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Original Research

Distribution of Sugar Content in Chinese Pre-Packaged Foods

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Abstract

Background: Sugar intake from pre-packaged foods has increased continuously in China and is strongly associated with a range of adverse health outcomes. However, comprehensive data on the sugar content of the pre-packaged food supply in China remains limited. **Objective:** This study aimed to provide a comprehensive evaluation of the sugar content of Chinese pre-packaged foods. Samples were collected across 29 provincial-level administrative regions by the National Institute for Nutrition and Health (NINH, China CDC) from 2017 to 2024. Additionally, sugar content was compared with international data sourced from the national food composition databases of the United States, France, and Australia. **Methods:** A total of 743 Chinese pre-packaged food samples and 2852 international samples were included in the analysis. Descriptive statistics, including the median, interquartile range (IQR), and range, are used to describe the distribution of sugar across different food categories. **Results:** Within the snack food category, high sugar levels were identified in confectionery (46.6 g/100 g) and preserved fruits (44.2 g/100 g), followed by biscuits (37.0 g/100 g), Western pastries (26.7 g/100 g), and Chinese pastries (25.9 g/100 g); conversely, red meat, poultry, and seafood exhibited the lowest sugar concentrations, ranging from 0.6 to 1.0 g/100 g. Dairy products and solid beverages exhibited median sugar levels of 4.9 g/100 g and 15.1 g/100 g, respectively. Furthermore, 61.6% of the snack foods analyzed in this study were classified as high insugar according to the UK traffic light system. **Conclusion:** Certain categories of pre-packaged foods in China contain relatively high levels of sugar. Raising public awareness and promoting reduced consumption of such products are warranted, alongside further monitoring and reformulation efforts.

Keywords: pre-packaged food; sugar content; nutrient content

1. Introduction

The Report on Nutrition and Chronic Disease Status of Chinese Residents (2020) shows that the prevalence of overweight and obesity among Chinese adults stood at 34.3% and 16.4%, respectively [1]. The prevalence of diabetes has risen since 2015 [1]. Substantial evidence suggests that excessive sugar intake is associated with various adverse health outcomes [2,3,4], including cardiovascular diseases [5,6], obesity [7,8,9], type 2 diabetes [10,11], dental caries [12,13,14], dyslipidemia [15] and various cancers [3].

In addition to sugar quantity, carbohydrate quality has also been proposed as a relevant dietary dimension for cardiometabolic health; a recent systematic review and meta-analysis suggested that higher carbohydrate quality index may be inversely associated with several cardiometabolic risk factors, although the pooled evidence remains insufficient for firm conclusions [16]. The World Health Organization (WHO) recommends limiting free sugar intake to less than 10% of total energy intake, while suggesting a further reduction to below 5% for additional health benefits [17]. In 2019, the Healthy China Initiative, launched by China's National Health Commission, recommended that daily per capita added sugar intake be limited to no more than 25 g, representing less than 5% of total energy intake [18]. The Dietary Guidelines for Chinese Residents (2022) recommend that daily added sugar intake for adults be limited to less than 50 g, and ideally below 25 g [19]. A report released by the China National Center for Food Safety Risk Assessment indicates that culinary sugar, sweetened dairy products, baked goods, and beverages are the four primary sources of daily sugar intake among urban residents in China [20]. Driven by the rapid expansion of the food industry and growing disposable incomes, consumption of pre-packaged foods has risen markedly [21]. Consequently, pre-packaged products with high-sugar content [20,21,22] have become dietary staples for the Chinese population [23].

