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ANÁLISE DO PERFIL DE COMPRA DE SUPLEMENTOS ALIMENTARES EM UMA FARMÁCIA COMUNITÁRIA DA CIDADE DE REDENÇÃO-CEARÁ

ANALYSIS OF THE DIETARY SUPPLEMENT PURCHASE PROFILE AT A COMMUNITY PHARMACY IN THE CITY OF REDENÇÃO, CEARÁ

ANÁLISIS DEL PERFIL DE COMPRA DE SUPLEMENTOS DIETÉTICOS EN UNA FARMACIA COMUNITARIA DE LA CIUDAD DE REDENÇÃO, CEARÁ

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Resumo

Este estudo teve como objetivo analisar o perfil de compra de suplementos alimentares em uma farmácia comunitária privada localizada nas dependências de um supermercado em Redenção-Ceará, a fim de compreender padrões de consumo e possivelmente subsidiar estratégias para promoção de uso racional desses produtos. Trata-se de um estudo descritivo, retrospectivo baseado na análise de dados secundários de vendas no período de abril de 2024 a abril de 2025, obtidos por meio de sistema informatizado próprio do estabelecimento. Os produtos foram inicialmente categorizados pelo estabelecimento e posteriormente reclassificados pelos autores em diferentes grupos, sendo analisados em termos de percentual de comercialização, faixa de preços e forma farmacêutica. Após aplicação de critérios de exclusão, foram considerados 1703 produtos, totalizando mais de R$ 140 mil em vendas. Os suplementos mais comercializados foram, nesta ordem, ômega-3 (9%), creatina (8,8%), polivitamínicos (7%), bebidas energéticas (4,2%) e enzimas digestivas (3,8%). A análise das subclasses revelou predominância de nutrientes (28,2%) e produtos funcionais (27,6%), seguidos por compostos bioativos e outros insumos (16,3%), produtos naturais (12,9%), consumíveis (9,4%) e, por fim, produtos para saúde digestiva (5,6%). Os resultados indicam forte influência de tendências relacionadas à manutenção da saúde, desempenho físico, estética e bem-estar; comportamento semelhante aos padrões evidenciados pela literatura e pesquisas mercadológicas. Observou-se também um consumo expressivo de bebidas energéticas, cujas pode implicar riscos à saúde. Nesse contexto, destaca-se o papel estratégico da farmácia comunitária e do farmacêutico na promoção do uso racional de suplementos alimentares, por meio de ações educativas, além do acompanhamento clínico nutricional. Assim, o estudo contribui para a compreensão do comportamento de consumo na cidade de redenção e na microrregião do Maciço de Baturité, reforçando a necessidade de ações de conscientização e regulação no setor.

Palavras-chave: Creatina; Ômega-3; Nutracêuticos; Polivitamínicos; Suplementos Alimentares.

Abstract

This study aimed to analyze the purchasing profile of food supplements in a private community pharmacy located within a supermarket in Redenção, Ceará, in order to understand consumption patterns and possibly support strategies for promoting the rational use of these products. This is a descriptive, retrospective study based on the analysis of secondary sales data from April 2024 to April 2025, obtained through the establishment's own computerized system. The products were initially categorized by the establishment and subsequently reclassified by the authors into different groups, being analyzed in terms of percentage of sales, price range and dosage forms. After applying exclusion criteria, 1703 products were considered, totaling more than R$ 140,000 in sales. The most sold supplements were, in this order, omega-3 (9%), creatine (8.8%), multivitamins (7%), energy drinks (4.2%), and digestive enzymes (3.8%). Analysis of the subcategories revealed a predominance of nutrients (28.2%) and functional products (27.6%), followed by bioactive compounds and other inputs (16.3%), natural products (12.9%), consumables (9.4%), and finally, products for digestive health (5.6%). The results indicate a strong influence of trends related to maintaining health, physical performance, aesthetics, and well-being; behavior also evidenced by the literature and market research. Significant consumption of energy drinks was also observed, which may imply health risks. In this context, the strategic role of community pharmacies and pharmacists in promoting the rational use of food supplements through educational actions, in addition to clinical nutritional monitoring, is highlighted. Thus, the study contributes to understanding consumption behavior in the city of Redenção and the microregion of Maciço de Baturité, reinforcing the need for awareness and regulation actions in the sector.

Keywords: Creatine; Omega-3; Nutraceuticals; Multivitamins; Food Supplements.

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Resumen

Este estudio tiene como objetivo analizar el perfil de compra de suplementos alimentarios en una granja comunitaria privada localizada en dependencias de un supermercado en Redenção-Ceará, a fin de comprender los padrones de consumo y posiblemente subsidiar estrategias para promover el uso racional de estos productos. Trata-se de un estudio descriptivo, retrospectivo basado en el análisis de datos secundarios de ventas no período de abril de 2024 a abril de 2025, obtenidos por meio de sistema informatizado propio del establecimiento. Os produtos foram inicialmente categorizados pelo estabelecimento y posteriormente reclasificados pelos autores em diferentes grupos, sendo analizados em termos de percentual de comercialização, faixa de preços e forma farmacêutica. Después de la aplicación de criterios de exclusión, se consideraron 1703 productos, totalizando más de R$ 140 mil en ventas. Os suplementos mais comercializados foram, nesta ordem, ômega-3 (9%), creatina (8,8%), polivitamínicos (7%), bebidas energéticas (4,2%) y enzimas digestivas (3,8%). El análisis de las subclases revela predominio de nutrientes (28,2%) y productos funcionales (27,6%), seguidos por compostos bioativos y otros insumos (16,3%), productos naturales (12,9%), consumibles (9,4%) y, por fim, productos para salud digestiva (5,6%). Los resultados indican una fuerte influencia de las tendencias relacionadas con la salud, el desempeño físico, la estética y el bienestar; comportamento semelhante aos padrões evidenciados pela literatura e pesquisas mercadológicas. Observe también el consumo expresivo de bebidas energéticas, ya que podría implicar riesgos para la salud. En este contexto, se destaca el papel estratégico de la farmacia comunitaria y de la promoción farmacéutica del uso racional de suplementos alimentarios, por medio de acciones educativas, además del acompañamiento clínico nutricional. Assim, el estudio contribuye para la comprensión del comportamiento de consumo en la ciudad de redención y la microrregião de Maciço de Baturité, reforzando la necesidad de acciones de conscientización y regulación del sector.

Palabras clave: Creatina; Omega-3; Nutracéuticos; Multivitaminas; Complementos alimenticios.

1. Introduction

Dietary supplements (DS) are oral pharmaceutical forms intended to supplement the diet of healthy individuals or those with specific nutritional deficiencies. These products contain, in isolation or in combination, components such as nutrients, bioactive substances, enzymes, or probiotics (ANVISA, 2018a, 2018b). According to the Brazilian Association of Food Industries for Special Purposes (ABIAD), DS are consumed by 59% of Brazilian households, mainly represented by vitamins, minerals, and proteins.

The latest census, conducted in 2020, considered the consumption habits of 1006 volunteers, men and women aged 17 to 70, from capital cities in all regions. The market research showed a 10% increase in consumption compared to the census conducted before the COVID-19 pandemic. Conversely, it can be observed that only 76% of purchases were made in pharmacies or drugstores, raising the hypothesis of unregulated and possibly irrational consumption, without any clinical guidance or guarantee of safety and efficacy (ABIAD, 2025).

