



Python Pandas and Matplotlib Portfolio

# SALES ANALYSIS FOR HEALTH SUPPLEMENTS

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## Executive Summary

This analysis examined weekly health supplement sales from January 2020 through December 2024 across multiple platforms (Amazon, Walmart, iHerb) and regions (USA, UK, Canada). The project aimed to uncover trends in product performance, regional demand, and platform effectiveness, while identifying key factors driving sales and returns. Key insights include strong year-over-year sales growth, distinct seasonal purchasing patterns, and notable differences in platform and regional performance, which reveal opportunities to optimize pricing, promotions, and inventory allocation.

## Business Problem

Supplement sales are distributed across various platforms and geographic markets, making it difficult to track performance consistently and identify which products, regions, or channels are most profitable. Additionally, return rates are not fully understood. Without a unified analysis, strategic decisions around inventory, promotions, and platform focus remain reactive rather than data-driven.

## Methodology

*Python, Pandas, and Matplotlib*

- Cleaned and structured weekly sales data using Python and pandas for time-series and comparative analysis
- Conducted trend analysis to evaluate overall sales evolution, seasonal patterns, and year-over-year growth
- Analyzed product and category performance to identify top sellers and return rate drivers
- Compared geographic and platform performance in terms of revenue, units sold, and return rates
- Investigated return trends, including the relationship between price and return likelihood
- Visualized findings using matplotlib with bar charts, line charts, pie charts, scatter plots, and stacked bar charts to support clear, actionable insights

## **Skills Used**

Python:

Pandas, Matplotlib, data cleaning, time-series analysis, data visualization, exploratory data analysis (EDA), comparative analytics, trend forecasting

## **Results & Business Recommendations**

The analysis revealed clear drivers of sales performance and returns across products, regions, and platforms:

- UK shows the highest return rate and volatile revenue, while the USA has the lowest returns and steady growth, and lastly, Canada is the most profitable location.
- Pre-Workout is a top seller but has one of the highest return rates.
- Higher-priced items do not lead to more returns—in fact, they have slightly lower return rates.
- Sales are highly seasonal, with dips in February, April, and November.
- iHerb leads slightly in sales, but all three platforms perform consistently well with low return rates.

### **Based on these findings, I recommend:**

- Investigate and address UK fulfillment and customer satisfaction issues.
- Review Pre-Workout product details and gather customer feedback to reduce returns.
- Introduce premium bundles and confidently price higher for quality items.
- Run targeted promotions in low-season months to balance revenue.
- Localize platform listings: highlight Fish Oil on Amazon, Green Tea on Walmart, and specialty supplements on iHerb.
- Bundle top-selling, low-return products like Zinc and Ashwagandha to boost loyalty and average order value.

# Table of Contents

Project Description .....	05
Key Questions .....	06
Findings & Insights .....	07
Summary of Findings .....	23
Recommended Actions .....	24
Code Snippet .....	25

# Project Description

## Goal

- To analyze health supplement sales data from 2020–2024 to identify key trends, product performance, geographic demand, and platform effectiveness, uncovering actionable insights that can optimize sales strategy, reduce returns, and improve overall profitability.

## Problem

- Despite consistent growth in the supplement market, sales and return performance vary significantly across platforms, regions, and product categories. Without a unified analysis of these patterns, the company cannot effectively allocate marketing spend, optimize pricing and promotions, or strategically manage inventory, leading to missed revenue opportunities and higher operational costs due to returns.

## Who Will Benefit

- **Management**
  - Gain data-driven insights to optimize pricing and promotion across channels and regions.
- **Marketing & Customer Service Teams**
  - Can use product and category performance trends to design targeted campaigns .
- **Operations & Supply Chain Teams**
  - Will benefit from understanding geographic demand patterns and return drivers to improve fulfillment.
- **Company Leadership**
  - Can make informed strategic decisions regarding product development, market expansion, and platform investment to drive growth and profitability.

# Key Questions

## Overall Sales Trends

- How have total sales evolved from 2020 to 2024?
- Are there seasonal patterns in supplement sales?
- Which months have the highest/lowest sales?
- Is there year-over-year growth?

## Product Performance

- What are the top 10 best-selling products?
- Which products have the highest/lowest return rates?

## Category Insights

- Which supplement category is most popular?
- How do category sales trends differ?

## Geographic Performance

- Which location (USA, UK, Canada) generates the most revenue?
- Do product preferences vary by location?
- Which location has the highest return rates?

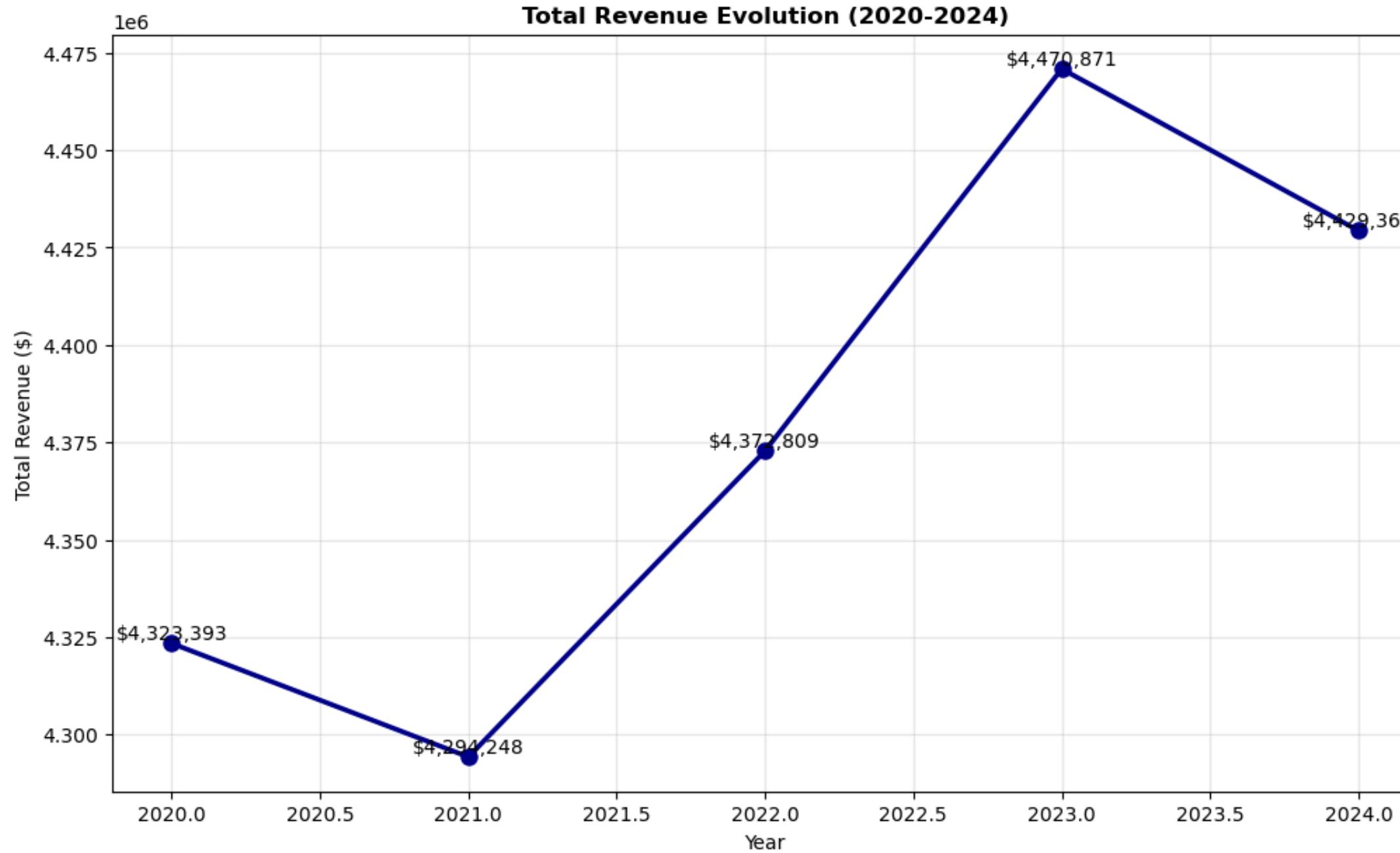
## Platform Performance

- Which platform (Amazon, Walmart, iHerb) has the highest sales?
- Do platform preferences vary by location?
- How do return rates compare across platforms?