However, published data on the sugar content in Chinese pre-packaged foods remain limited, hindering consumers from making informed dietary choices [22]. To address this, the newly updated National Food Safety Standard: General Rules for Nutrition Labeling of Pre-packaged Foods mandates the inclusion of sugar and saturated fat, alongside existing requirements for energy, protein, fat, carbohydrates, and sodium [24]. Consequently, the present study utilizes data from the China Food Composition Monitoring Program to evaluate the total sugar content of pre-

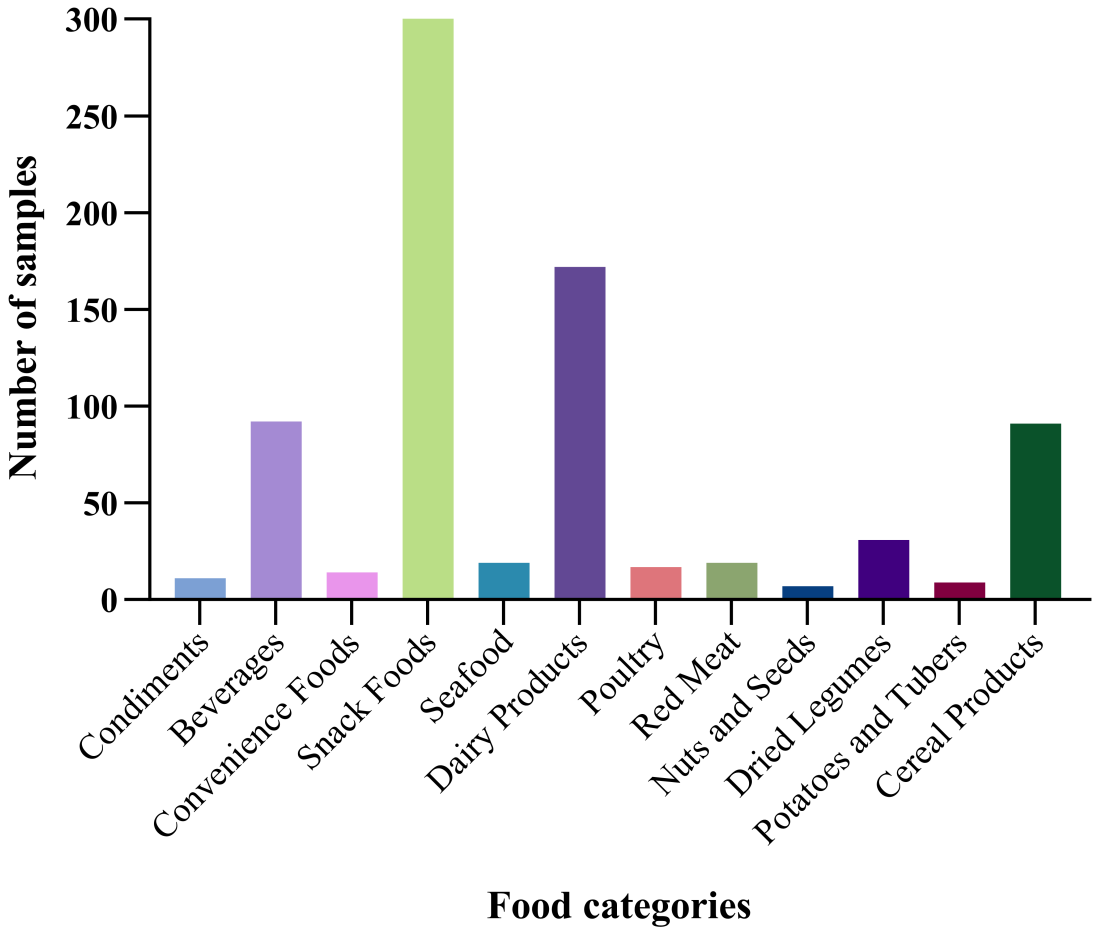

Fig. 1. Distribution of pre-packaged food sample quantities.

packaged foods. This specific focus on total sugar—defined as the sum of all sugars including added sugars—facilitates comparability with international food composition databases. Ultimately, this research aims to provide an evidence-based foundation for food reformulation, the mitigation of chronic disease risks, and the development of targeted public health policies.

2. Materials and Methods

2.1 Collection of Data on Chinese Pre-Packaged Foods

2.1.1 Sample Collection

In accordance with the protocol of the China Food Composition Monitoring Program, laboratories across 29 provincial-level administrative regions conducted sample collection and sugar analysis of pre-packaged foods between 2017 and 2024. Sampling sites, such as markets and supermarkets, were selected from various cities and counties based on high consumer foot traffic and brand diversity. Repeated sampling was performed to ensure the representativeness of samples and minimize sampling errors.