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Furthermore, another study, also conducted across all regions of Brazil with over 1400 adults of both sexes, showed that 75% of participants routinely consumed one or more supplements. Filtering out socioeconomic classes A and B, these figures reach 85%. Regarding the main objectives of consumption, participants stated they used the products to improve overall health, increase energy and vitality, as well as to address nutritional deficiencies. On the other hand, this same research reveals an alarming statistic: only 36% of participants had any clinical guidance regarding the supplements they used (FELIX, 2025).

DS are strategic tools for addressing deficiencies and improving the health and performance of healthy individuals monitored by a qualified clinical professional. On the other hand, for various reasons, such as media and social networks, these products are often used irrationally, without individualized or personalized care, without clear objectives or established indications. Therefore, the indiscriminate use of NSSs carries risks that must be constantly considered, such as: placebo effect, lack of clinical evidence for certain claims, adverse effects, and drug interactions (ANVISA, 2018a; NATIONAL INSTITUTES OF HEALTH (NIH), 2025)

Another worrying factor should be highlighted: the growing number of frauds and regulatory inconsistencies. In August 2025, the Brazilian National Health Surveillance Agency (ANVISA) issued an alert that placed the supplement sector as the main target of investigations due to complaints of low quality and fraud. Comprising 63% of complaints among other segments, a cancellation rate of approximately 65% of the investigated products was observed, and more than 200 companies presented technical and/or regulatory irregularities. Digital sales, misleading advertising, lack of stability studies, misuse of trademarks, and the inclusion of unauthorized substances are among the main reasons for this problem (AGÊNCIA CÂMARA DE NOTÍCIAS, 2025).

Community pharmacies play a strategic role in providing the population with access to supplements, constituting an important health service integrated into primary and territorial care. In this context, guidance from qualified professionals, such as pharmacists and nutritionists, is fundamental to ensuring the rational use

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of these products, preventing drug interactions, overdoses, and inappropriate use associated with scientifically unfounded expectations. Studies show that a large proportion of consumers use supplements without a prescription or professional supervision, which reinforces the need for clinical and educational intervention in community pharmacies (CFF, 2016; KANTOR et al., 2016)

Analyzing purchasing profiles at the local level is essential to understanding the social and cultural determinants that influence the consumption of these products. Regional studies allow for the identification of specific consumption patterns, such as the search for supplements associated with physical performance, immunity, or aesthetics, as well as possible gaps in professional guidance. Furthermore, they can contribute to the planning of health education initiatives and the strengthening of pharmaceutical clinical practices, aligned with the real needs of the population of Redenção-CE, a tourist city whose market is visited by people from surrounding cities in the Maciço de Baturité Region (RMB) (CFF, 2016; IBGE, 2022)

Promoting rational use, pharmaceutical care, and increased oversight by regulatory bodies are essential factors for promoting the safe and effective use of DS. Therefore, this study aims to evaluate the consumption profile of pharmaceutical products, mainly dietary supplements, intended for complementary and integrative health in a private community pharmacy in the city of Redenção – CE.

2. Methodology

2.1 Data Collection location

The data was collected from a private community pharmacy located in the city of Redenção, Ceará, situated within one of the city's largest supermarkets. According to the IBGE (Brazilian Institute of Geography and Statistics), the municipality had an estimated population of 28,382 people in 2025, registering a population density of 109.74 inhabitants/km² in the last census (2022). According to the last census, the city has a Gross Domestic Product (GDP) per capita of R$

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19,137.44, but in 2010 the Municipal Human Development Index was evaluated at 0.626 (IBGE, 2022). Located in the RMB (Metropolitan Region of Belém), the city is marked by the decentralization of higher education in terms of the presence of the University of International Integration of Afro-Brazilian Lusophony (UNILAB), which impacts the age, cultural, and behavioral composition of the population.

With the approval of the technical and legal representatives, the establishment provided a monthly list of products sold between April 1, 2024, and April 30, 2025, retrieved from the INOVAFarma® software.

2.2 Data Analysis

Month by month, the document provided by the community pharmacy described information on 2878 products, categorizing them into: i. Nutraceuticals; ii. Multivitamins and multiminerals; iii. Health and wellness; and iv. Supplements. Data associated with sales frequency and the pharmaceutical forms sold could also be observed.

Pharmaceutical forms were grouped into: capsules, powders and granules, tablets, liquid and moldable pharmaceutical forms. Information on unit values in Brazilian Real (R$) was grouped into values up to R$ 25; between R$ 26 and 50; between R$ 51 and 100; between R$ 101 and 150; and above R$ 150. Financial and economic data were also available, such as: stock quantity, values, costs, and discount and profit margins. However, some of these were considered sensitive and, therefore, were not evaluated in this study.

During data collection, it was noticed that some products – massage gels and other cosmetics, apple cider vinegar, and other foods – had been registered as SA. Therefore, 1175 items were excluded from the final count: cosmetic products, foods, officinal preparations, and any other types that were not considered food supplements and/or natural products marketed as SA.

In a general analysis, the five most marketed products during the studied period were addressed regarding the potential risks and benefits of using these SAs. The data were also grouped according to individual price range and pharmaceutical form of presentation.

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Next, the collected data were recategorized into 6 subclasses by the authors of the study. This reclassification was carried out to group the data to discuss the peculiarities of each segment, considering nutritional and regulatory aspects. The recategorization was done as follows:

1. Nutrients: 480 products were grouped together, including: isolated micronutrients (such as vitamin A, D and B12 supplements), combinations (such as vitamin C + zinc, calcium + vitamin D) and adult and children's multivitamins;
2. Functional products: 470 products were grouped together that presented some type of functional claim, such as ergogenic products, adaptogens, and products intended for women's health and other population groups (such as elderly health), joint, hair, nail, and immune system health;
3. Bioactive compounds and other inputs: this subclass grouped 277 compounds such as Omega-3 and docosahexaenoic acid (DHA), coenzyme Q10, turmeric and other isolated substances that did not fit into other subclasses, such as chromium picolinate;
4. Natural products: 220 products were grouped together, relating to herbal drugs and derivatives of medicinal plants, dry extracts and aqueous extract of propolis;
5. Consumables: 160 products were grouped together, relating to energy drinks and energy replenishing drinks, protein snacks and ginger candies;
6. Digestive health: this subclass includes inputs capable of modulating the health of the gastrointestinal tract, such as digestive enzymes (n=81) and probiotics (n=15).

Each of these subclasses was analyzed separately, and then the three most marketed products from each were highlighted, except for the last subclass (digestive health), which had only two products.

All data processing was performed using Excel® software, expressing the results in terms of sums and percentages (%).

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2.3 Ethical Aspects

The data analysis was performed using exclusively secondary and anonymized data, extracted from the unit's commercial database, without access to any civil identification fields. In compliance with the General Data Protection Law (LGPD - Law 13.709/2018), the data were processed in a way that guarantees the irreversibility of the direct re-identification of consumers, as stipulated in article 12. Therefore, since this is an observation of secondary data related to the purchase and sale of products, solely for academic research purposes, there was no need for submission to a Research Ethics Committee.

3. Results and Discussion

First, it was observed that, after applying the exclusion criteria to this annual sample, 1,703 products were sold (Figure 1.a), generating revenue of over R$ 140.000 (Figure 1.b).

