

**Title:** Development of a Nutrient Profile Model for Processed Foods in Japan: A Localization Strategy Reflecting Nutritional Standards and Food Culture

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**Abstract:**

While numerous nutrient profile models (NPMs) are utilized globally, Japan lacks an official system for evaluating the nutritional quality of individual food products. To address this gap, we developed the "Nutrient Profile Model for Processed Foods in Japan version 1.0" (NPM-PFJ (1.0)), specifically tailored to Japanese food culture and nutritional policies. This developmental process was structured into a three-step localization of the Health Star Rating (HSR) system.

First, the HSR system was selected as the reference model based on nutritional, practical, and methodological perspectives. Its transparent and traceable scoring algorithm provided a robust numerical basis for adaptation to national recommendations. Furthermore, the HSR evaluation unit (per 100 g or 100 mL) is particularly well-suited to the Japanese context, where publicly standardized serving sizes have not yet been established.

Second, we revised the reference values for the scoring algorithm. Nutrient components—including energy, saturated fat, total sugars, sodium, protein, and dietary fiber—were adapted for alignment with Japanese standards, specifically the Dietary Reference Intakes (DRIs) for Japanese (2020) and the national health goals of "Health Japan 21 (third term)." Validation analysis revealed a strong correlation between the final scores of NPM-PFJ (1.0) and the HSR system ( $r = 0.939$ ,  $p < 0.01$ ), ensuring international comparability.

Third, hierarchical cluster analysis was employed to define six unique food categories representative of the Japanese diet. This data-driven approach identified culturally specific food groups, such as high-sodium traditional foods (e.g., pickled vegetables and dried seafood), enabling the establishment of realistic reformulation targets within these clusters. NPM-PFJ (1.0) provides a transparent, evidence-based framework that assists manufacturers to enhance the nutritional quality of their products.

This localization process—optimizing a global framework through the integration of national dietary data—may serve as a potential template for other Asian countries seeking to implement their own culturally relevant nutrient profiling systems.