Following sampling, samples were immediately transported to the laboratory for processing. Batches were combined in equal quantities and homogenized, followed by quartering, aliquoting, and frozen storage. Solid samples were pulverized and thoroughly mixed, with 0.5–1.0 g then accurately weighed. For liquid samples, 0.5–1.0 mL was precisely pipetted after thorough mixing. The sugar content was determined via ion exchange chromatography (IEC). The elution procedure was optimized based on previous studies on sugar determination through ion chromatography, and a final protocol with high resolution and stability was established. In this study, total sugar is defined as the sum of all monosaccharides (e.g., glucose, fructose, and galactose) and disaccharides (e.g., sucrose, lactose, maltose) determined via laboratory analysis, with all results expressed as g/100 g.

2.1.2 Sample Classification

In accordance with the Specifications for the Presentation of Food Composition Data (WS/T 464-2015), the National Food Safety Standard for Uses of Food Additives (GB 2760-2024) [25], and the Food Production Licensing Catalog, all sample products were systematically categorized. This classification process integrated multiple factors, including food characteristics, consumption patterns, production processes, formulations, and nutritional profiles. The complete classification scheme, along with

its underlying principles and definitions, is detailed in **Supplementary Table 1**.

Accordingly, the pre-packaged foods were classified into 12 major categories, among these, snack foods, dairy products, beverages, convenience foods and condiments—were further partitioned into specific subcategories. The sample sizes and distribution for each category are illustrated in Fig. 1.

2.2 Data Collection for Pre-Packaged Foods From the United States, France, and Australia

International data were sourced from three authoritative national databases. For the United States, the U.S. Department of Agriculture (USDA) FoodData Central was utilized [26], which provides comprehensive nutrient profiles for various basic and processed foods. For France, the Oqali database [27] was employed, as it encompasses extensive information on the nutritional composition and labeling of the French processed food market. Australia's Food Composition Database [28], an authoritative national food nutrition data resource, was published in 2021. It provides comprehensive information on food nutrition and basic characteristics, laying a solid foundation for the application of nutritional data in Australia's food sector (**Supplementary Table 2**).

The following data fields were extracted: Universal Product Code (UPC), brand name, labeling unit, product description, and sugar content (g/100 g). To ensure categorization accuracy, researchers cross-referenced the food items from each country's original database with the Chinese pre-packaged food classification system. This process ensured that only relevant data were included in the study (**Supplementary Table 3**). The detailed data processing and classification workflow are illustrated in Fig. 2.

2.3 Statistical Analysis

The Kolmogorov-Smirnov test (K-S test) was used to assess the normality of the data. Descriptive statistics, including the median, interquartile range (IQR), and total range, were utilized to characterize the distribution of sugar content (g/100 g) across all subcategories of Chinese pre-packaged foods. The Kruskal–Wallis H test was adopted to compare total sugar levels in similar food categories among China, the United States, France, and Australia. Pairwise post-hoc comparisons were performed with Bonferroni correction to control for Type I errors, with adjusted p-values reported accordingly. Given the unbalanced sample sizes across categories, the potential influence of this disparity on the statistical results was carefully interpreted. All statistical analyses were conducted using IBM SPSS Statistics (Version 26.0, IBM Corp, Armonk, NY, USA). A two-tailed adjusted $p < 0.05$ was considered statistically significant.

3. Results

3.1 Distribution of Sugar Content Across Various Categories of Pre-Packaged Foods in China

Snack foods exhibited the highest median sugar content (30.2 g/100 g), whereas the red meat category recorded the lowest (0.6 g/100 g). The Kruskal - Wallis H test revealed significant variations in sugar content across these categories ($H = 299.334$, $p < 0.001$). Detailed comparisons of sugar concentrations among the various groups are summarized in Table 1.

Table 1. Comparison of sugar content among different pre-packaged food categories.