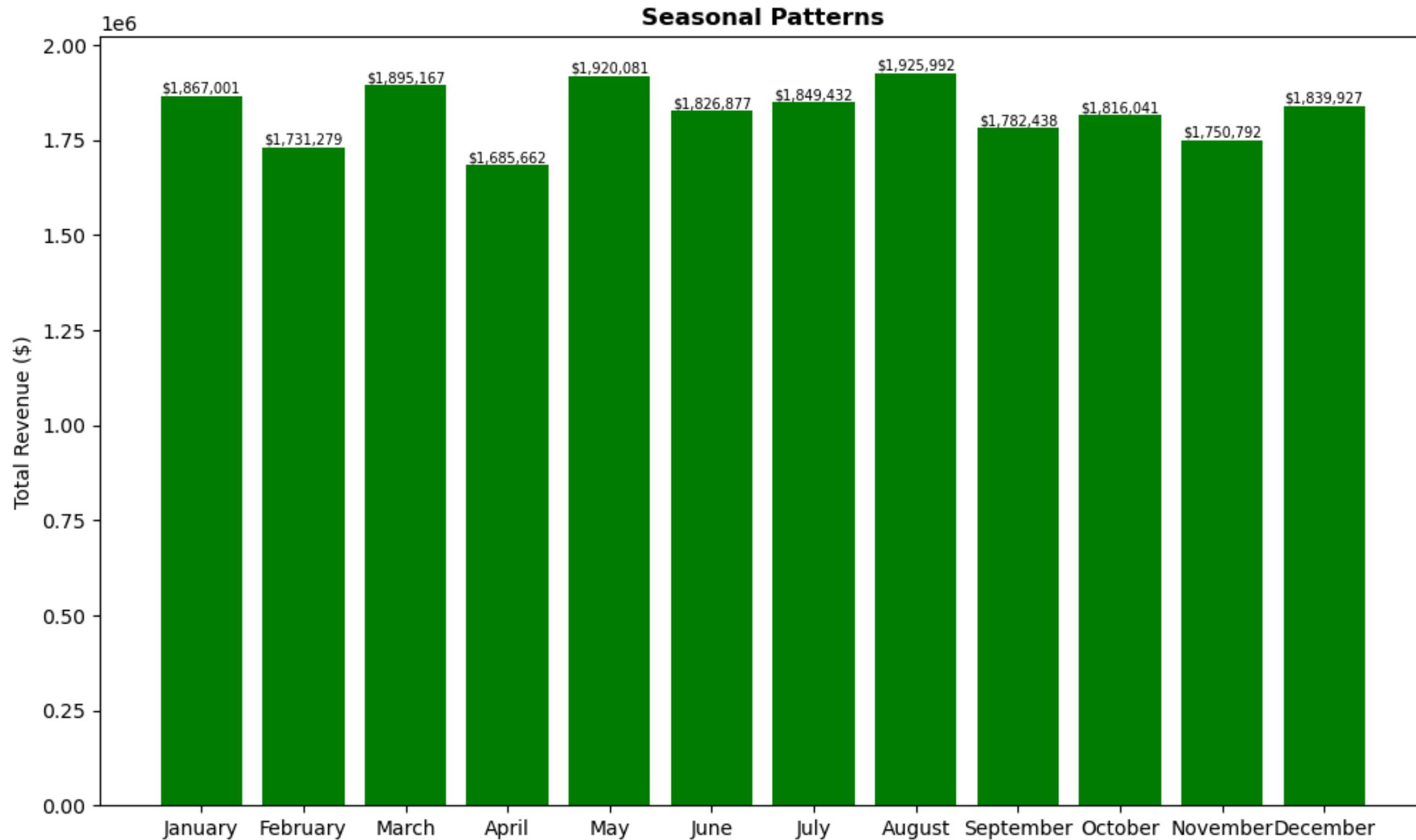
## Return Analysis

- What is the overall return rate trend?
- Which products have abnormally high return rates?
- Do higher-priced items have higher return rates?

# Overall Sales Trend

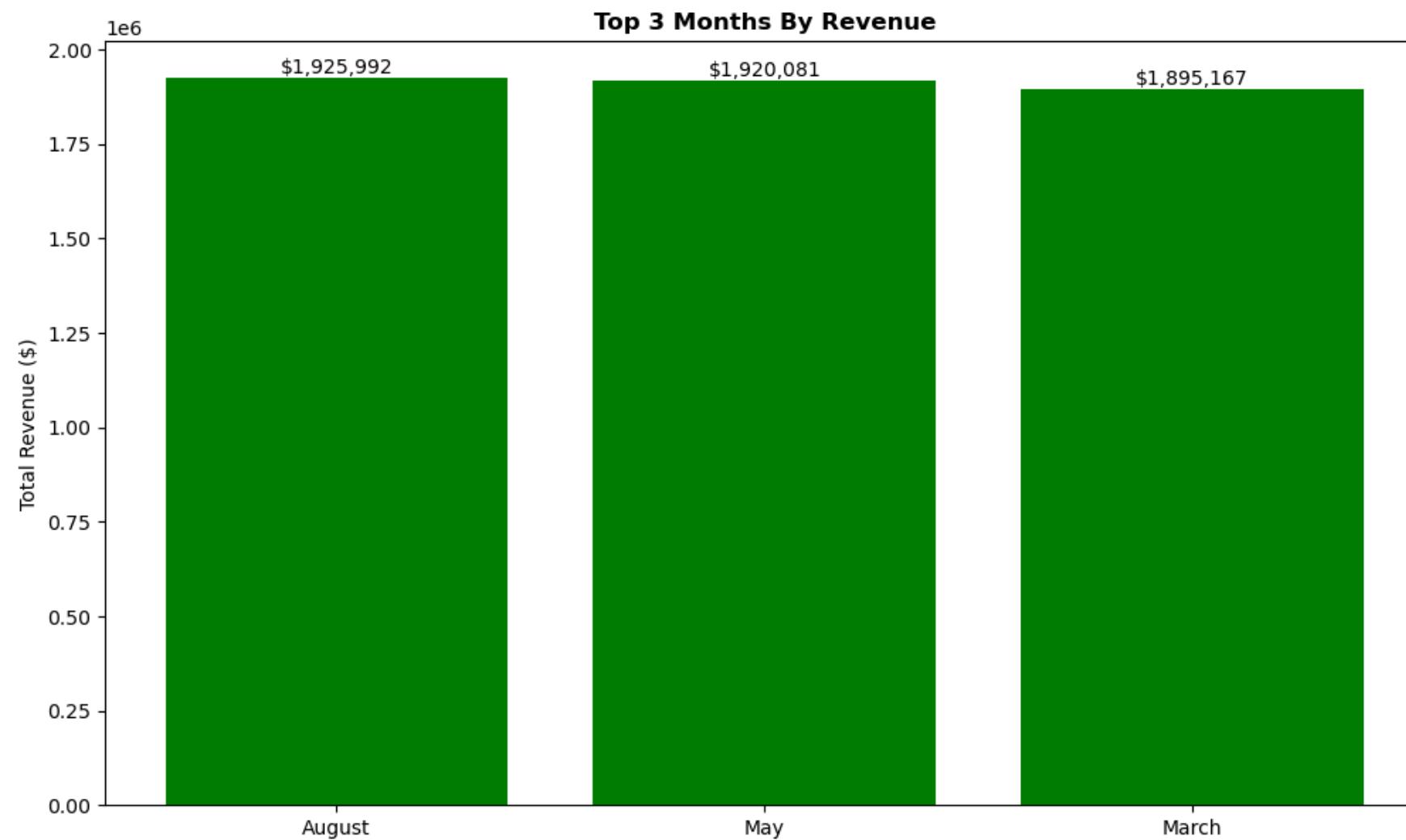


From 2020 to 2024, total sales show moderate growth with periodic fluctuations. Revenue peaked in 2023 before a slight dip in 2024. The overall trend suggests market stability, but the YoY volatility indicates sensitivity to external factors—possibly post-pandemic adjustments, inventory shifts, or competitive changes.