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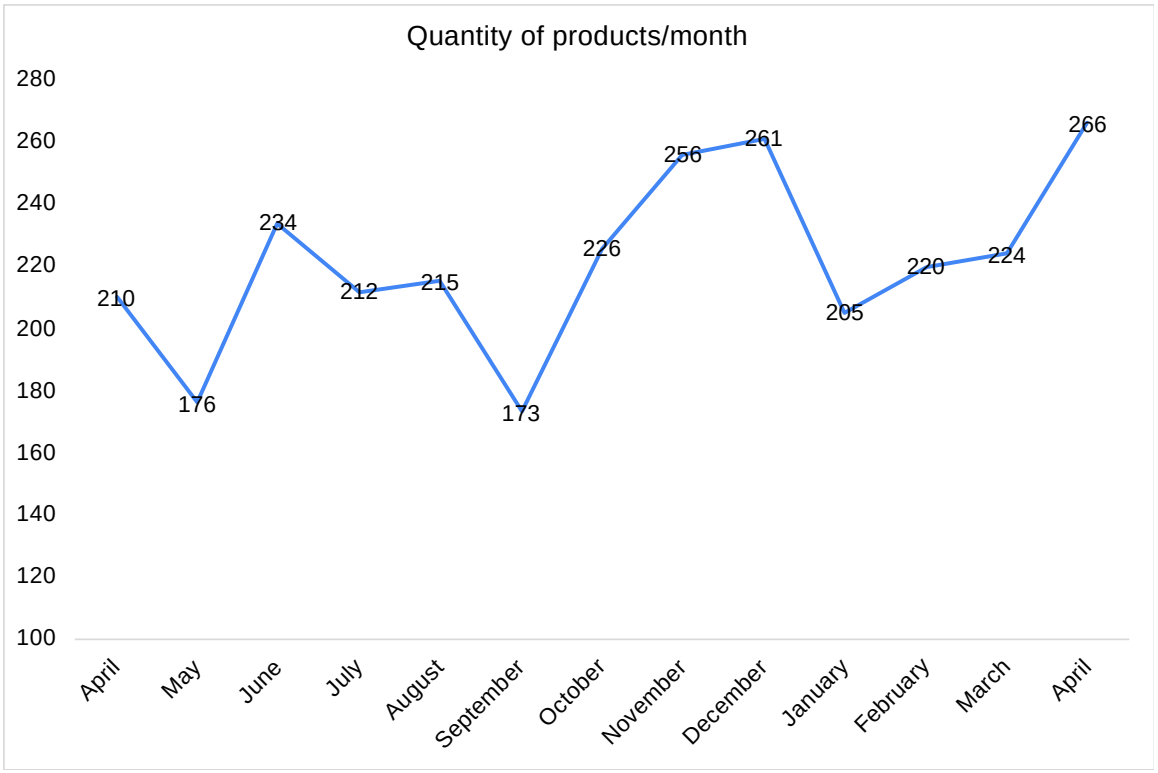
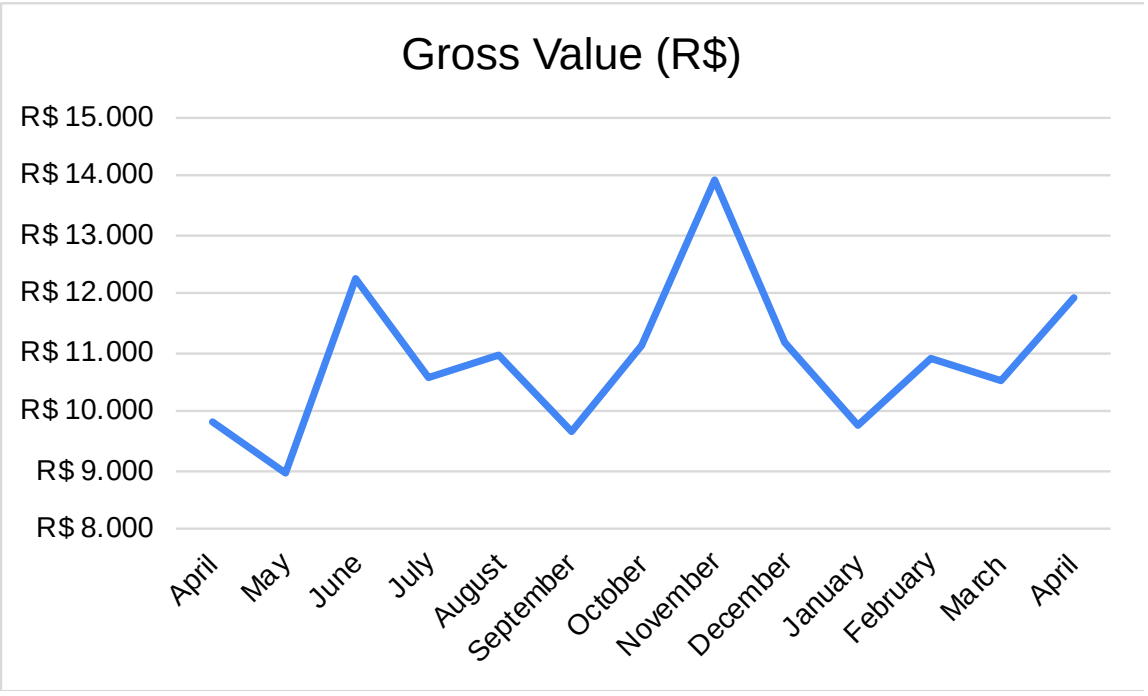
Figure 1. a) Number of SA products sold per month (april 2024 to april 2025); b) Gross sales (R$) during the same period.

a)



b)



Sales were predominantly concentrated in November and December 2024 and April 2025, while May and September recorded the lowest figures. Gross sales,

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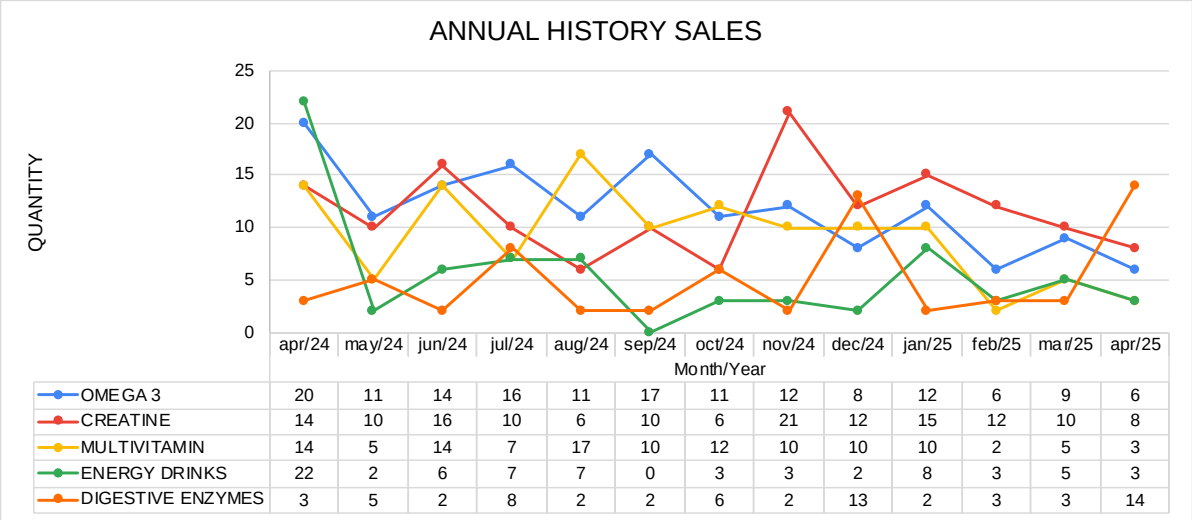
on the other hand, appear to have remained relatively stable during the period, ranging from R$ 8.976,54 (May/2024) to R$ 13.938,04 (November/2024).