Food categories	n	Sugar (g/100 g)	
		Median	IQR (P25–P75)
Cereal Products[a]	11	4.3	2.5–29.6
Potatoes and Tubers[a]	9	5.6	0.1–28.0
Dried Legumes[a]	14	0.8	0.0–11.4
Nuts and Seeds[a]	7	4.0	1.5–19.6
Red Meat[acdefg]	22	0.6	0.0–1.6
Poultry[abcdefg]	17	1.0	0.5–1.5
Dairy Products	182	4.9	4.4–7.6
Seafood[adf]	19	0.8	0.3–4.2
Snack Foods	268	30.2	12.5–47.7
Convenience Foods[acdef]	31	1.3	0.3–1.7
Beverages[a]	72	7.6	5.5–9.3
Condiments[adf]	91	2.8	0.5–16.4

Note: Differences were assessed using the Kruskal–Wallis H test, followed by Bonferroni-adjusted pairwise comparisons. Superscript letters denote significant differences ($p < 0.05$) between the marked category and: [a] Snack Foods; [b] Potatoes and Tubers; [c] Dried Legumes; [d] Dairy Products; [e] Cereal Products; [f] Beverages; and [g] Condiments. IQR, interquartile range.

3.2 Sugar Content Distribution in Different Categories of Pre-Packaged Foods

Analysis revealed that sugar content was unevenly distributed across the different pre-packaged food categories. Sugar levels remained consistently low in all subcategories of convenience foods (e.g., oatmeal, frozen rice/noodle products, and fast food), with median values ranging from 0.3 to 1.7 g/100 g. Within the snack foods category, confectionery, preserved fruits, biscuits, and Western pastries emerged as the primary subcategories with high sugar levels (medians: 46.6, 44.2, 37.0, and 26.7 g/100 g, respectively). The sugar content of fermented milk is 9.4 g/100 g; whereas liquid milk and modified milk maintained lower levels (4.6 and 5.0 g/100 g, respectively). In the beverage category, solid beverages recorded the highest sugar content (15.1 g/100 g). For condiments, the sugar/sweeteners subcategory peaked at 72.2 g/100 g. This value serves as a baseline reference to benchmark other packaged foods.

