

INTRODUCTION

Food processing is scrutinised for its perceived role in poor nutritional quality, leading to a demonization of processed foods. Branded Food Datasets (BFDs) provide nutritional data on packaged foods, enabling more nuanced evaluations. This study aims to develop a harmonised dataset of packaged foods from Greece and Slovenia to assess their degree of processing and nutritional quality to support the design of evidence-based strategies for a healthier food system.

METHODOLOGY

Data Collection

Data from 5,099 food products across 13 product categories (Table 1) with reformulation potential were collected from major supermarkets in Greece and Slovenia using the Composition and Labelling Information System tool. This tool consists of a mobile application for photo collection interconnected with an online software for data curation and storage. The dataset included information on product description (brand name, manufacturer), nutritional composition per 100g/ml and ingredients.

Table 1: Number of products in each subcategory per country

Subcategory	Greece (N)	Slovenia (N)
Breakfast cereals	159	483
Desserts	134	362
Energy drinks	43	141
Flavoured yogurt	87	387
Flavoured yogurt drinks	15	138
Juices	132	348
Milk	94	154
Milk drinks	38	65
Milk imitates	84	187
Nectars	61	216
Plain yogurt	138	272
Soft drinks	406	891
Yogurt imitates	20	44
Total	1411	3688

Data analysis

To enable the nutritional comparison of products within the same food category we used Nutri-Score algorithm 2023. Nutri-Score employs a five-grade, color-coded ranking scale from dark green (A, most favourable composition) to dark orange (E, less favourable composition) corresponding to a total score derived by subtracting positive component points (the content of fruits, vegetables, legumes, and oils in specific food categories, e.g. fats, nuts and seeds, dietary fiber, and protein) from negative component points (total sugars, saturated fat, and sodium).

We used the NOVA system to categorise foods based on the extent and purpose of processing:

- NOVA 1: Unprocessed or minimally processed foods (e.g. fresh milk, plain yogurt)
- NOVA 2: Processed culinary ingredients (e.g., sugar, oils)
- NOVA 3: Processed foods (e.g., cheese, bread)
- NOVA 4: Ultra-processed foods (UPFs) – industrial formulations often containing additives, colorants, artificial flavorings, and cosmetic ingredients not used in home cooking.

Companies were classified based on available business registry data and grouped into two categories:

- micro, small, and medium-sized enterprises (MSMEs)
- big enterprises (BE)

RESULTS-DISCUSSIONS

Most packaged products in both countries were classified as NOVA4 (ultra-processed). In juices, nectars, milk imitates, and plain yogurt, Slovenia had a higher share of less processed products (NOVA1/3), whereas Greece presented more ultra-processed products (NOVA4). Conversely, milk products in Greece were less processed than in Slovenia. Ingredients that often shift products between NOVA levels in these categories include different types of sugars (e.g., added sucrose typically aligns with NOVA 3, while glucose-fructose syrup is associated with NOVA 4), fortification ingredients (e.g., added vitamins and minerals, which classify products as NOVA 4), added fats (e.g. cream in yogurt places it in NOVA 3, while plain yogurt without cream is NOVA 1), added proteins (especially in plain yogurts, where added protein results in NOVA 4) and specific additives (such as emulsifiers in milk imitates, which may differentiate NOVA 3 from NOVA 4).

