarding the most efficient changes in the first phase of the pathways

- We found that a one-step increase in the consumption of **whole/semi-refined bread** (60 g) was the first step in all healthiest trajectories.

- For males, the subsequent decrease in **red meat** was immediately preceded by increases in **legumes**.
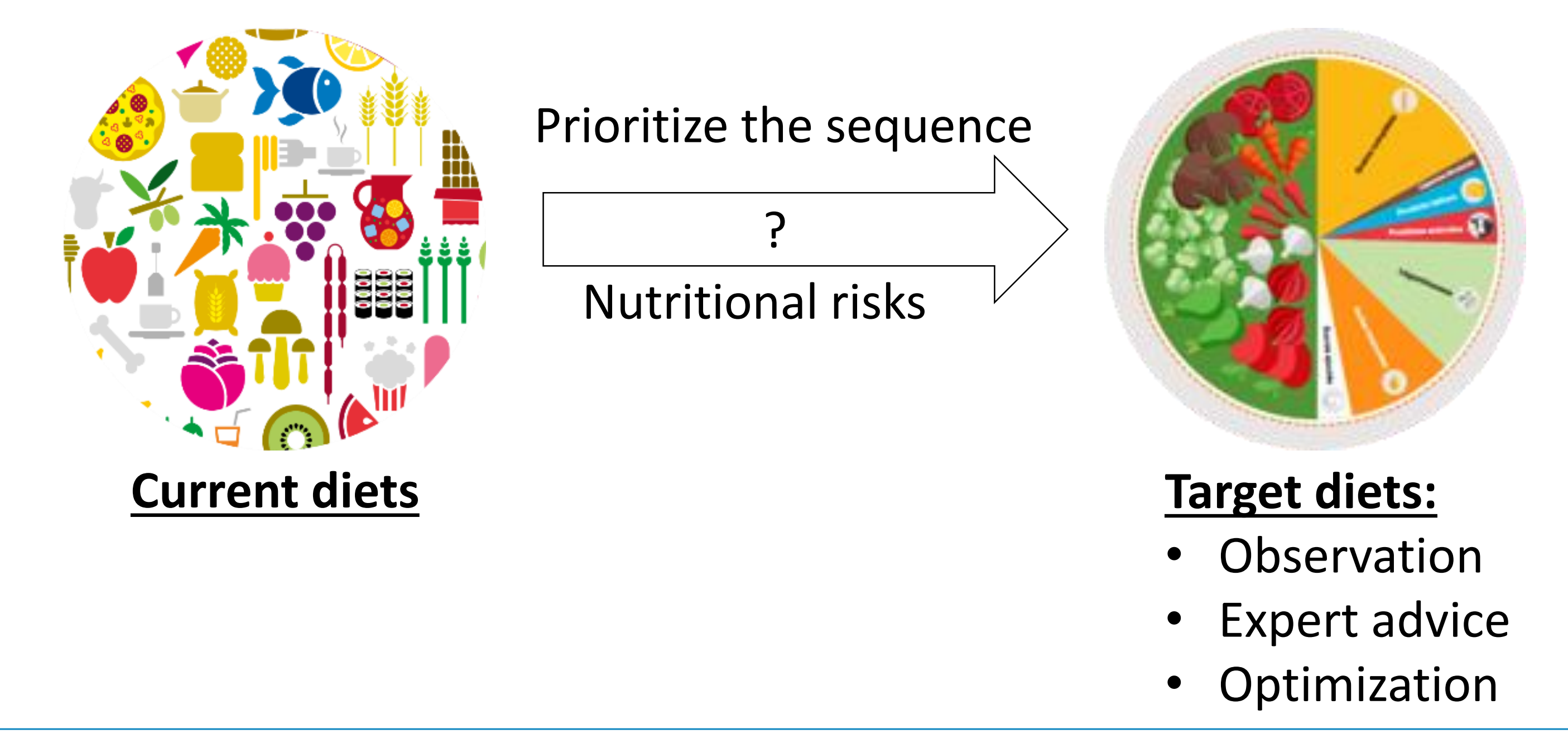
Conclusions:

- We show **simple practical dietary changes** that can be prioritized along an integral pathway that is the most efficient overall for health when **transiting** toward a distant healthy diet.