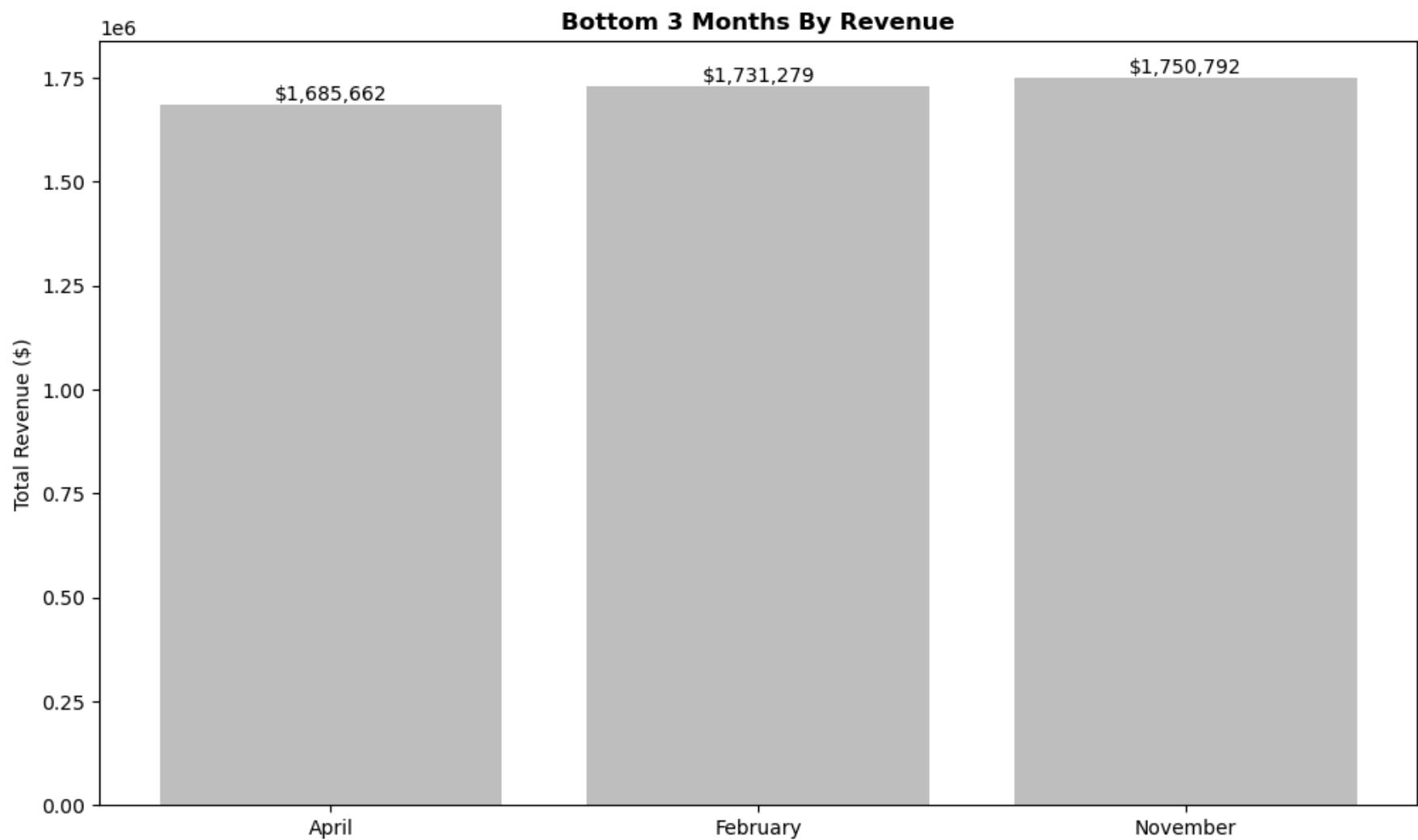


Sales are highly seasonal, with clear peaks in late spring and late summer. This aligns with common health and fitness cycles. The dip in April may reflect a post-Q1 slump, while November's low could signal holiday budget reallocation by consumers.

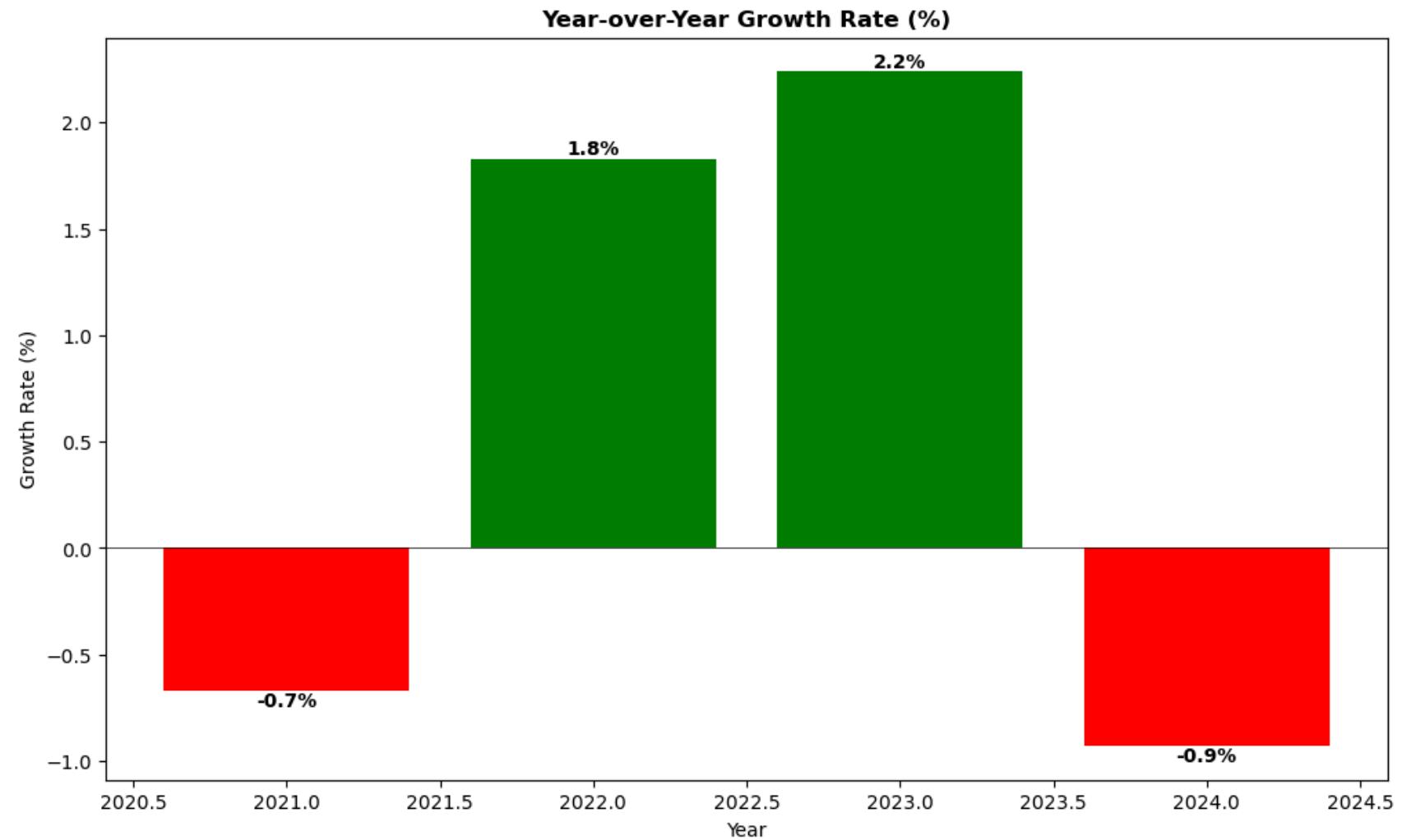
Marketing and inventory should be ramped up in Q1 and Q3 to capture seasonal demand. Consider running retention campaigns in low months to smooth revenue.