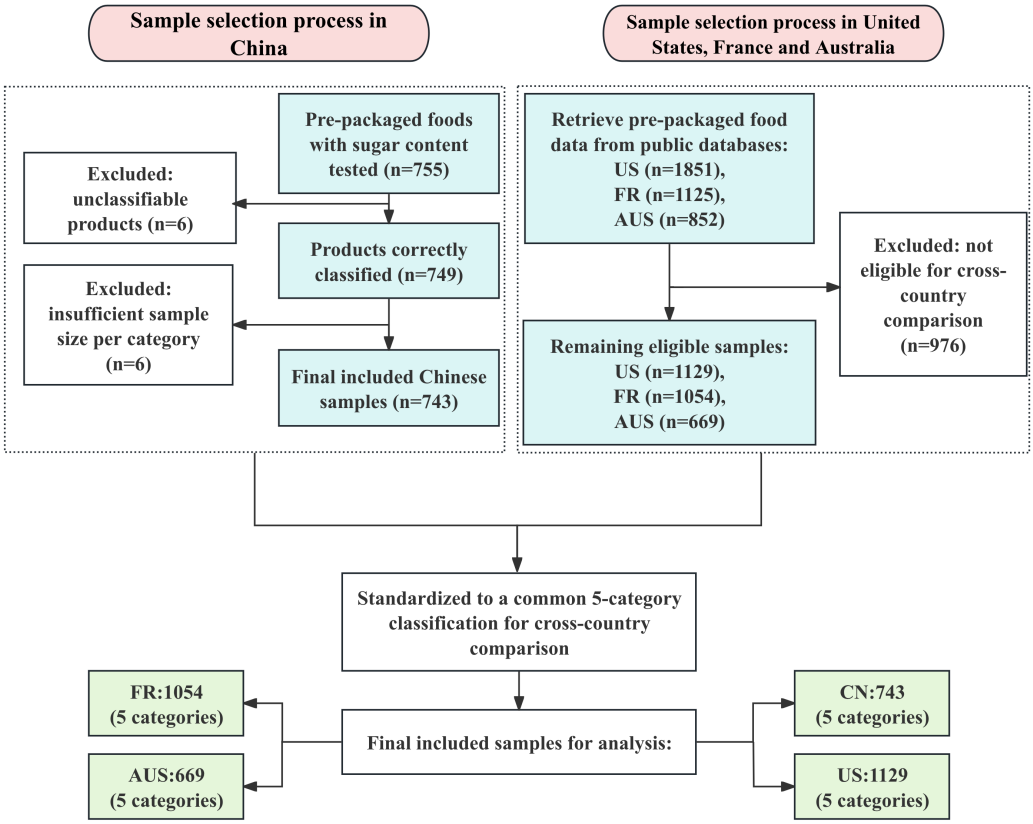

Fig. 2. Flowchart of the sample selection process, encompassing pre-packaged food products from four countries. China (CN), the United States (US), France (FR), and Australia (AUS).

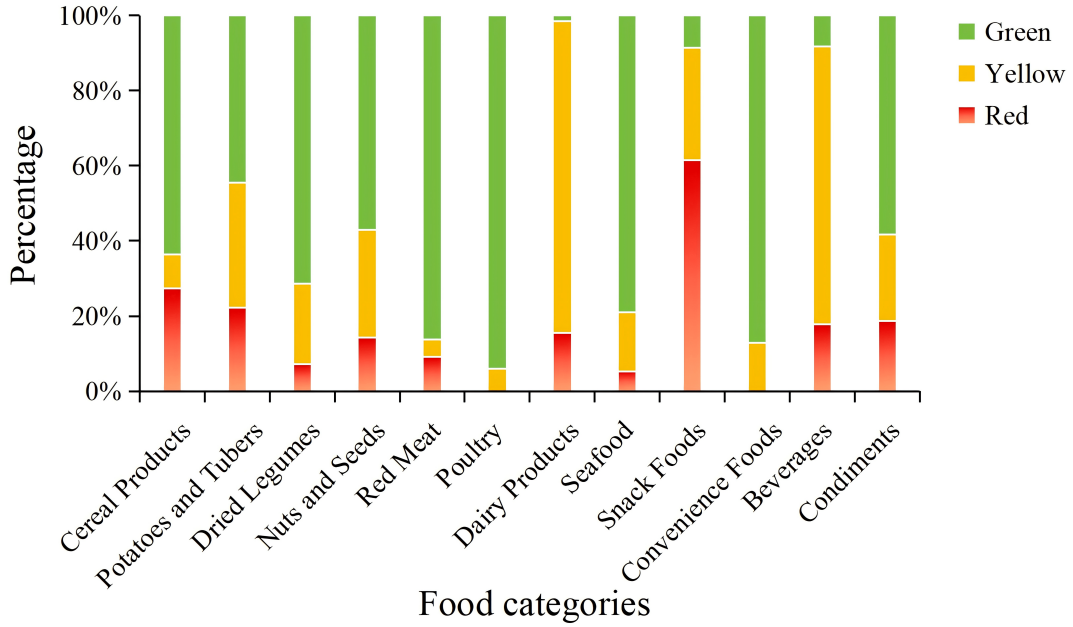

Fig. 3. Classification of sugar content in pre-packaged foods based on the UK Traffic Light labeling system. Green (Low): sugar content ≤5 g/100 g for solids or ≤2.5 g /100 mL for liquids; Yellow (Medium): sugar content >5 g to ≤22.5 g/100 g for solids, or from >2.5 g to ≤11.25 g/100 mL for liquids; Red (High): sugar content >22.5 g/100 g for solids or >11.25 g/100 mL for liquids.

Conversely, savoury dishes (8.4 g/100 g), spices (0.0 g/100 g), and soy sauce (0.2 g/100 g) exhibited significantly lower values. Detailed distributions across all subcategories are summarized in Table 2.