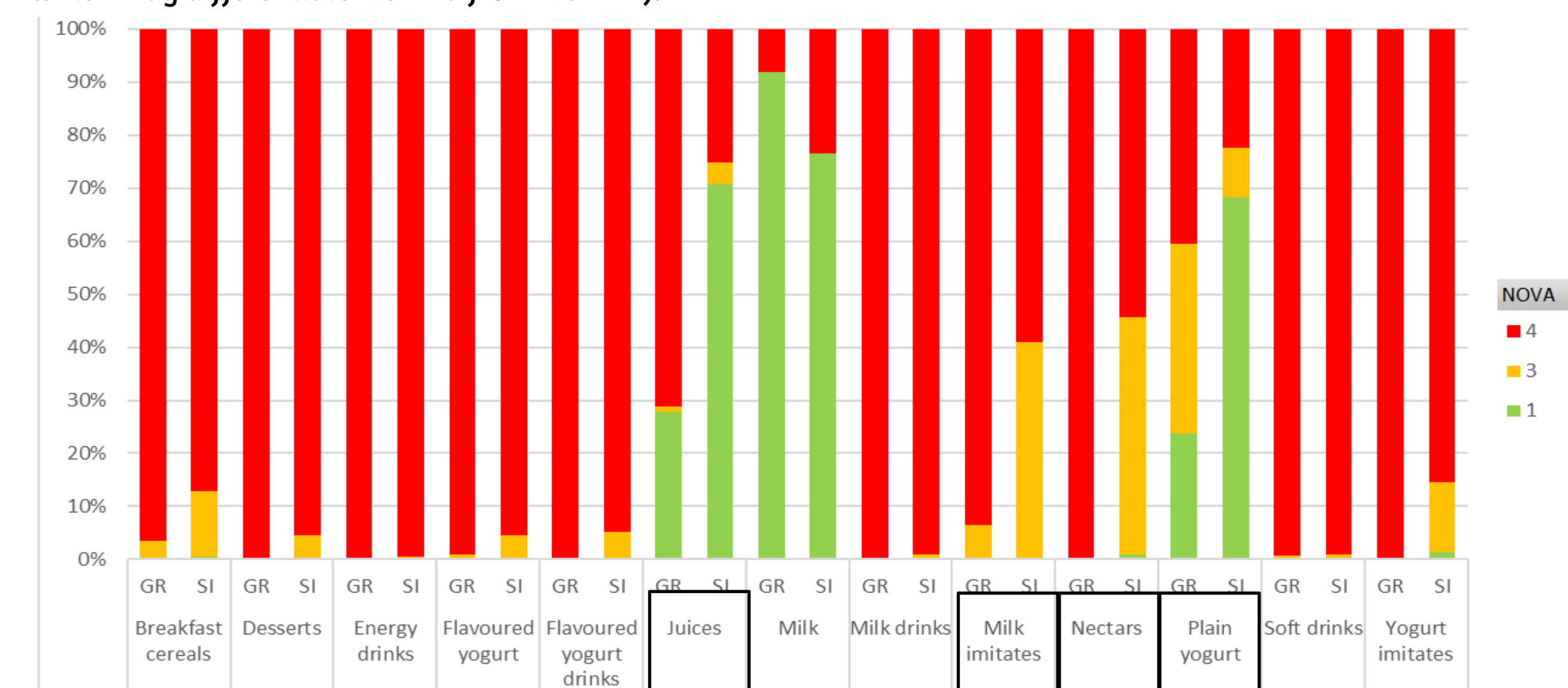


Figure 1: Distribution of products into NOVA groups in Greece and Slovenia

Nutri-Score analysis showed more favourable scores (A-B) for flavoured yogurts and milk drinks in Greece, while Slovenia's yogurt imitates scored better. Most of the observed variation is likely due to differences in consumer preferences and dietary habits, which are reflected in the available product offerings in each country, but also due to slightly different samplings.

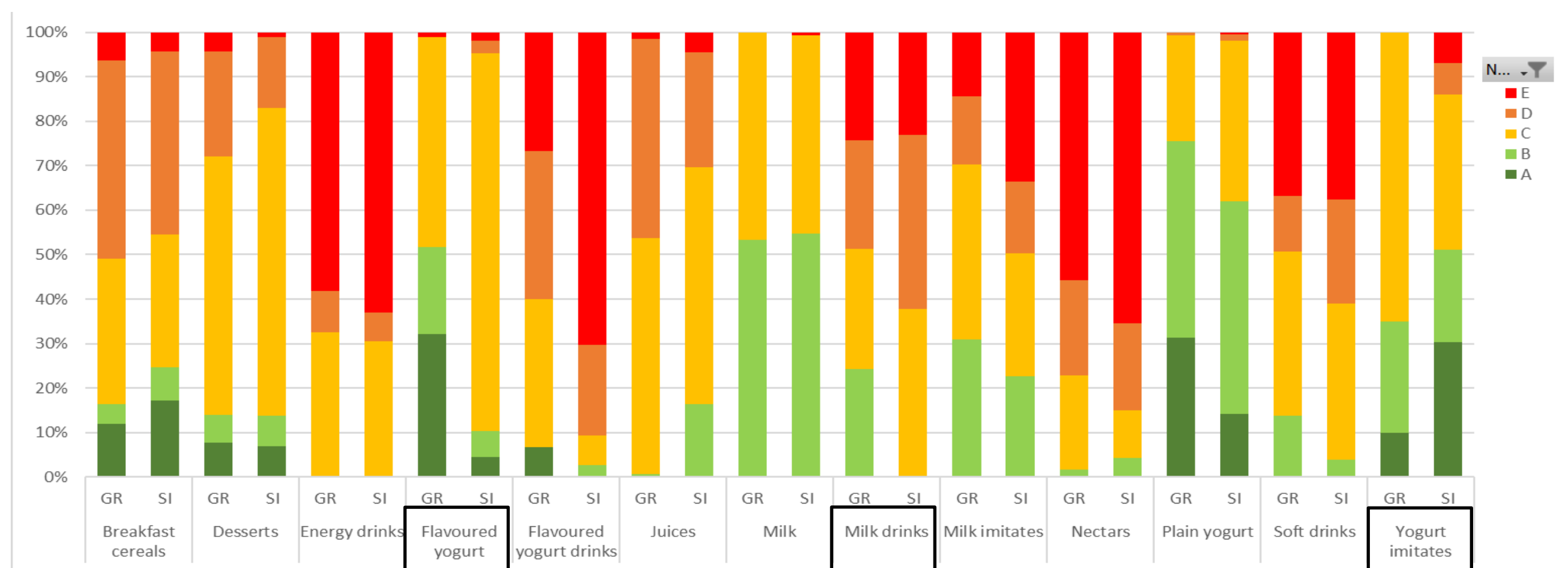


Figure 2: Distribution of products into Nutri-Score grades in Greece and Slovenia