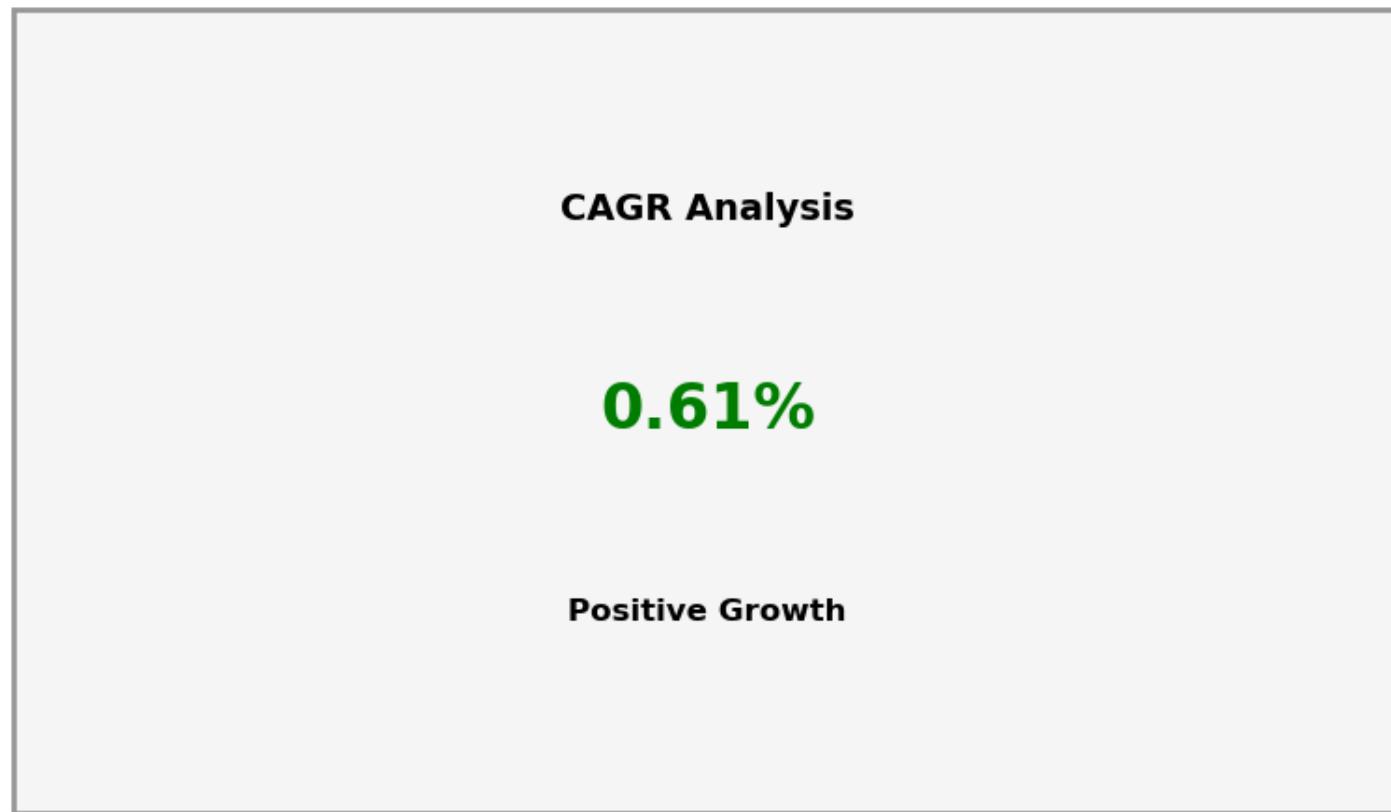
Revenue varies meaningfully by month. The best months deliver ~14% more revenue than the worst months. This isn't extreme seasonality, but it's enough to impact cash flow and inventory planning



Focus promotional efforts in February, April, and November to lift baseline performance. Test whether discounts, bundles, or email campaigns in these months can reduce the seasonal gap.

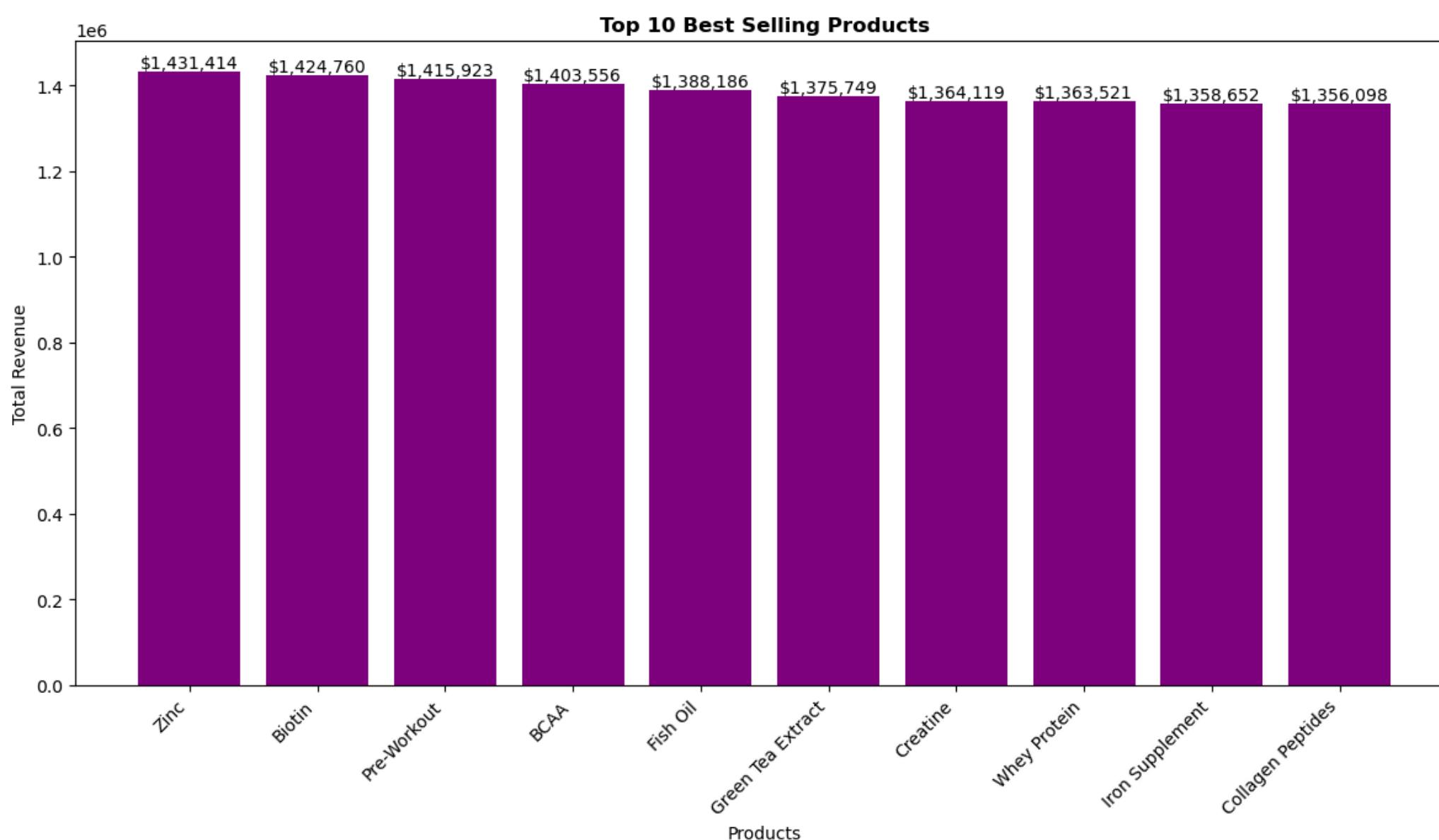


Year-over-year growth has been inconsistent, with two years of decline. However, the positive CAGR of 0.61% shows we've maintained slight upward momentum over five years. This suggests resilience but not aggressive growth."



To improve CAGR, we need to address the down years. Was 2021's decline pandemic-related? Was 2024's drop due to new competitors? Deep dives into those years can unlock strategies to stabilize growth.