The main products sold (and their respective percentage of the total) were, in descending order: omega-3 (9%), creatine (8,8%), multivitamins (~7%), energy drinks (4,2%), and digestive enzymes (3,8%) (figure 2). A study conducted between march and september 2025 in Teresina- PI, recorded the sale of 1.881 products, highlighting the sale of dietary supplements intended for immune health, liver protection, and muscle mass gain. In the nutrients category—which accounted for only 11,2% of sales—the authors highlighted the sales of multivitamins and omega-3 (SALES; MOURA; MEIRELLES, 2025).

It was observed that in May 2024 there is a decline in sales of omega-3 supplements, creatine, multivitamins, and, in particular, energy drinks, which appears to contribute to this being the least profitable month, due to the high price point and lower sales volume of these products: ranging from R$51 to R$100 for the first three and up to R$25 for energy drinks.

Figure 2. Main dietary supplements sold at a private community pharmacy in Redenção- CE, from april 2024 to april 2025.



	apr/24	may/24	jun/24	jul/24	aug/24	sep/24	oct/24	nov/24	dec/24	jan/25	feb/25	mar/25	apr/25
OMEGA 3	20	11	14	16	11	17	11	12	8	12	6	9	6
CREATINE	14	10	16	10	6	10	6	21	12	15	12	10	8
MULTIVITAMIN	14	5	14	7	17	10	12	10	10	10	2	5	3
ENERGY DRINKS	22	2	6	7	7	0	3	3	2	8	3	5	3
DIGESTIVE ENZYMES	3	5	2	8	2	2	6	2	13	2	3	3	14

Sales volumes fluctuate slightly over the months, however, there is a peak in creatine sales (n=21) in November 2024, contributing to the higher revenue observed during this period. These data appear to support the findings discussed

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earlier (figure 1.b). Digestive enzymes, sold for up to R$ 25, show a small monthly sales volume, with more significant numbers in December 2024 (n=13) and April 2025 (n=14).

3.1 Omega-3

The main product sold during the specified period was omega-3, particularly in April 2024, in the form of soft gel capsules with a unit price ranging from R$ 51 to 100. This may suggest greater local concern regarding cardiovascular and cerebrovascular disorders and inflammatory diseases, which are the main indications for supplementation with this product, an important source of eicosapentaenoic acid (EPA) and DHA (GUTIERRES; PACHECO; REIS, 2025; PONTE et al., 2024)

Chaim et al. (2024) point out that EPA and DHA act as precursors to pro-resolution mediators of inflammation, such as resolvins, particularly resolvin D2. Doses equivalent to those used in humans, ranging from approximately 1.000 to 3.000 mg/day of EPA + DHA, are associated with a reduction in intestinal inflammatory markers, decreased inflammatory cell infiltration, improved epithelial barrier integrity, and favorable modulation of the immune response. For this reason, omega-3 is also recognized as an adjunctive strategy in inflammatory conditions, particularly in the context of inflammatory bowel diseases (CHAIM; PASCOAL; DE CASTRO, 2024).

Clinical studies also point to a consistent association between EPA + DHA and cardiometabolic benefits. In a cross-sectional population-based study conducted by Alvarenga et al. (2025), involving 697 brazilian adults (51,5% women), the average intake of EPA + DHA (between 150 and 224 mg/day derived solely from the regular diet) was associated with reduced triglyceride levels, increased HDL-cholesterol, and an improved glycemic profile. Another finding was an improvement in the Visceral Adiposity Index, an indirect marker of visceral fat and cardiometabolic risk. In men, however, the associations with EPA and DHA did not hold after adjustments, suggesting a possible influence of sex on the metabolic

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response (ALVARENGA et al., 2025).

On the other hand, omega-3 intake may be associated with moderate interactions with certain medications, such as nonsteroidal anti-inflammatory drugs and anticoagulants/antiplatelet agents, including clopidogrel, heparin, and warfarin; due to its antiplatelet effect. Therefore, concomitant use may increase the risk of bleeding, especially at high doses or during prolonged treatment, which underscores the need for caution and clinical monitoring in patients using these therapies (MEDSCAPE, 2026).

3.2 Creatine

Secondly, creatine was the second most sold product in powder form, priced between R$ 51 and 100, particularly in November 2024. It is also highlighted in some studies using methodologies like the present study, particularly among individuals engaged in physical activity (PAZ; PEREIRA, 2025; SALES; MOURA; MEIRELLES, 2025).

The high frequency of creatine use observed in this study can be explained by the growing recognition of this supplement as one of the most extensively studied ergogenic aids in the scientific literature. This appears to reflect a consumption pattern driven by aesthetic goals and improved athletic performance, although cognitive benefits may also be noteworthy.

Creatine primarily acts by increasing intramuscular phosphocreatine stores, promoting ATP resynthesis during high-intensity, short-duration exercises, which contributes to improved physical performance and increased muscle mass. Recent systematic reviews demonstrate that creatine supplementation, especially when combined with training, can increase lean body mass and reduce body fat percentage, reinforcing its popularity among those who engage in physical activity (DESAI et al., 2024)

Therefore, supplementation may contribute to improved physical function, increased muscle strength, and the prevention of functional decline, especially in individuals at risk of muscle loss, such as the elderly (DAVIES et al., 2024).

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Additionally, recent reviews point to potential benefits in specific groups, such as women and vegetarians, who have lower baseline creatine levels, which may further expand the consumer base (GUTIÉRREZ-HELLÍN et al., 2024).

On the other hand, although it is generally considered safe when used in appropriate doses, studies highlight the need for professional supervision to provide guidance on dosage, duration of use, and possible adverse effects, especially in individuals with comorbidities or who are taking other supplements concurrently (SILVA; CORREIA; FÉ, 2024). In this regard, the high sales volume observed fuels the discussion regarding the importance of the pharmacist's role in promoting the rational and safe use of these products in the community pharmacy setting, as well as providing nutritional guidance tailored to each user's needs.

3.3 Multivitamins

Multivitamin tablets priced between R$51 and R$100 ranked third, reflecting a consumer trend linked to the pursuit of health maintenance and disease prevention. "A to Z" nutrient formulations were also highlighted in a cross-sectional observational study conducted between December 2020 and January 2021 among individuals who engage in physical activity (PAZ; PEREIRA, 2025).

These products combine various essential vitamins and minerals and are widely used as a complementary strategy to diet, especially in situations where there is a perceived nutritional deficiency. This consumption pattern is often driven by cultural factors, marketing, and the idea that supplementation can compensate for suboptimal dietary habits, which contributes to high demand for these products in community pharmacies (LOFTFIELD et al., 2024).

According to the Brazilian Society of Pediatrics (SBP), a balanced diet generally meets micronutrient needs. These products may provide vitamins in varying amounts, increasing the risk of excessive intake and toxicity, especially for fat-soluble vitamins, which accumulate in the body. In addition, they often contain less bioavailable forms of nutrients, with fixed doses and combinations of various elements. Thus, when attempting to spread the dose throughout the day using

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multivitamins, there may be a simultaneous increase in the intake of other micronutrients present in the formulation, which can elevate the risk of toxicity. Therefore, supplementation should be judicious and based on the recommended daily intake (RDI), avoiding exceeding safe limits (SCHUCHARDT; HAHN, 2017; SOCIEDADE BRASILEIRA DE PEDIATRIA, 2021).