Table 2. Sugar content across specific subcategories of pre-packaged foods.

Food categories	Subcategories	*n*	Sugar (g/100 g)		
			Median	IQR (P25–P75)	Range
Convenience Foods	Oatmeal	14	1.5	1.3–1.9	0.9–5.6
	Frozen rice and noodle products	7	1.7	0.1–15.4	0.0–17.6
	Fast foods	10	0.3	0.2–0.8	0.2–2.1
Snack Foods	Puffed foods	45	9.1	4.8–19.8	1.1–62.5
	Chinese pastries	25	25.9	15.5–38.8	6.3–61.5
	Western pastries	20	26.7	14.8–42.5	1.4–68.1
	Bread	13	8.6	6.8–11.8	3.8–19.2
	Biscuits	85	37.0	18.9–57.9	0.8–81.1
	Confectionery	51	46.6	38.1–51.6	0.0–98.0
	Preserved fruits	29	44.2	27.8–70.8	3.8–89.9
Dairy Products	Liquid milk	108	4.6	4.4–4.9	0.0–6.6
	Modified milk	27	5.0	4.5–5.9	4.1–8.1
	Fermented milk	23	9.4	8.4–11.0	4.8–15.5
	Milk powder	24	43.6	35.5–48.6	30.2–48.6
Beverages	Tea and coffee products	9	6.3	4.1–8.5	1.1–9.1
	Fruit juices	27	9.3	7.9–11.4	3.7–19.1
	Milk-based drinks	8	5.4	5.1–7.1	4.8–8.1
	Plant-based protein drinks	14	6.9	5.7–7.6	3.2–8.7
	Solid beverages	5	15.1	2.3–30.3	0.9–32.5
	Others	9	5.5	3.5–10.8	0.0–14.5
Condiments	Vinegar	8	1.0	0.2–1.8	0.0–6.6
	Soy sauce	8	0.2	0.2–0.2	0.2–0.2
	Sauces	31	4.1	1.4–13.6	0.1–31.7
	Savoury dishes	9	8.4	3.1–11.1	1.3–18.6
	Sugar/Sweeteners	13	72.2	69.1–74.7	65.8–79.4
	Compound seasonings	8	6.1	1.8–18.3	0.6–25.5
	Spices	14	0.0	0.0–2.7	0.0–4.0

Note: "Sugars/Sweeteners" includes concentrated products such as honey and syrups, serving as a high-sugar baseline for comparison with other food categories.

3.3 Compare With the UK "Traffic Light" System for Sugar Content Assessment

The sugar content of the sampled pre-packaged foods was evaluated using the UK Department of Health's traffic light labeling system. This internationally recognized Front-of-Package Labeling (FOPL) scheme was selected for several key reasons. First, it provides clear, quantitative thresholds for sugar (low, medium, and high) that are widely adopted in global public health research to benchmark product healthiness. Second, while China currently mandates nutrition labeling (GB 28050-2011) based on Nutrient Reference Values (NRVs), it lacks a formalized, color-coded interpretive FOPL system to facilitate rapid consumer decision-making. Therefore, the UK system serves as a robust and intuitive proxy to visualize the sugar landscape within the Chinese market. Although these thresholds were developed based on UK dietary guidelines, they offer a valuable comparative benchmark for assessing sugar-reduction targets in a global context.

Of the 743 pre-packaged food samples analyzed, the proportions categorized at green, yellow, and red light levels were 25%, 44%, and 31%, respectively. Notably, 61.6% of snack foods fell into the red light category for sugar content, as illustrated in Fig. 3.

3.4 Comparative Analysis With Pre-Packaged Foods From the United States, France, and Australia

In this study, we compared the sugar content of pre-packaged foods in China with that of three developed countries: the United States, France, and Australia. Comparative analyses were performed across five core food categories: beverages, snack foods, condiments, dairy products, and convenience foods. The detailed distributions and cross-country variations in sugar content for each subcategory are illustrated in Fig. 4A–E.