# Product Performance

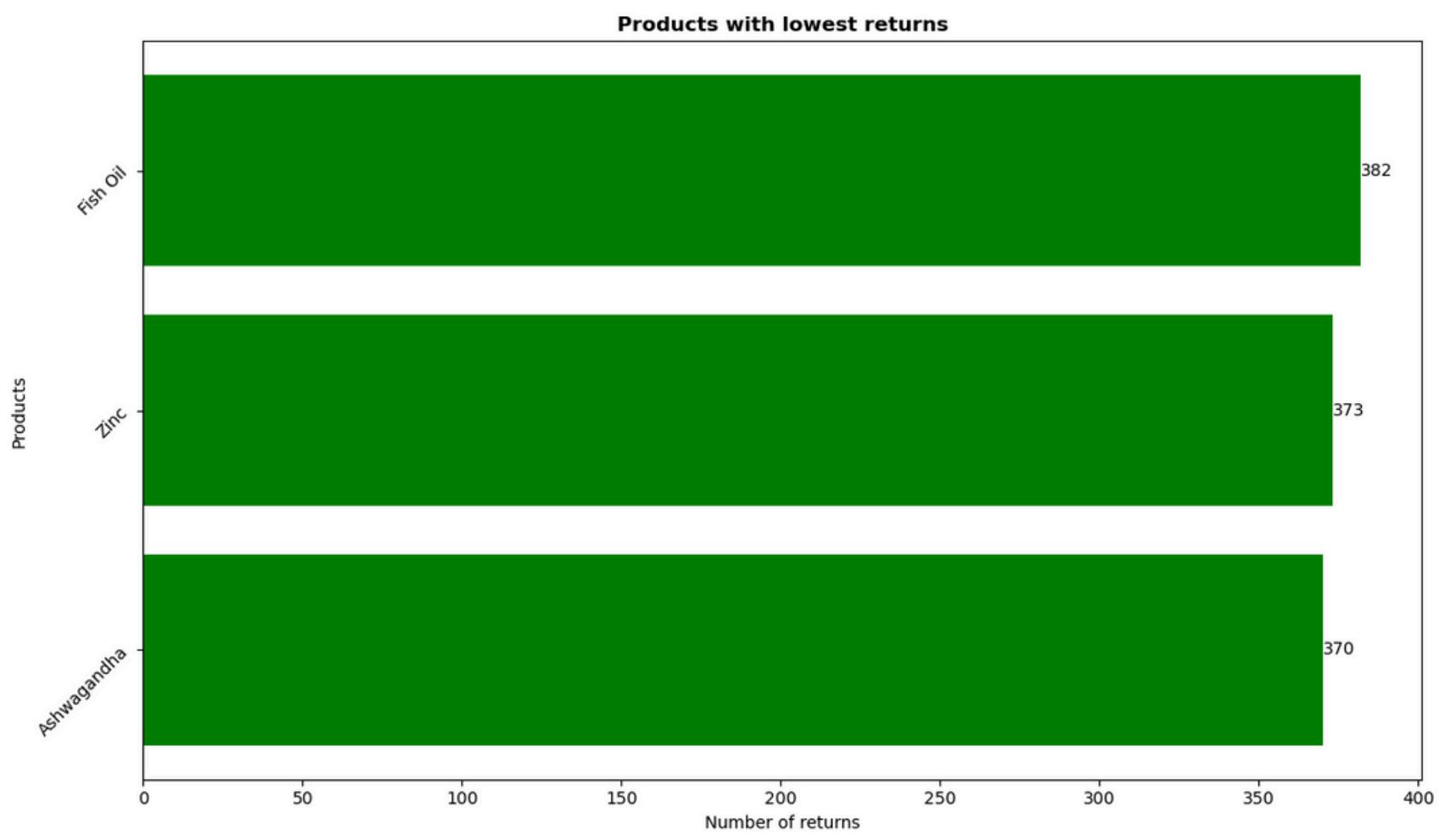
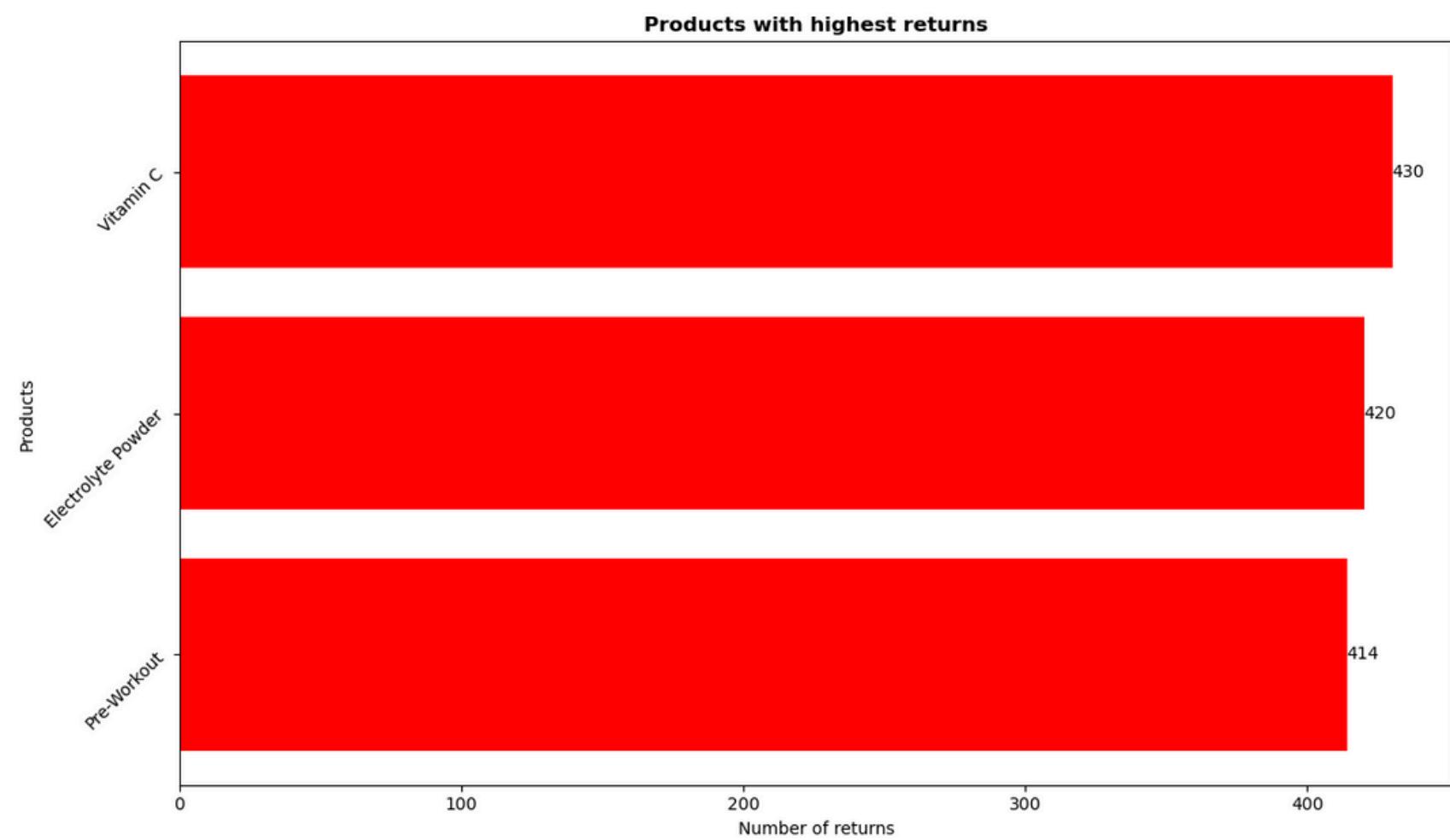


The top 10 products are very close in revenue, ranging from \$1.43M (Zinc) down to \$1.36M (Collagen Peptides).

This suggests a balanced portfolio—no single product dominates, which reduces risk.

Top 10 products generate remarkably consistent revenue, with less than a 5% gap between #1 and #10. This indicates a well-diversified product lineup with broad customer appeal. Zinc and Biotin lead, reflecting strong demand for immune and beauty-related supplements.