Despite their widespread use, recent scientific evidence has called into question the benefits of routine multivitamin supplementation in healthy individuals. A large cohort study published in 2024, featuring long-term follow-up, found no association between multivitamin use and reduced mortality, suggesting that these products do not provide significant benefits in terms of longevity for the general population. Similarly, contemporary reviews indicate that indiscriminate supplementation does not consistently reduce the risk of chronic diseases, such as cancer and cardiovascular disease, reinforcing the need for evidence-based recommendations (BARNARD; KAHLEOVA; BECKER, 2024).

On the other hand, in certain clinical conditions, continuous supplementation with multivitamins is recommended, provided it is accompanied by periodic monitoring. Examples of these situations include: i. the postoperative period following bariatric surgery (SANTOS et al., 2025); ii. ii. exocrine pancreatic insufficiency (BRASIL, 2025); iii. different stages of the life cycle, such as pregnancy, lactation, childhood, and adolescence, especially in children with risk factors such as intestinal malabsorption and/or who use certain medications (anticonvulsants, corticosteroids, ketoconazole, rifampicin) and who have liver disease, chronic kidney disease, obesity, and/or follow a strict vegetarian diet (SOCIEDADE BRASILEIRA DE PEDIATRIA, 2024).

In the present study, 31 children's multivitamins (approximately 2%, categorized in the nutrients subclass) were found on the market, all in liquid form. Conversely, the use of multivitamins may induce a mistaken perception of protection against nutritional deficiencies, leading to the neglect of healthy habits such as a balanced diet, physical activity, and a regular sleep routine (GUALLAR et al., 2013). Finally, it is important to note that the Brazilian Ministry of Health has national programs that propose interventions to address nutritional deficiencies in

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different population groups, such as the National Iron and Vitamin A Supplementation Program (BRASIL, 2013a, 2013b).

3.4 Energy drinks

In fourth place were liquid energy drinks and oral rehydration solutions priced at up to R$25, which recorded the highest sales volume in april 2024. Consumption of these products has increased significantly, driven primarily by the desire to boost alertness and enhance physical and mental performance. This industry is experiencing rapid expansion, generating nearly $74 billion and recording nearly double-digit growth between 2021 and 2024 (MANDATO et al., 2025).

Although some of these products are classified as foods, other formulations are categorized as DS composed of ingredients permitted under Brazilian law. According to regulations, energy drinks cannot make claims regarding therapeutic effects or improvements in physical or cognitive performance. On the other hand, claims are permitted that are restricted to the nutrients present in the formulation, such as caffeine, which helps increase alertness and concentration; or B-complex vitamins, related to energy metabolism (ANVISA, 2005).

Conversely, indiscriminate consumption has been associated with increased cardiovascular risks, such as increased heart rate, systolic and diastolic blood pressure, as well as negative changes in the electrocardiogram (MANDATO et al., 2025). A controlled clinical study involving 36 healthy adults evaluated the effects of consuming an energy drink containing caffeine and taurine. The results indicated a temporary increase in alertness and attention, accompanied by a slight elevation in heart rate, with no sustained effects on physical or cognitive performance. These findings characterize an acute stimulant effect, attributed primarily to caffeine a (ALFORD; COX; WESCOTT, 2001).

In addition, Higgins et al. (2010) reported that the main effect observed with the consumption of these beverages is only a temporary increase in alertness, while excessive consumption is associated with adverse effects such as anxiety, sleep disturbances, palpitations, and elevated blood pressure (HIGGINS; TUTTLE;

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HIGGINS, 2010). This is particularly concerning when considering the habits of the target audience of children and adolescents.

It is estimated that between 30% and 50% of young people consume energy drinks. For them, a safe level of energy drink consumption has not yet been established. However, their use may be primarily associated with the expectation of increased energy and the influence of aggressive marketing (LIMA, 2025). The high caffeine content has been linked to adverse effects, and in 2007, 46% of caffeine poisonings in the U.S. occurred in individuals under 19 years of age, sparking debates about restrictions on the sale of these products. Furthermore, observational studies demonstrate a consistent association between the consumption of these beverages and the occurrence of adverse effects, such as seizures, episodes of mania, strokes, and even sudden death (SEIFERT et al., 2011).

In addition, there is evidence that certain components of energy drinks may interact with medications, reducing their pharmacological effect and/or increasing the occurrence of side effects, examples include caffeine and taurine when used concurrently with tricyclic antidepressants, anticoagulants, hypoglycemic agents, sedatives, and hypnotics. Inositol, on the other hand, has fewer documented interactions; however, higher doses have been associated with mild gastrointestinal effects, such as nausea, bloating, and diarrhea, with no dose-dependent increase in severity (DOBREK, 2025; MEDSCAPE, 2026).

In this context, widespread social acceptance and low risk perception clash with the lack of evidence regarding benefits, highlighting an imbalance between risk and benefit and underscoring the need for educational initiatives and more in-depth research on the short- and long-term impacts on health, behavior, and the educational context (VISRAM et al., 2016).

3.5 Digestive enzymes

In the digestive health subcategory, sachets containing digestive enzyme powders and granules priced at up to R$ 25 ranked fifth, with the highest sales in december 2024. This suggests an increase in demand for lactose intolerance management, possibly due to the seasonal festivities. It is estimated that 70 to 75%

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of the world's population has some form of congenital or secondary lactase deficiency, which is more common among people of Asian, South American, and African descent (CORGNEAU et al., 2017).

Digestive enzymes are biologically active proteins essential to the digestive process. They act as catalysts for the chemical reactions responsible for breaking down macromolecules, such as carbohydrates, proteins, and lipids, into smaller compounds that can be absorbed. These enzymes exhibit high specificity for their substrates and play a fundamental role in metabolism, in addition to other pathophysiological functions, highlighting the systemic role of these molecules and the relevance of proteomics in investigating molecular mechanisms related to health and disease (CHAVAN; SCHMID-SCHÖNBEIN, 2025).

Among the main digestive enzymes, lactase and sachets for the on-demand preparation of beverages and foods containing a combination of alpha-amylase, lactase, protease, bromelain, and lipase stood out, such as Enzyfor® (Vitafor™). Used primarily to reduce or prevent the symptoms of lactose intolerance, lactase enables the consumption of dairy products without significant discomfort for individuals who are more sensitive to dairy. The enzyme is administered orally, usually in the form of tablets, capsules, or drops, before or during the consumption of foods containing lactose, with the aim of compensating for endogenous enzyme deficiency and promoting adequate digestion of the disaccharide while it is still in the intestinal lumen (DENG et al., 2015).

Lactose malabsorption can cause symptoms through multiple pathophysiological mechanisms. Initially, undigested lactose remains in the intestinal lumen, where it acts as an osmotically active substance, promoting water retention and leading to osmotic diarrhea. Later, upon reaching the colon, lactose is fermented by the gut microbiota, producing short-chain fatty acids, hydrogen, carbon dioxide, and methane. These products of bacterial fermentation can contribute to increased intestinal secretion, characterizing secretory diarrhea, as well as causing colonic distension, flatulence, abdominal pain, and a sensation of bloating resulting from gas accumulation (DENG et al., 2015).

The efficacy of exogenous lactase has been demonstrated in clinical trials,

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showing improvement in symptoms and functional parameters in adults with lactase deficiency. A randomized controlled clinical trial involving 129 adult patients with lactose intolerance demonstrated a relationship between oral administration (one tablet, three times daily) for 42 days and improved gastrointestinal symptoms and lactose tolerance, compared to the control group (FRANCESCONI et al., 2016).