4. Discussion

This study analyzed 743 pre-packaged food samples collected in China. Within the snack group, confectionery (46.6 g/100 g), preserved fruits (44.2 g/100 g), biscuits (37.0 g/100 g), and western pastries (26.7 g/100 g) had the highest sugar contents. Milk powder (43.6 g/100 g)

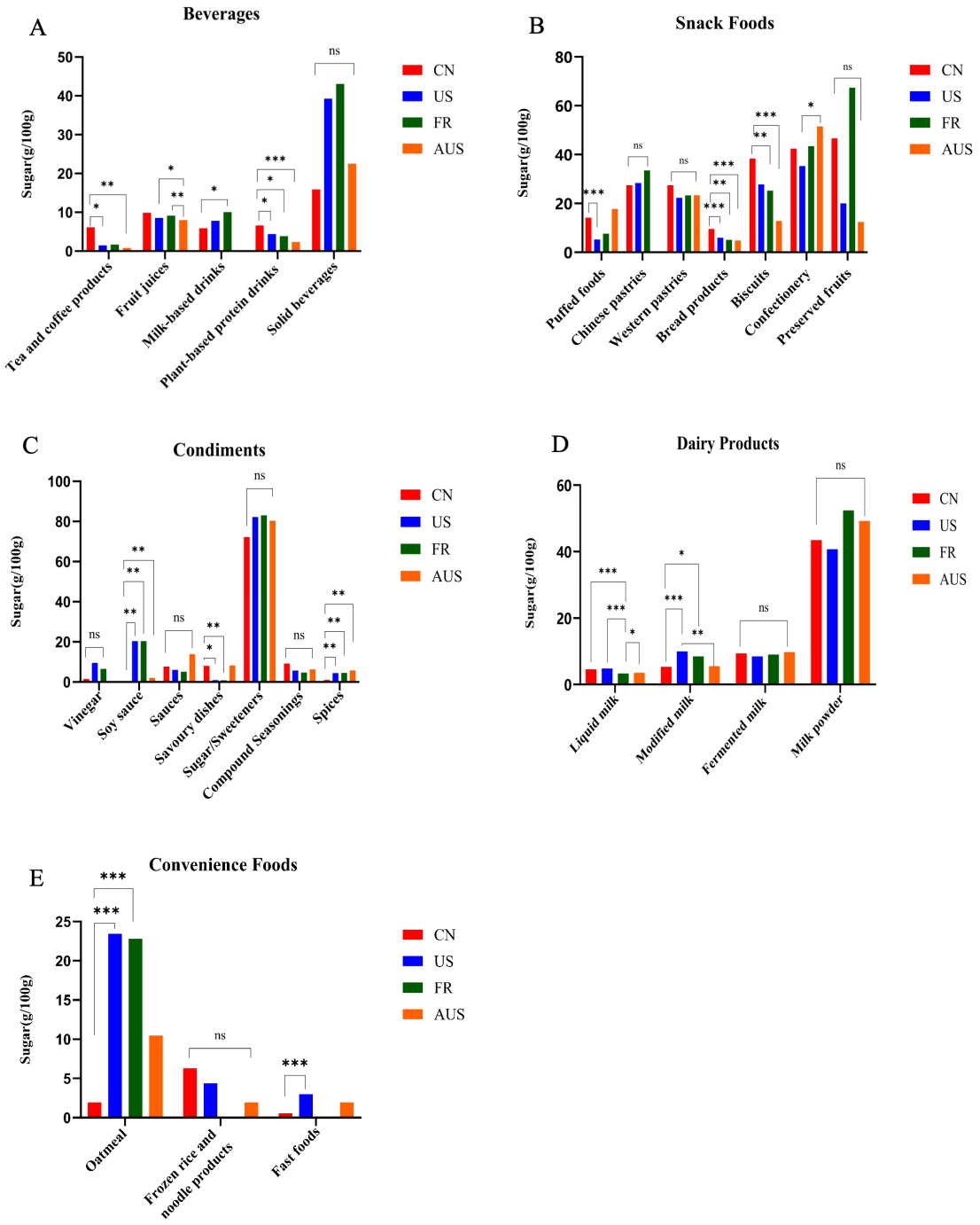

Fig. 4. Comparison of sugar content (g/100 g) in food subcategories among China (CN), the United States (US), France (FR), and Australia (AUS). (A) Beverages. (B) Snack Foods. (C) Condiments. (D) Dairy products. (E) Convenience Foods. Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, ns, not significant.