Products marketed by MSMEs were less likely to fall into more processed categories (NOVA3 and 4), particularly in categories such as breakfast cereals, juices, and plain yogurts. However, products marketed by MSMEs were more likely to fall into less healthy Nutri-Score categories (C-E range). The difference was most noticeable in flavoured yogurts, desserts, and milk imitates. While MSMEs are often limited by technological and economic constraints, they may also use simpler or more traditional processing methods, resulting in lower NOVA classifications. However, despite being less processed, these products can still have less favourable Nutri-Score ratings, due to higher levels of sugar, saturated fats, or salt, which are directly penalised in the Nutri-Score algorithm. Big enterprises typically operate in more competitive and regulated environments, where reformulation is part of broader strategies tied to branding, front-of-pack labelling (e.g., aiming for Nutri-Score A or B), and public health commitments.



Figure 3: Distribution of products into NOVA grades between Big Enterprises (BE) and Micro, Small, and Medium-sized enterprises (MSMEs).

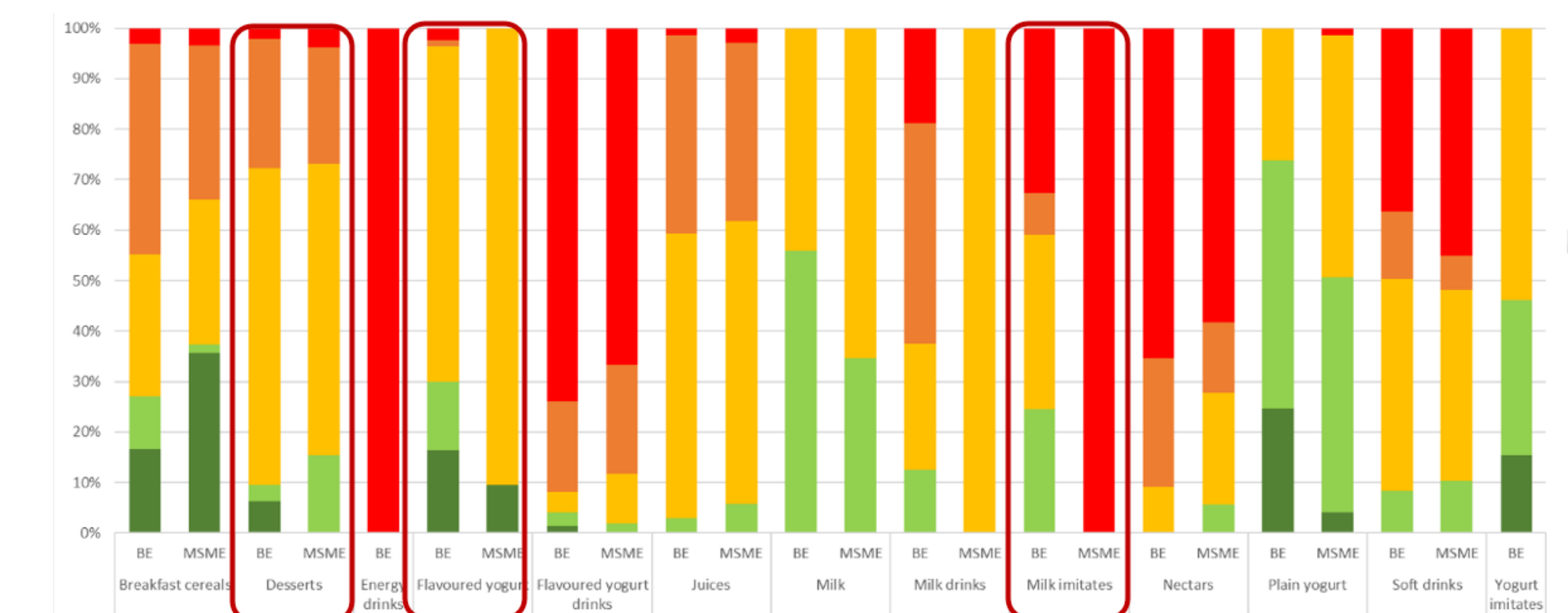


Figure 4: Distribution of products into Nutri-Score grades between Big Enterprises (BE) and Micro, Small, and Medium-sized enterprises (MSMEs).

CONCLUSION

Cross-country and enterprise-level differences highlight opportunities for targeted reformulation and innovation, while similarities underscore persistent challenges in reducing ultra-processed foods.