3.6 Analyzing each subclass data

It was observed that, respecting the necessary proportions, the consumption profile of dietary supplements in the city of Redenção-CE appears similar to the consumption of Brazilians. A market survey showed that vitamins and minerals are the most commonly consumed products, followed by FS for sports nutrition and herbal products (FELIX, 2025). When examining the subcategories, it becomes clear that the products mentioned also show significant sales in this study (Table 1).

Table 1. Main dietary supplements sold in a private community pharmacy in Redenção, CE, Brazil, across subcategories in April 2024 and April 2025 (n = 1,703).

Category	Products		Quantity	% of total	Number of products per subclass	% per subclass
Nutrients	1º	Multivitamins	119	7.0	480	~28.2
	2º	Magnesium	62	3.6		
	3º	Vitamin B12	44	2.6		
Functional Products	1º	Creatine	150	8.8	470	~27.6
	2º	Women's Health Products	41	2.4		
	3º	Pre-workouts	38	2.3		
Bioactive Compounds and Other Ingredients	1º	Omega-3	153	9.0	277	~16.3
	2º	Turmeric	39	2.3		
	3º	Coenzyme Q-10 and combinations	33	1.9		
Natural Products	1º	Aqueous propolis extract	58	3.4	220	~12.9
	2º	Green tea	26	1.5		
	3º	Evening primrose oil	17	1.0		
Consumables	1º	Energy drinks	71	4.2	160	9.4
	2º	Protein bars	31	1.8		
	3º	Ginger candies	28	1.6		
Digestive Health	1º	Digestive Enzymes	81	3.8	96	5.6

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When all marketed products were analyzed, a higher sales volume was observed for solid pharmaceutical dosage forms (figura 3), primarily: capsules (n=604), powders and granules (n=465) and tablets (n=366); followed by liquid pharmaceutical forms (n=188) and moldable, like gums (n=80) (Figure 3.a). Regarding the unit prices of the products sold, it was observed that approximately 50% of them (n = 850) were priced between R$ 51-100, while 25% cost less than R$ 25 (Figure 3.b).

According to the Brazilian Institute of Geography and Statistics (IBGE), Redenção, CE, has an average monthly salary for formal workers of approximately R$ 5,500, nearly twice that observed in other cities in the Baturité Massif Region. However, the municipality ranks 5,571st nationally and 184th within the state. On the other hand, in 2010, it was estimated that approximately half of the population had a nominal monthly *per capita* income of up to half the minimum wage, which may be associated with underreporting of formal employment, as the city is characterized by intense agricultural activity and a high population density in rural areas (IBGE, 2022).

These results differed from data observed in a similar study conducted in Piauí/Brazil, where liquid pharmaceutical forms were predominant (71.85% of sales) (SALES; MOURA; MEIRELLES, 2025). On the other hand, Limenh et al. (2024) A cross-sectional study in community pharmacies demonstrated a preference for tablets, especially when they are easier to swallow (LIMENH et al., 2024). Ademais, do ponto de vista industrial, formas farmacêuticas sólidas apresentam vantagens associadas ao custo-benefício da produção, maior estabilidade e melhor logística relacionada à distribuição e armazenamento, o que pode justificar a maior disponibilidade de produtos (TAYLOR; AULTON, 2021)

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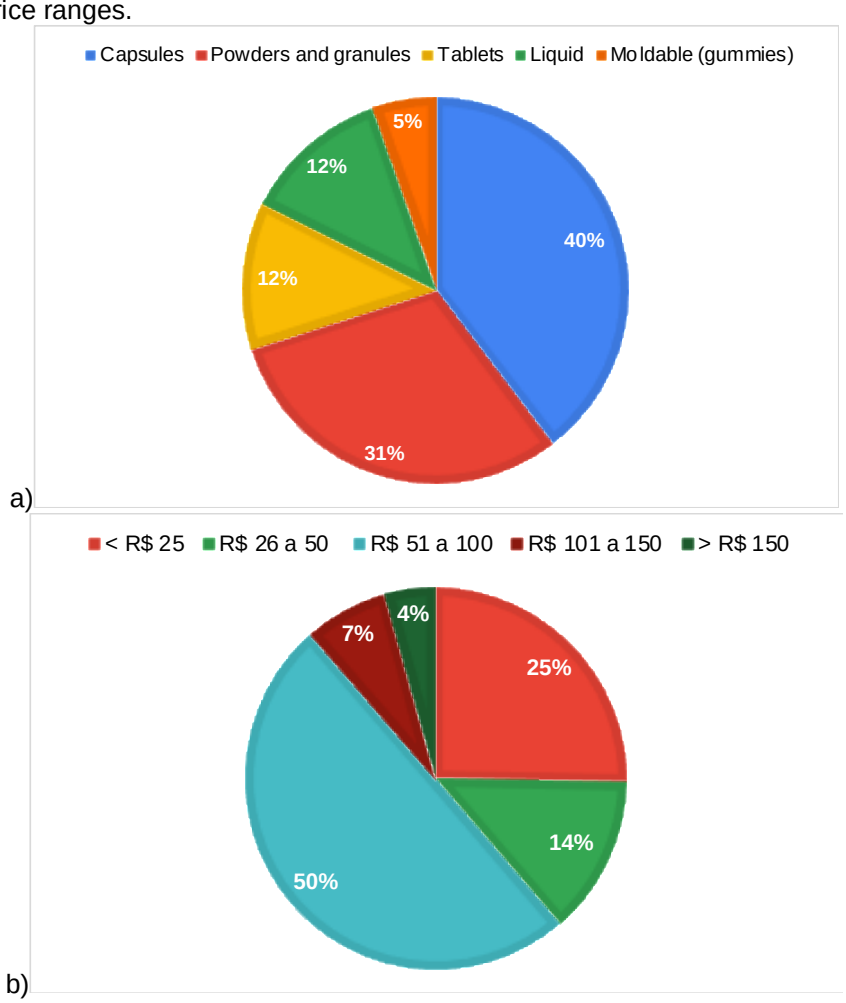
Figure 3. (a) Main dosage forms of dietary supplements sold in April 2024 and April 2025; (b) Product unit price ranges.



3.6.1 Nutrients

FS containing trace elements, vitamins, and minerals were the main products sold in this subclass, accounting for 28.2% of the supplements. In addition to the multivitamins previously mentioned, magnesium and vitamin B12 also stood out. Sales, Moura e Meirelles (2025) also reported that magnesium was the main FS sold in the *Nutrients* category; however, this subcategory accounted for only 5% of total sales.

Magnesium plays a fundamental role in nearly all intracellular metabolic and biochemical processes, participating in a wide range of functions, from bone structure formation and neuromuscular activity to cellular signaling and

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macronutrient metabolism (FIORENTINI et al., 2021). Considering that a large proportion of the population does not meet daily recommendations through diet alone, supplementation may be a useful strategy, particularly for individuals with specific needs or difficulty maintaining a varied diet (MATEK SARIĆ et al., 2025).

Magnesium supplementation is available in different formulations, with absorption being more efficient in organic forms, and has demonstrated beneficial effects in various clinical conditions, such as cardiovascular and bone health (DOMINGUEZ; VERONESE; BARBAGALLO, 2020; KAPPELER et al., 2017).