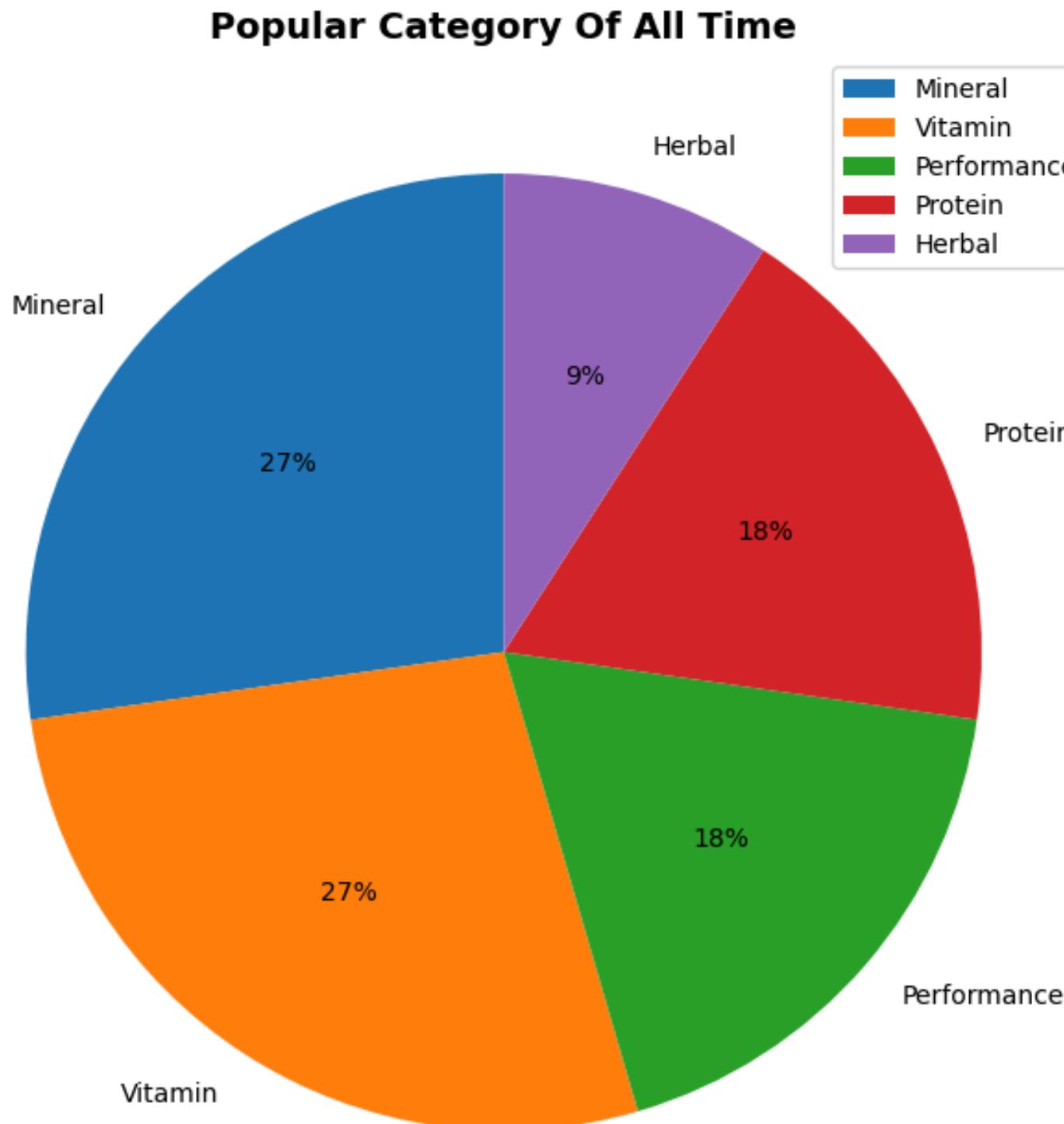
Since revenue is evenly distributed, we should avoid over-investing in just one 'star' product. Instead, focus on bundling top sellers (e.g., Zinc + Vitamin C) or cross-promoting within categories to increase average order value.



While Pre-Workout is a top seller, it also has one of the highest return rates. This could signal quality issues, flavor dissatisfaction, or mismatched customer expectations. In contrast, Zinc and Fish Oil perform well in both sales and retention, making them high-efficiency products.

Investigate why Pre-Workout is being returned—consider customer reviews, flavor options, or labeling clarity. Leverage low-return products like Zinc and Ashwagandha in marketing as 'customer favorites' to build trust.

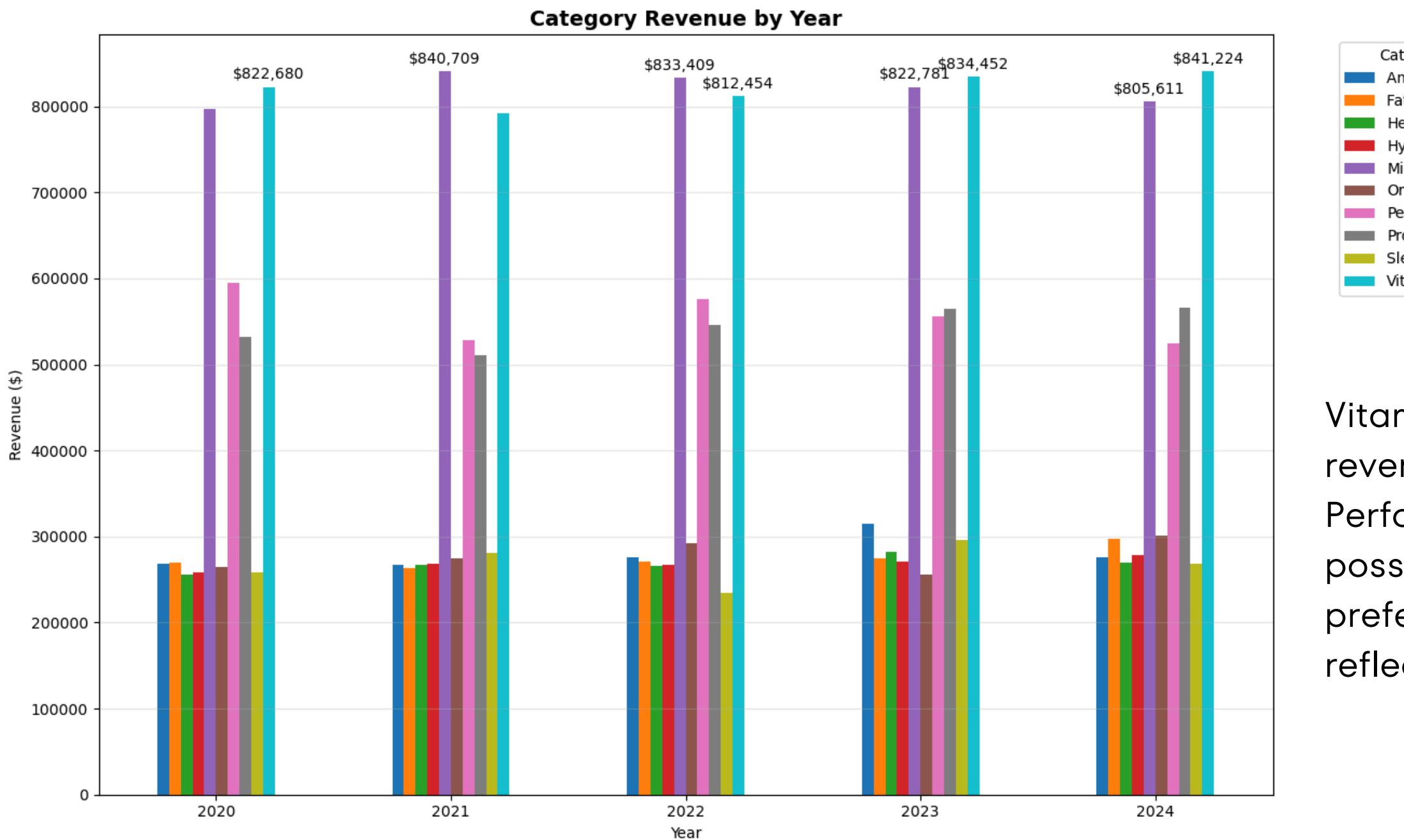
# Category Insights



What the data shows:

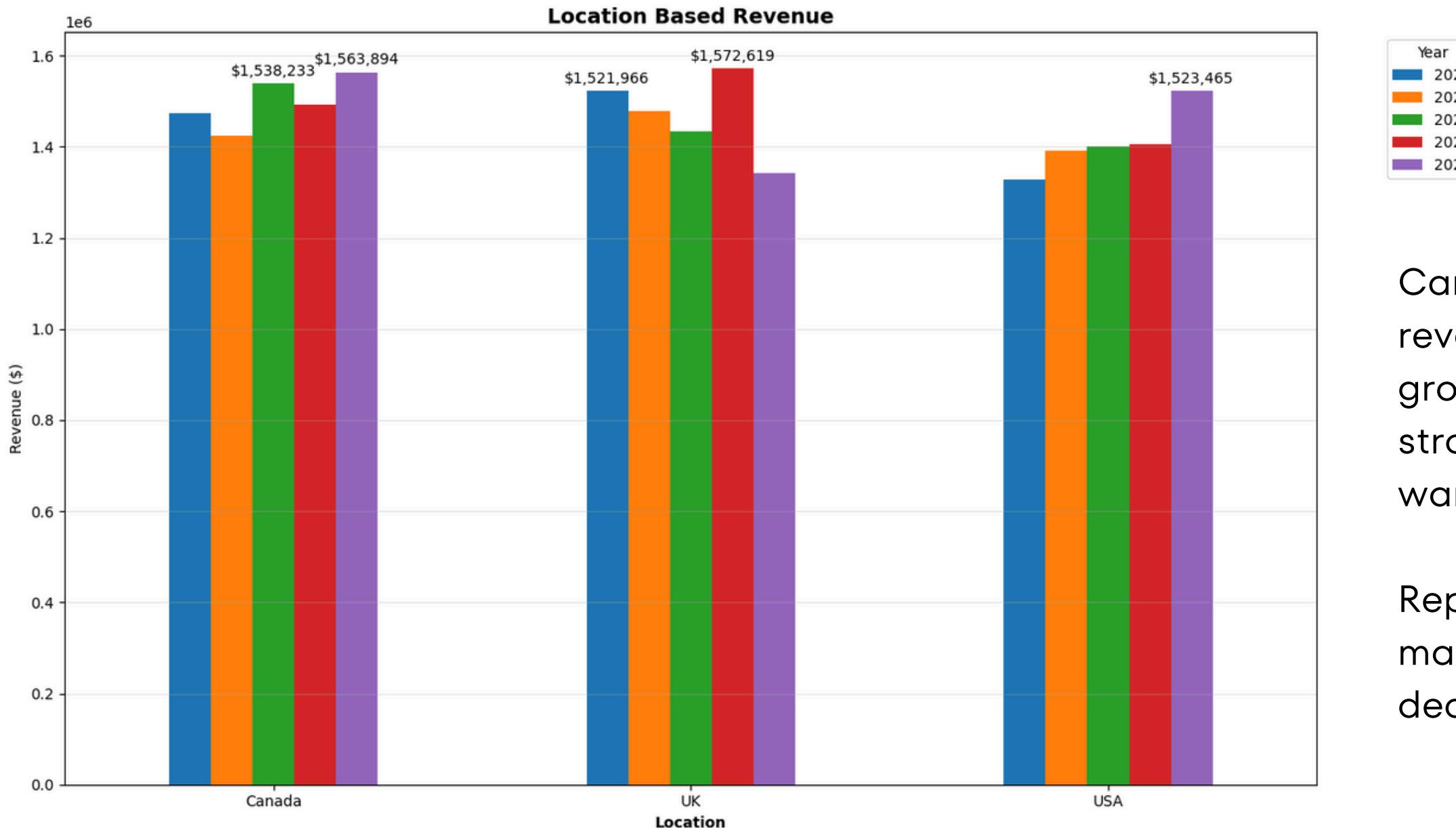
- Mineral and Vitamin categories are virtually tied for #1 (117K units each), dominating the market.
- Performance and Protein are strong second-tier categories (78K units each).

Focus inventory and marketing on Minerals and Vitamins for volume, but leverage Protein for revenue growth. Consider bundling Protein with Performance products to tap into the fitness audience.



Vitamins and Minerals consistently compete for the top revenue spot, showing enduring consumer trust. Performance supplements have declined since 2020, possibly due to market saturation or shifting consumer preferences. Protein is on a steady upward trajectory, reflecting sustained demand in fitness and wellness.

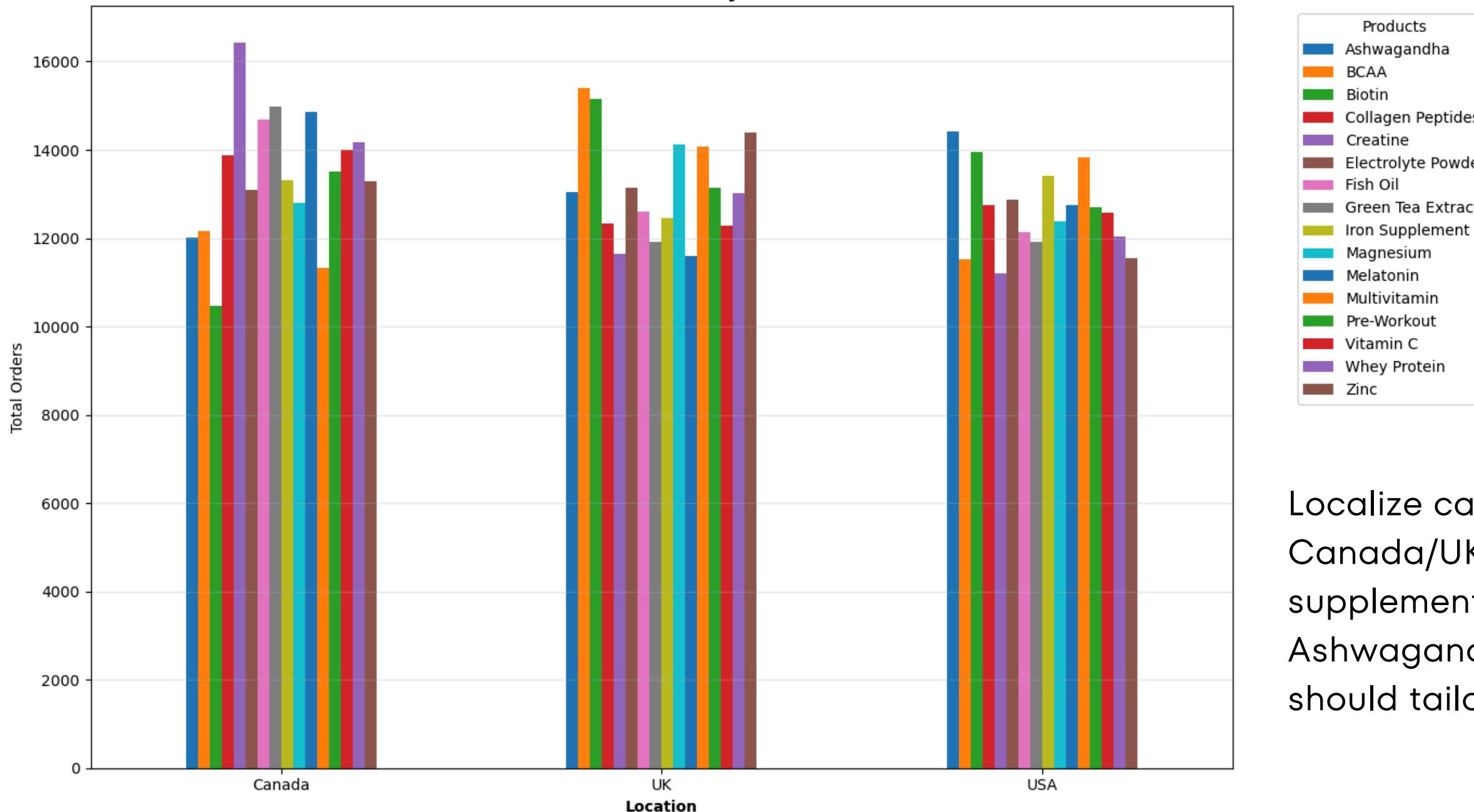
# Geographic Performance



Canada is our most stable and growing market, with revenue increasing each year. The USA shows consistent growth, reflecting steady demand. The UK is volatile, strong in 2020 and 2023, but a significant drop in 2024 warrants investigation.

