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Analysis of the Current Status of Nutritional Fortification in Dairy Products in China

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Abstract: ***Introduction:*** ***This study aims to investigate and analyze the current status of nutritional fortification in dairy products sold in China. It evaluates the fortification of nutrients in different categories of dairy products and examines the usage of nutrients without specified lower fortification limits. By systematically analyzing the nutritional fortification status of commercially available dairy products, this study provides scientific evidence and references for the revision of relevant food fortification standards in China.*** ***Method:*** ***A cross-sectional survey method was used to collect label samples of prepackaged dairy products from major supermarkets and e-commerce platforms across the country. The samples included pasteurized milk, modified milk, fermented milk, milk powder, cheese, and other dairy products, covering various brands, product lines, and imported items. In accordance with the GB 14880-2012 standard, the types and amounts of nutritional fortifiers in each category were recorded, with a particular focus on nutrients without specified lower fortification limits. Data were processed and analyzed using Microsoft Excel and SPSS to calculate the fortification ratios and variations among different categories of dairy products.*** ***Results:*** ***The results reveal significant differences in the fortification ratios among various types of dairy products in China. The fortification ratios were relatively high in modified milk and modified milk powder, at 50.77% and 95.37% respectively, whereas the ratios were lower in cheese and other dairy products, at 27.17% and 0% respectively. Regarding fortified nutrient types, the fortification ratios were higher for VA, VD, calcium, and zinc—nutrients commonly lacking in the Chinese population—while the ratios were lower for Y β-Glu, LF, and OPO. Additionally, for nutrients without specified lower fortification limits, most products used fortification levels close to the minimum, contributing minimally to consumers' nutrient intake. The overall nutritional fortification status of dairy products sold in China is commendable, but there is room for improvement in certain categories and nutrient types. It is recommended to expand the range of permissible fortified nutrients and establish reasonable lower fortification limits for currently unspecified nutrients in future standard revisions. This approach would effectively enhance product quality and safeguard consumer nutritional health.***

Keywords: Nutritional Fortification, Dairy Products, Prepackaged Foods, Current Status Analysis.

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1. Introduction

Nutritional fortification is widely recognized as an effective approach to improving the intake of micronutrients in populations. It has been extensively applied to various food products worldwide. Dairy products, due to their unique hydrophilic and lipophilic properties, serve as ideal carriers for both water-soluble and fat-soluble vitamins as well as minerals. Consequently, they play a significant role in international nutritional fortification practices. In developed countries such as those in Europe and North America, nutritional fortification in dairy products is well-established and supported by comprehensive regulatory frameworks. For example, the European Union permits the addition of a wide range of vitamins and minerals to dairy products, while the United States specifies mandatory fortification requirements for vitamins A and D in certain dairy categories.

In China, dairy products constitute a crucial component of the dietary structure and contribute significantly to public health and nutrition. However, existing studies indicate that the fortification rate of prepackaged foods, including dairy products, is relatively low. Notably, there are significant disparities in the fortification ratios across

different types of dairy products. Although China has implemented the National Food Safety Standard for the Use of Nutritional Fortifiers in Foods (GB 14880-2012), certain nutritional fortifiers lack specified lower limits for fortification. Consequently, the actual fortification levels are often low, resulting in limited contributions to the nutrient intake of consumers [1]. With the growing public awareness of health and increasing demand for balanced nutrition, it is imperative to investigate the current status of nutritional fortification in dairy products. This research is essential to support the revision of national standards, enhance product quality, and ensure public nutritional health.

This study aims to systematically investigate and analyze the current status of nutritional fortification in dairy products sold in China. Specifically, it examines the types, proportions, and actual fortification levels of nutrients across different categories of dairy products to identify patterns and characteristics of nutritional fortification. Additionally, this study focuses on nutrients without specified lower fortification limits under GB 14880-2012, evaluating their usage in actual products and assessing their impact on consumers' nutrient intake [2].

Furthermore, the study compares the nutritional fortification status and regulatory standards of dairy products in China with international practices. By aligning the findings with the nutritional health needs of the Chinese population, this research proposes targeted recommendations for optimization. The ultimate goal is to provide scientific evidence and references for the revision of relevant standards, the development of the dairy industry, and the formulation of nutrition policies.

By conducting an in-depth analysis of the current status of nutritional fortification in dairy products sold in China, this study not only provides valuable data to support the revision of GB 14880-2012 but also offers scientific guidance for manufacturers to optimize product formulations and enhance nutritional quality. The findings will enable relevant authorities to better understand the status and challenges of nutritional fortification in dairy products, thereby facilitating the improvement of national nutritional standards and the development of effective nutrition policies.