Supplementation with organic forms of magnesium (290–370 mg/day) has been associated with consistent reductions in systolic and diastolic blood pressure (KASS; WEEKES; CARPENTER, 2012), as well as suppression of bone remodeling in postmenopausal women with osteoporosis (AYDIN et al., 2010). Magnesium oxide, in turn, is commonly used as a laxative in the management of constipation (MORI et al., 2019).

On the other hand, although excess magnesium from food rarely poses a risk in healthy individuals, this is due to renal regulation (ISMAIL; ISMAIL; ISMAIL, 2018), high doses can trigger osmotic diarrhea, nausea, abdominal cramps, and even more serious complications such as fatal cardiac arrhythmias and respiratory failure (NANDURI; SALEEM; KHALAF, 2020).

Cobalamin, commonly known as vitamin B12, acts in concert with other B-complex vitamins to support multiple cellular metabolic pathways. The effects of vitamin B12 deficiency are primarily observed in hematological parameters, serum homocysteine levels, and the nervous system (MAZUR et al., 2025). Therefore, the high demand for this FS may be associated with the need to address cardiovascular and neurobehavioral disorders, as well as other causes of deficiency across different population groups.

Vitamin B12 deficiency can occur due to various causes, ranging from insufficient dietary intake and excessive alcohol consumption to inadequate absorption. The latter can be triggered by autoimmune conditions, such as pernicious anemia, or by structural changes resulting from surgeries and gastrointestinal diseases. In addition, the use of certain medications, infections

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(such as HIV), and hereditary disorders that affect the transport and affinity of cellular receptors are also important causes of B12 deficiency (MAZUR et al., 2025)

In addition to being indicated in these cases, cobalamin supplementation may also be considered for higher-risk populations, such as older adults, patients in the postoperative period following bariatric surgery, chronic users of metformin or proton pump inhibitors, and individuals following plant-based diets (SLYWITCH, 2022; WOLFFENBUTTEL et al., 2019).

3.6.2 Functional products

Functional products accounted for 27.6% of the FS sold. In the context of the survey conducted, in addition to the creatine already described, products related to women's health and athletic performance stood out. This highlights a demand associated with the prevention of symptoms related to hormonal imbalance, increased performance, and improved quality of life, aesthetics, and well-being.

Regarding women's health, this consumption profile reflects a growing search for self-care strategies, especially during specific phases of the female life cycle, such as childbearing age, pregnancy, and climacteric. In the clinical field, the literature presents consistent evidence on the use of some of these inputs, such as iron supplementation associated with folic acid in the prevention of iron deficiency anemia in women of childbearing age (NIH, 2024) and calcium and vitamin D in maintaining bone health, especially in postmenopausal women, reducing the risk of osteopenia and fractures (BOLLAND; GREY; AVENELL, 2018).

Pre-workout supplements also stood out in this subcategory. These products are widely consumed by individuals seeking improved physical performance, increased energy, and reduced fatigue during exercise. Consumption is strongly associated with people who engage in recreational physical activity, not necessarily athletes, which broadens the reach of these products in the context of community pharmacies (ROUNSEFELL et al., 2020).

In regulatory terms, the main ingredients identified in these products, such as isolated forms or combinations of caffeine, creatine, beta-alanine, and amino acids,

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are among those permitted by Brazilian legislation (ANVISA, 2018On the other hand, it is important to note that the use of pre-workout supplements without proper consideration of appropriate dosage, frequency of use, or concomitant intake of other stimulant substances may increase the risk of adverse effects, particularly in sensitive individuals or those with pre-existing comorbidities (ROUNSEFELL et al., 2020).

One study reported that, although pre-workout supplements may enhance physical performance, improving strength, focus, and energy, their use has also been associated with cardiovascular alterations, which may be either deleterious or cardioprotective depending on factors such as dosage, population group, level of physical inactivity, and the presence of comorbidities (BELLA et al., 2025).

3.6.3 Bioactive compounds and other inputs

Ranking third (16.3% of the FS sold), in addition to omega-3, turmeric and coenzyme Q10 also stood out.

In Brazil, turmeric (*Curcuma longa* L.) and curcumin—the main bioactive compound in turmeric—are authorized as food additives and ingredients, with claims restricted to antioxidant function and use as a natural colorant, without permission for therapeutic claims (ANVISA, 2018b; MESSA et al., 2025).

Clinical evidence regarding curcumin suggests potential benefits in reducing inflammatory markers in inflammatory and gastrointestinal conditions, and as an adjunct in the treatment of obesity (BRITTO et al., 2025; KATTAH et al., 2025; MESSA et al., 2025). Therefore, the present study may indicate a link between consumption and modulation of the inflammatory response.

In this context, it is important to highlight issues related to the lack of standardization of plant extracts and, consequently, the variability in the composition of commercial products. Chromatographic analyses of FS have revealed quality deviations and potential fraud, with wide variation in the labeled curcumin content (0.057% to 2.06% w/w); 77% of samples contained less than 1% w/w, with no consistent correlation with price. These findings suggest the use of

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inadequate raw materials, degradation, or adulteration, such as dilution with starches and artificial colorants. Such inconsistencies contribute to divergent perceptions of efficacy and underscore the need for greater standardization, regulatory oversight, and appropriate guidance regarding the limitations and rational use of these supplements (BRITTO et al., 2025; MARTIROSYAN, 2025).

Regarding health risks, turmeric presents clinically relevant drug interactions, mainly due to inhibition of the CYP3A4 enzyme, which may increase the plasma concentrations of various drugs, such as anticoagulants and antiplatelet agents, anticonvulsants (e.g., carbamazepine), benzodiazepines (midazolam and triazolam), and opioids (fentanyl), potentially intensifying adverse events. In transplant patients or those receiving immunosuppressive therapy (cyclosporine, tacrolimus, sirolimus, and everolimus), the risk of toxicity is particularly high. Therefore, turmeric use should be approached with caution and monitored by healthcare professionals, especially in therapies involving drugs with a narrow therapeutic index (MEDSCAPE, 2026)

Coenzyme Q10, also called ubiquinone, is a lipophilic compound naturally synthesized by the body. The molecule exhibits three redox states: ubiquinone, semiquinone, and ubiquinol (reduced form), with the latter being primarily responsible for its antioxidant activity. It is located predominantly in mitochondrial membranes, where it acts as an essential cofactor in the electron transport chain, participating in oxidative phosphorylation and ATP production. In addition to its bioenergetic role, it acts as a fat-soluble antioxidant, contributing to the neutralization of reactive oxygen species and the regeneration of other antioxidants, as well as participating in cell signaling processes and membrane stabilization (RAIZNER, 2019). Thus, its consumption is commonly associated with antioxidant activity, as an energy-enhancing agent, an anti-aging agent, and an adjuvant in cardiovascular therapies.

Several studies are investigating the biochemical and therapeutic potential of Coenzyme Q10 in cardiovascular, metabolic, neuromuscular, sexual, and reproductive health (AKHIGBE et al., 2024; STAIANO et al., 2023). Clinical trials have shown that prolonged consumption of 100 to 200 mg/day of Coenzyme Q10

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reduces the side effects associated with statin use (muscle pain and fatigue), in addition to improving cardiac function in patients with chronic heart failure (STAIANO et al., 2023).

In reproductive health, supplementation with doses of 200 and 600 mg/day showed a significant increase in the number of oocytes retrieved, improved embryo quality, and increased clinical pregnancy rates. The findings suggest that these effects appear to be dose- and time-dependent and may be associated with improved mitochondrial function, reduced oxidative stress, and greater efficiency of cellular and tissue responses due to coenzyme Q10 supplementation (JIANG et al., 2025; XU et al., 2018).