recorded the highest sugar level among dairy products. Previous studies have shown that the availability and consumption of high-sugar foods in China have increased over recent decades [23]. Excessive dietary sugar intake has become a prevalent public health concern across the globe, and this problem is not limited to China [29,30].

Hou et al. [31] reported that ice cream, pastries and non-sandwich biscuits manufactured in China contained less total sugar than equivalent products from the United States. By contrast, whole-wheat bread, fermented biscuits and plain yogurt had higher sugar concentrations [31]. Nevertheless, few studies have conducted systematic cross-country comparisons of sugar levels in pre-packaged foods worldwide. China has launched the National Nutrition Plan (2017–2030) and the Healthy China Initiative (2019–2030), which include the 'Three Reductions' campaign focus on

salt, oil, and sugar reduction. In this context, food composition data can be used to guide healthier dietary choices, which is critical for reducing excessive sugar intake [32,33].

Compared with existing literature, the present study provides a more granular and comprehensive analysis of sugar content in Chinese pre-packaged foods. Of particular concern are sugar-sweetened beverages and snacks frequently consumed by children and adolescents; these have been consistently identified as major sources of added sugar in national surveys and the Report on Sugar Intake and Risk Assessment of Urban Residents in China (2021) [20]. Consistent with the findings of Pan et al. [23], our results demonstrate that several food categories—specifically beverages, confectionery, and baked goods—exhibit exceptionally high sugar levels. Given the high consumption rates of these products among children and adolescents, these categories warrant targeted public health interventions.

In summary, the data in this study were derived from the food monitoring database of the National Institute for Nutrition and Health (NINH, China CDC), covering the major pre-packaged foods circulating in the Chinese market. The use of standardized protocols for data collection and classification ensures the authenticity and comparability of the findings, thereby underscoring the practical significance of this research for public health.

5. Limitations

This cross-country comparison has several limitations. First, sampling periods and sugar detection methods differed across datasets, which may cause comparability bias. Thus, cross-national differences should be interpreted cautiously. Future studies need unified sampling timelines and standardized testing protocols. Second, this study only measured sugar levels in packaged foods without dietary intake data. We cannot assess actual population sugar exposure, as intake is also affected by consumption habits and market share. Combining food composition and national dietary survey data is suggested for further research.

6. Conclusions

This study evaluated the total sugar content of 743 pre-packaged food products across 12 categories. Snack foods and beverages had the highest median sugar levels. Sugar concentrations of some food subcategories were higher than those of equivalent products from other countries, while most showed no obvious differences. These findings provide an evidence-based foundation for comprehensive sugar-reduction strategies, including food reformulation and the implementation of front-of-package labeling (FOPL). These measures are essential to reducing sugar intake and alleviating the burden of diet-related noncommunicable diseases (NCDs) among the Chinese population.

Abbreviations

NINH, National Institute for Nutrition and Health; IQR, interquartile range; WHO, The World Health Organization; IEC, ion exchange chromatography; UPC, Universal Product Code; FOPL, Front-of-Pack Labelling; NRVs, Nutrient Reference Values; NCDs, Non-Communicable Diseases.

Availability of Data and Materials

Data sets generated during the study are available from the corresponding author on reasonable request.

Author Contributions

YY designed the research. YD and JY performed the research. YD and ZW provided help and advice on data processing. YD, ZW and JW analyzed the data. YD and ZW wrote the manuscript. All authors read and approved the final manuscript. All authors contributed to editorial changes in the manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

Not applicable.

Acknowledgment

Not applicable.

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Conflicts of Interest

The authors declare no conflicts of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.31083/JFSFQ54762.

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