Additionally, this study contributes to public education on nutritional fortification, raising consumer awareness and acceptance of fortified dairy products. Ultimately, the research outcomes are expected to promote the healthy development of the dairy industry and contribute to the overall improvement of public nutrition and health in China.

2. Methods

2.1 Sample Sources

The samples for this study were obtained from major supermarkets and e-commerce platforms across China, covering prepackaged dairy products from various regions and brands. The categories included pasteurized milk, modified milk, fermented milk, milk powder, cheese, and other dairy products. To ensure the representativeness of the data, the sampling process considered brand diversity, product line variations, and the proportion of imported versus domestic products. In addition, this study specifically focused on high-sales-volume categories and products with high public attention to provide a comprehensive reflection of the nutritional fortification status of dairy products sold in China.

2.2 Data Collection

Data were collected through on-site photography and note-taking to meticulously record product labels, ingredient lists, and nutrition facts panels. To ensure the completeness and accuracy of the information, the investigation strictly followed the requirements of GB 14880-2012: National Food Safety Standard for the Use of Nutritional Fortifiers in Foods. The types and amounts of nutritional fortifiers, as well as their labeling methods on ingredient lists, were cross-checked and recorded for each category of dairy products [3]. For samples with unclear or incomplete labeling, secondary verification was conducted to enhance the reliability and accuracy of the data.

2.3 Statistical Analysis

The collected data were input and statistically analyzed using Microsoft Excel and SPSS software. First, a database was established to record the types, usage frequencies, and amounts of nutritional fortifiers in each category of dairy products. Then, the nutritional fortification ratios were calculated for each category, followed by a comparative analysis of the fortification status across different product types, brands, and product lines. For

nutrients without specified lower fortification limits under GB 14880-2012, a detailed analysis of their fortification level distribution was conducted to assess their impact on consumers' nutrient intake. Descriptive statistical methods were employed in the data analysis, including frequency analysis, percentage calculations, and comparisons of means and medians. These analyses provided a comprehensive overview of the nutritional fortification status of dairy products sold in China.

3. Results and Discussion

3.1 Current Status of Nutritional Fortification in Different Dairy Products

Figure 1 illustrates the nutritional fortification ratios across various categories of dairy products in China, highlighting the significantly higher ratios in modified milk and modified milk powder compared to cheese and other dairy products.

Consider adding a correlation analysis to see if brand type (domestic vs. imported) affects fortification trends.

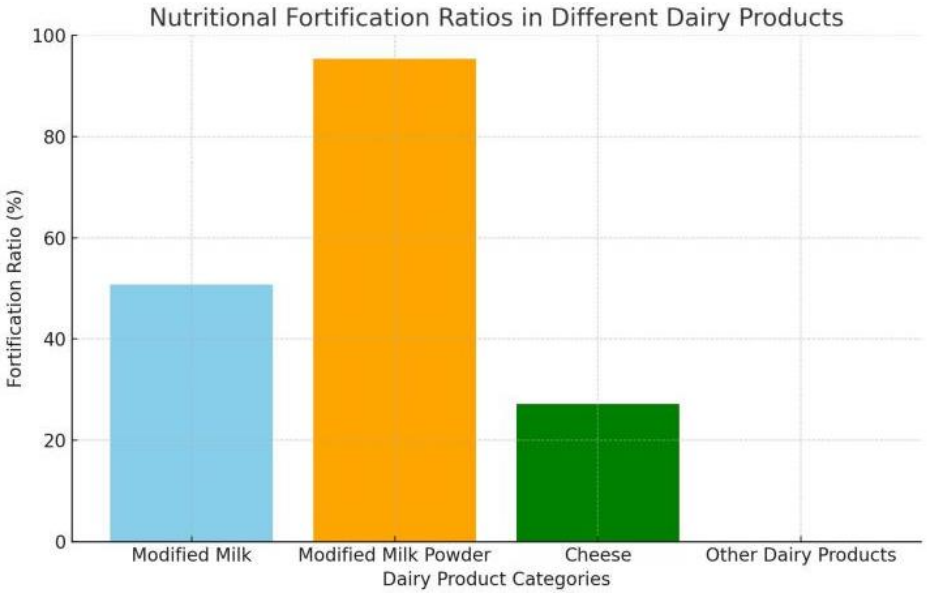

Figure 1: Nutritional Fortification Ratios in Different Dairy Products

The survey results revealed significant differences in the nutritional fortification ratios among various types of dairy products sold in China. The fortification ratios for modified milk and modified milk powder were relatively high, reaching 50.77% and 95.37%, respectively [4]. This indicates a substantial market demand for nutritional fortification in these categories, possibly due to consumer awareness and demand for functional dairy products and nutritional supplements. In contrast, the fortification ratios were lower for cheese and other dairy products, at 27.17% and 0%, respectively. Only a small proportion of cheese products were fortified with calcium, VA, VD, and taurine, while almost no nutritional fortification was observed in other dairy products. This could be attributed to the regulatory limitations on the types and usage of fortifiers for these categories, as specified in national standards, as well as relatively low market demand.