Among the risks associated with the use of this compound, it is important to consider that there may be a reduced response to warfarin, requiring rigorous monitoring of anticoagulation, and potentiation of the effect of antihypertensive drugs, increasing the risk of hypotension. Consumption should also be evaluated when used concurrently with cancer therapy, given its antioxidant properties and potential interaction with antineoplastic agents (JIANG et al., 2025; MEDSCAPE, 2026).

3.6.4 Natural Products

Comprising 12.9% of all marketed natural products, this subcategory highlighted aqueous propolis extract, green tea, and evening primrose oil. The results suggest a consumption of natural products related to immunoprotection, stimulant activity, and control of menopausal symptoms. This consumption profile may be associated with the traditional use of natural resources in rural areas, given that 41% of the population of the city of Redenção-CE (almost 3 times higher than the national average) resides in rural areas (IBGE, 2022).

Propolis extract was also one of the main products marketed in the study by Sales, Moura, and Meirelles (2025), when this type of product was categorized as an SA (supplementary substance) for immune health. Propolis is a natural resin produced by bees that can be registered as an SA, as well as a traditional

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phytotherapeutic product, if it claims therapeutic properties. There are 3 main types of propolis in Brazil, and the classification is based on botanical and geographical aspects: green, red, and brown propolis (SURAN *et al,* 2021). Recent studies, mostly preclinical, have demonstrated the anti-inflammatory, antioxidant, antimicrobial, and especially immunomodulatory potential of aqueous extract of green propolis, activities attributed to the high concentration of flavonoids, phenolic acids, and their derivatives (MAGNAVACCA et al., 2022).

Green tea, in turn, is traditionally used in the form of an infusion of *Camellia sinensis* leaves due to its potential benefits regarding antioxidant and thermogenic activities, which makes it considered a stimulant, thermogenic, and auxiliary tool in the weight loss process (ABREU et al., 2022). Chen *et al* (2016), demonstrated that the effect of supplementation with green tea extract standardized to 57.12% epigallocatechin-3-gallate (EGCG), the main antioxidant polyphenol present in the species, showed statistically significant reductions in abdominal circumference, body mass index, and body weight (CHEN et al., 2016).

Evening primrose seed oil (*Oenothera biennis*), in turn, contains essential fatty acids, such as Omega-6. It is popularly used due to its ability to help treat disorders associated with women's health, such as alleviating symptoms caused by menopause, helping to manage hot flashes and night sweats (KAZEMI et al., 2021). The high demand for this active ingredient is consistent with the findings on the marketing of functional products aimed at women's health.

3.6.5 Consumables

In the Inputs subgroup (9.4%), in addition to the problem already presented regarding the consumption of energy drinks; the consumption of protein bars stood out, followed by ginger candies. This subclass prioritized the counting of products reported as SA.

Protein bars are used as *"snacks,"* practical sources for supplementing daily protein intake and controlling appetite when introduced into balanced diets. Coupled with physical exercise, adequate protein intake contributes to increased muscle

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mass and strength, especially in individuals with reduced basal protein consumption. However, there is a saturation point, beyond which increasing protein intake does not result in relevant additional gains. Furthermore, excessive consumption can lead to liver and kidney overload (JAGIM et al., 2020).

Ginger candies, in turn, are generally used to relieve nausea and mild throat and gastrointestinal discomfort, being associated with antiemetic and digestive action (dyspepsia, abdominal pain), without formal therapeutic character when the product is presented as food (LETE; ALLUÉ, 2016). In addition, studies show that ginger extract (600 to 2,500 mg) is associated with a reduction in the incidence and severity of Nausea and vomiting in pregnant women and patients undergoing surgery (BEIRANVAND; ALVANIB; SORORI, 2022; VILJOEN et al., 2014).

These doses, however, are not contained in ginger candy forms. Therefore, ginger consumption should be evaluated clinically and individually, as prolonged use may promote interaction with antiplatelet and anticoagulant drugs, such as warfarin. These risks are often ignored when the product is consumed in candy or food form, reinforcing the need for pharmaceutical and nutritional guidance (MEDSCAPE, 2026).

3.6.6 Digestive Health

In this last subclass, in addition to the digestive enzymes mentioned above, probiotics were grouped, together totaling 5.6% of the commercially available supplements. These results are particularly interesting for Redenção-CE, as it was estimated that hospitalizations due to diarrhea were around 230 per 100,000 inhabitants (IBGE, 2022).

Probiotics are defined as live microorganisms that, when administered in adequate amounts, confer health benefits to the host. In Brazil, obtaining these supplements is conditional upon proof of the safety and beneficial effects of probiotics, requiring unequivocal identification of the strain, safety data, and scientific evidence to support their consumption (ANVISA, 2018b; BRASIL, 2018).

Regarding the probiotics observed in this study, these SAs totaled only 0.9%

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of the products marketed, a result almost 6 times lower than the findings observed by Sales, Moura e Meirelles (2022). Probiotics were mainly represented by brewer's yeast (a nutritional supplement derived from the inactivated fungus *Saccharomyces cerevisiae*), in addition to combinations of probiotic strains, such as SIMCAPS® (Vitafor™), composed of *Bifidobacterium animalis subsp*. *lactis* HN019 and *Lactobacillus acidophilus* NCFM.

Probiotics are commonly used to maintain digestive health, modulate intestinal permeability, and reduce gastrointestinal symptoms, especially in situations of microbiota imbalance, such as after antibiotic use (reducing the incidence of diarrhea) or in gastrointestinal disorders associated or not with irritable bowel syndrome, such as abdominal pain, bloating, and flatulence (GOODMAN et al., 2020; GOODOORY et al., 2023).

The proposed mechanisms of action include competition with pathogenic microorganisms, the production of antimicrobial metabolites, the strengthening of the intestinal epithelial barrier, and the modulation of the local and systemic immune response (MARKOWIAK; ŚLIŻEWSKA, 2017; SANDERS et al., 2019). It is important to emphasize that the effects of probiotics are strain-dependent and not generalizable to all products available on the market (GOODOORY et al., 2023).

4. Conclusion

The analysis of the purchasing profile of dietary supplements at a private community pharmacy in Redenção-CE revealed the predominance of the sale of the following products: omega-3, creatine, multivitamins, energy drinks, and digestive enzymes, reflecting a diversified consumption pattern aligned with different health and lifestyle demands. In addition, isolated micronutrient supplements, ergogenic aids, bioactive compounds – such as turmeric and coenzyme Q10, natural products, protein snacks, ginger candies, and probiotics were also sold in significant quantities.

Given this context, the importance of the role of pharmacists and nutritionists in promoting the safe and rational use of supplements, especially in the community

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pharmacy setting, becomes evident. They play a fundamental role in providing evidence-based guidance, assessing the real need for supplementation, and preventing risks associated with indiscriminate use, contributing to a safer and more conscious practice on the part of the population.

It is important to highlight that the analysis is based on the annual sales report of a single private community pharmacy, so the data may not fully represent the consumption profile of the local community, and that the establishment is located within one of the city's main supermarkets, which may bias the results due to its characteristic commercial potential. Additionally, only secondary sales data were used during the study; information such as consumer adherence and habits, clinical follow-up, or formal prescription of the supplements were not evaluated.

Thus, future studies are needed to deepen the understanding of this phenomenon, including investigations that consider clinical aspects, sociocultural determinants, and the influence of communication and marketing in health on consumer behavior.

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