- We put forward a new method to analyze dietary strategy for public health transition and highlight the first critical steps to prioritize.
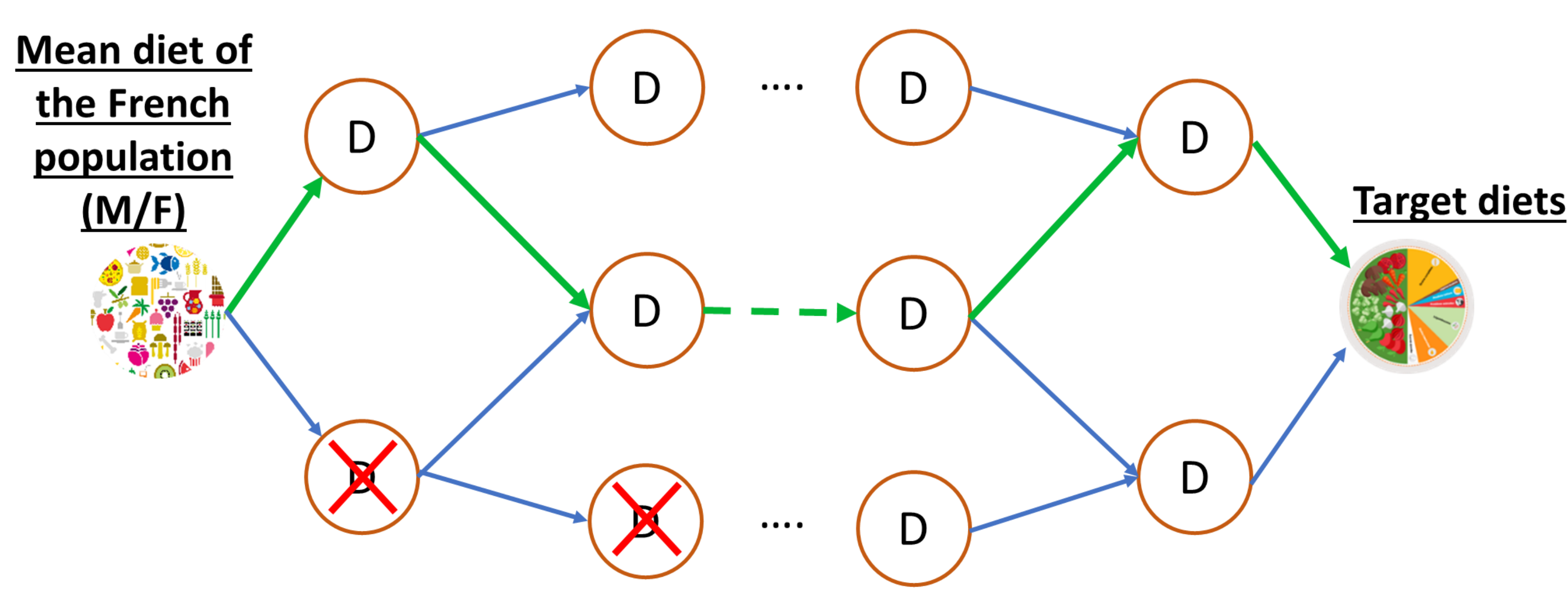
Introduction