3.2 Types and Proportions of Fortified Nutrients

The pie charts (Figure 2) illustrate the distribution of fortified nutrients in Modified Milk and Modified Milk Powder in China. The charts highlight the high proportions of VA, VD, Calcium, and Zinc, which are commonly deficient nutrients among the Chinese population.

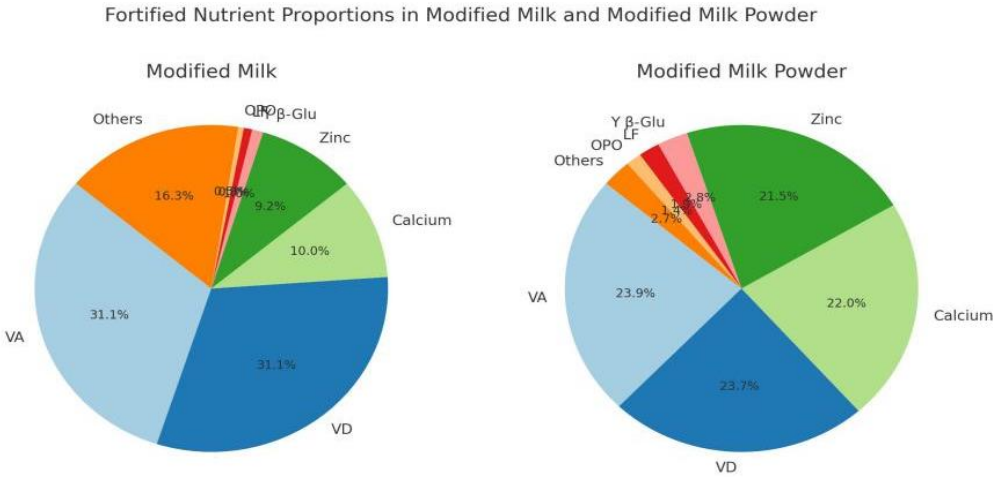

Figure 2: Fortified nutrient proportions in modified milk and modified milk powder

Regarding the types of fortified nutrients, VA, VD, calcium, and zinc are nutrients commonly deficient in the Chinese population and had relatively high fortification ratios across different dairy products. Specifically, in modified milk and modified milk powder, the fortification ratios for VA and VD reached 31.12% and 87.96%, respectively. These nutrients play a crucial role in addressing potential dietary deficiencies [5]. However, some nutrients, such as Y β-Glu, LF, and OPO, showed low fortification ratios and were mainly found in a small number of modified milk and milk powder products [6]. This may be due to high raw material costs, low market awareness, and complex processing technologies. Additionally, although VB1, VB2, VB6, niacin, and yeast β-glucan can be fortified according to conversion rules in the standard guidelines, their actual fortification ratios were low, suggesting that some manufacturers might have insufficient understanding or inconsistent implementation of the standards .

3.3 Usage of Nutrients Without Specified Lower Fortification Limits

The boxplot (Figure 3) shows the usage distribution of nutrients without specified lower fortification limits, including FOS, AA, DHA, LF, CPP, and GOS. It highlights the trend of most products using fortification levels close to the minimum, indicating limited contributions to consumers' nutrient intake.

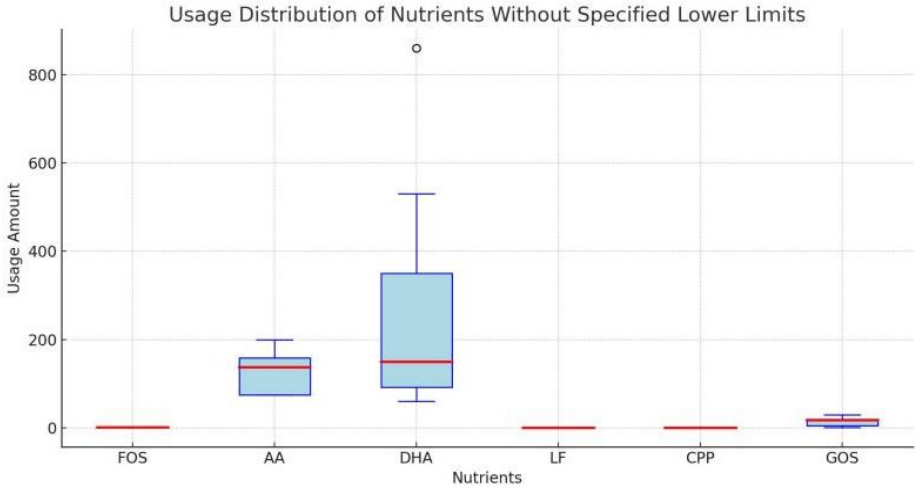

Figure 3: Usage Distribution of Nutrients Without Specified Lower Limits

This study also focused on the usage of nutrients without specified lower fortification limits under GB 14880-2012, including FOS, AA, DHA, LF, CPP, and GOS. The results showed that most products used fortification levels close to the minimum limit, contributing minimally to consumers' nutrient intake. For instance, the fortification levels of LF and CPP in modified milk and modified milk powder were close to the lower limits specified in the standard, indicating that manufacturers tend to use minimal amounts to comply with regulations while minimizing production costs.

However, some products were found to use dual-purpose ingredients (as both nutritional fortifiers and novel food ingredients). For example, FOS and GOS were frequently added to fermented milk and flavored fermented milk, even though they are not approved for use in these categories. This inconsistency highlights a gap between current regulations and market practices.

4. Discussion

Figure 4 compares consumer awareness levels and purchase intentions for fortified dairy products in China. It illustrates that consumers with higher awareness levels have a greater intention to purchase, highlighting the importance of public education and marketing strategies in promoting fortified dairy products.

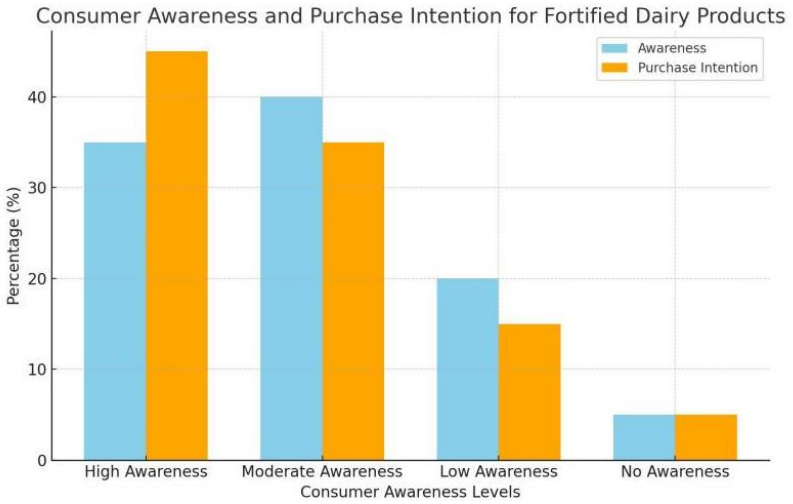

Figure 4: Consumer Awareness and Purchase Intention for Fortified Dairy Products

Overall, the nutritional fortification status of dairy products sold in China is generally positive, particularly in modified milk and modified milk powder, where the fortification ratios are high, and the variety of fortified nutrients is relatively rich. Essential nutrients such as VA, VD, calcium, and zinc—which are commonly deficient in the Chinese population—have been effectively fortified in these products, contributing to improved micronutrient intake [7].

However, the fortification ratios for cheese and other dairy products are relatively low, possibly due to the limitations on permissible fortifiers and usage scopes under GB 14880-2012, as well as lower market demand. In addition, most nutrients without specified lower fortification limits were fortified at near-minimal levels, resulting in limited contributions to consumers' nutrient intake.

To further enhance the nutritional value and market competitiveness of dairy products, it is recommended to expand the range of permissible fortified nutrients and establish reasonable lower fortification limits for currently unspecified nutrients in future revisions of national standards. Moreover, for nutrients with low fortification ratios, such as Y β-Glu, LF, and OPO, it is essential to optimize fortification technologies and strengthen market promotion and consumer education. This approach would increase public awareness and acceptance of these nutrients, ultimately supporting the healthy development of the dairy industry and contributing to improved public nutrition and health.

5. Conclusion

This study demonstrates that the overall nutritional fortification status of dairy products sold in China is commendable, particularly in modified milk and milk powder, where the fortification ratios are relatively high. The fortification primarily focuses on VA, VD, calcium, and zinc—nutrients commonly deficient in the Chinese population—which positively contributes to addressing dietary insufficiencies. However, the fortification ratios for cheese and other dairy products are notably low, possibly due to regulatory limitations on the types and usage scopes of allowable fortifiers.

To further enhance the nutritional value and market competitiveness of dairy products, it is recommended to

expand the range of permissible fortified nutrients and establish reasonable lower fortification limits for currently unspecified nutrients in future revisions of national standards. Additionally, strengthening public education and awareness about nutritional fortification is essential to increase consumer acceptance and understanding. Enhanced consumer education would promote informed purchasing decisions, ultimately supporting the healthy development of the dairy industry and contributing to improved public nutrition and health in China.

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