➡ Diets have a strong impact on health and the environment
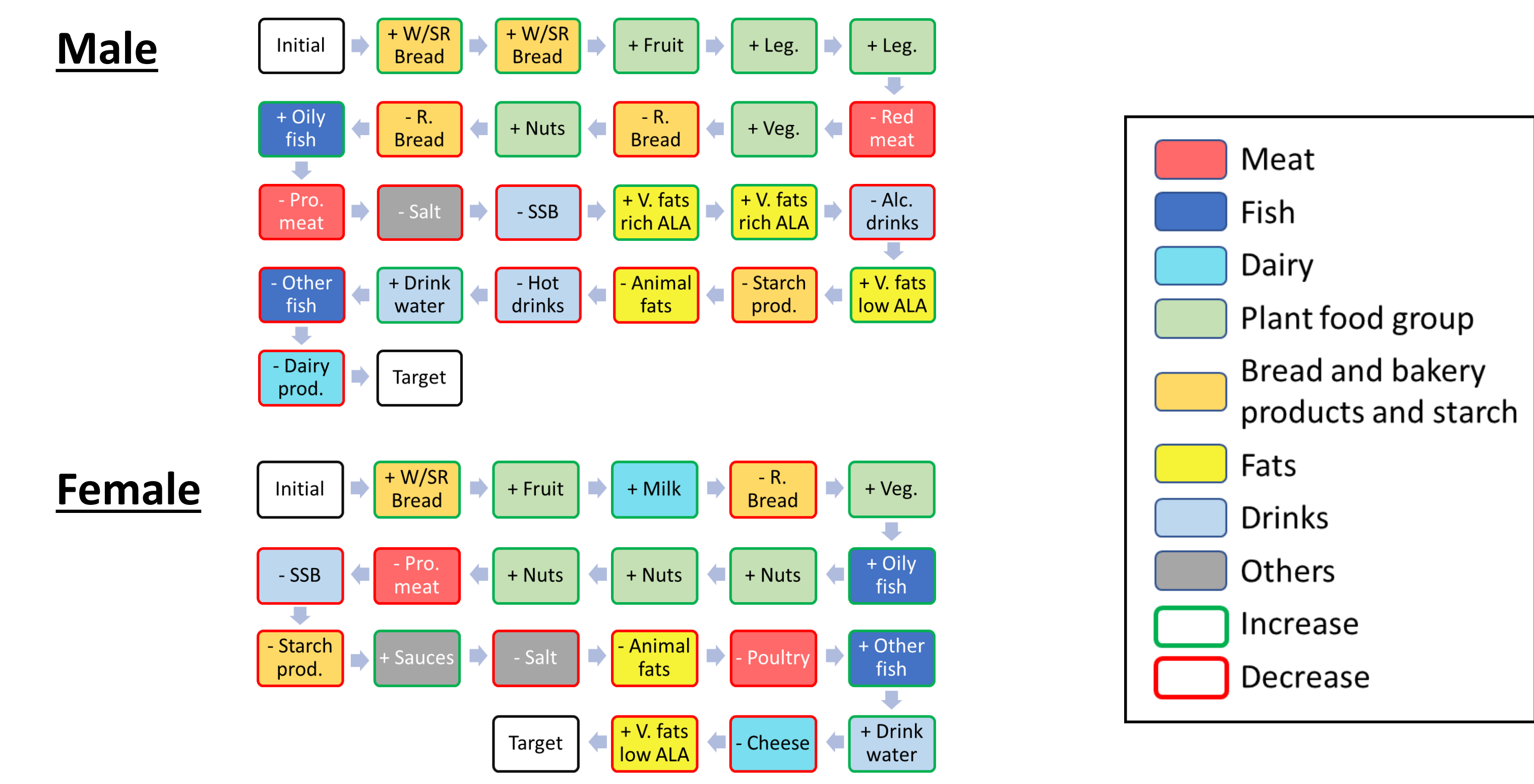
➡ Target diets have been identified.

Prioritize the sequence
?
Nutritional risks

Current diets

Target diets:
- Observation
- Expert advice
- Optimization

Methods

Optimization criteria:
Health score: TMREL, DALYs

Mean diet of the French population (M/F)

Target diets

Graph theory
- Ⓓ Diet: vector of 33 food groups
- ↗ Dietary change: 1 portion step

- ➡ Optimal trajectory
- ✗ Constraint application

Results

Male

Initial	+ W/SR Bread	+ W/SR Bread	+ Fruit	+ Leg.	+ Leg.
+ Oily fish	- R. Bread	+ Nuts	- R. Bread	+ Veg.	- Red meat
- Pro. meat	- Salt	- SSB	+ V. fats rich ALA	+ V. fats rich ALA	- Alc. drinks
- Other fish	+ Drink water	- Hot drinks	- Animal fats	- Starch prod.	+ V. fats low ALA
- Dairy prod.	Target				

Female

Initial	+ W/SR Bread	+ Fruit	+ Milk	- R. Bread	+ Veg.
- SSB	- Pro. meat	+ Nuts	+ Nuts	+ Nuts	+ Oily fish
- Starch prod.	+ Sauces	- Salt	- Animal fats	- Poultry	+ Other fish
	Target	+ V. fats low ALA	- Cheese	+ Drink water	

Legend:
- 🟥 Meat
- 🟦 Fish
- 🟦 Dairy
- 🟩 Plant food group
- 🟧 Bread and bakery products and starch
- 🟨 Fats
- 🟦 Drinks
- ⬜ Others
- ▭ Increase
- ▭ Decrease

Best trajectory identified based on the Health Risk Criterion, which uses estimates from the Global Burden of Disease.

Conclusion

➡ Trajectories are similar for males and females

➡ Importance of the consumption of whole/semi-refined bread

➡ Simple practical dietary changes that can be prioritized

➡ A new method to analyze dietary transitions

The study:

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