Replicate Canada's success in the USA through similar marketing/inventory strategies. Investigate the UK's 2024 decline

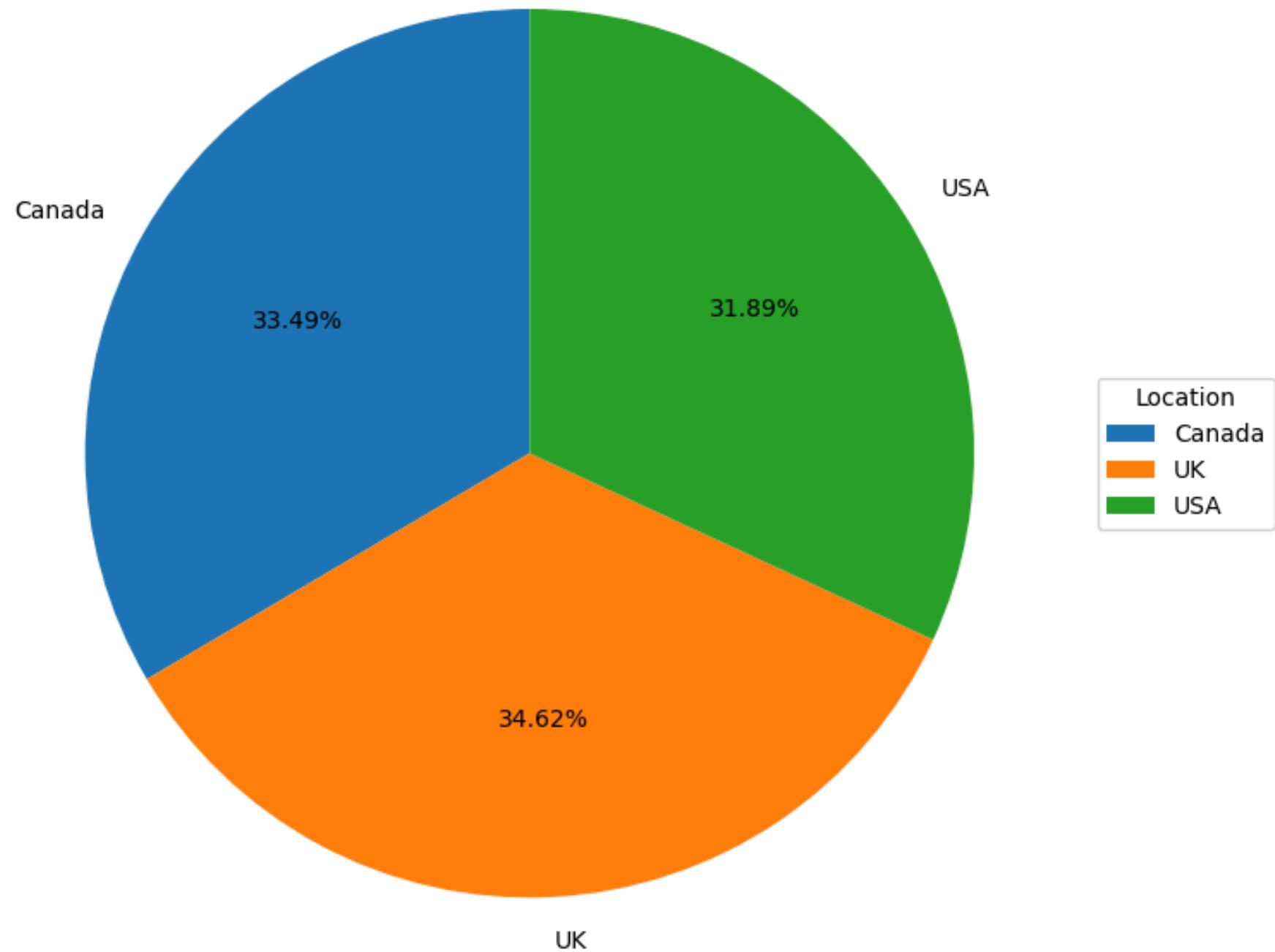
**Product Preference By Location**



Product demand varies meaningfully by region: Canada and UK are fitness-driven (Creatine, BCAA), while the USA leans into wellness trends (Ashwagandha). This tells us we should tailor marketing and inventory locally, not globally.

Localize campaigns: Promote Creatine/BCAA in Canada/UK; highlight Ashwagandha and other herbal supplements in the USA. Consider regional bundling (e.g., Ashwagandha + Magnesium in the USA).. This tells us we should tailor marketing and inventory locally, not globally.

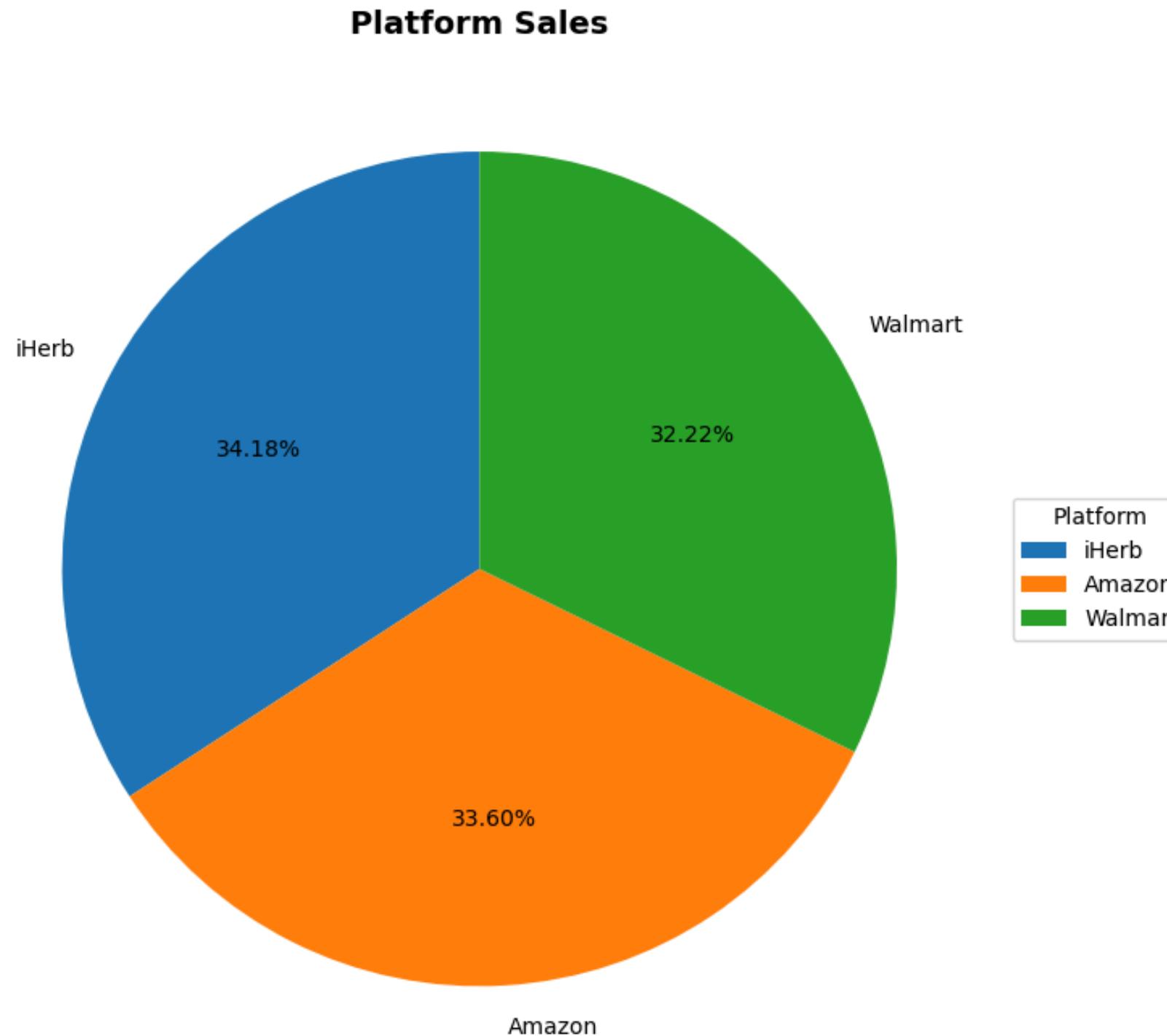
### **Location with high returns**



The UK not only has volatile revenue but also the highest return rate, suggesting customer satisfaction or fulfillment issues. The USA has the lowest returns, indicating better product-market fit or smoother operations.

Audit UK fulfillment and customer feedback to identify return drivers. Apply USA's low-return strategies to Canada and UK—possibly better packaging, clearer labeling, or post-purchase support.

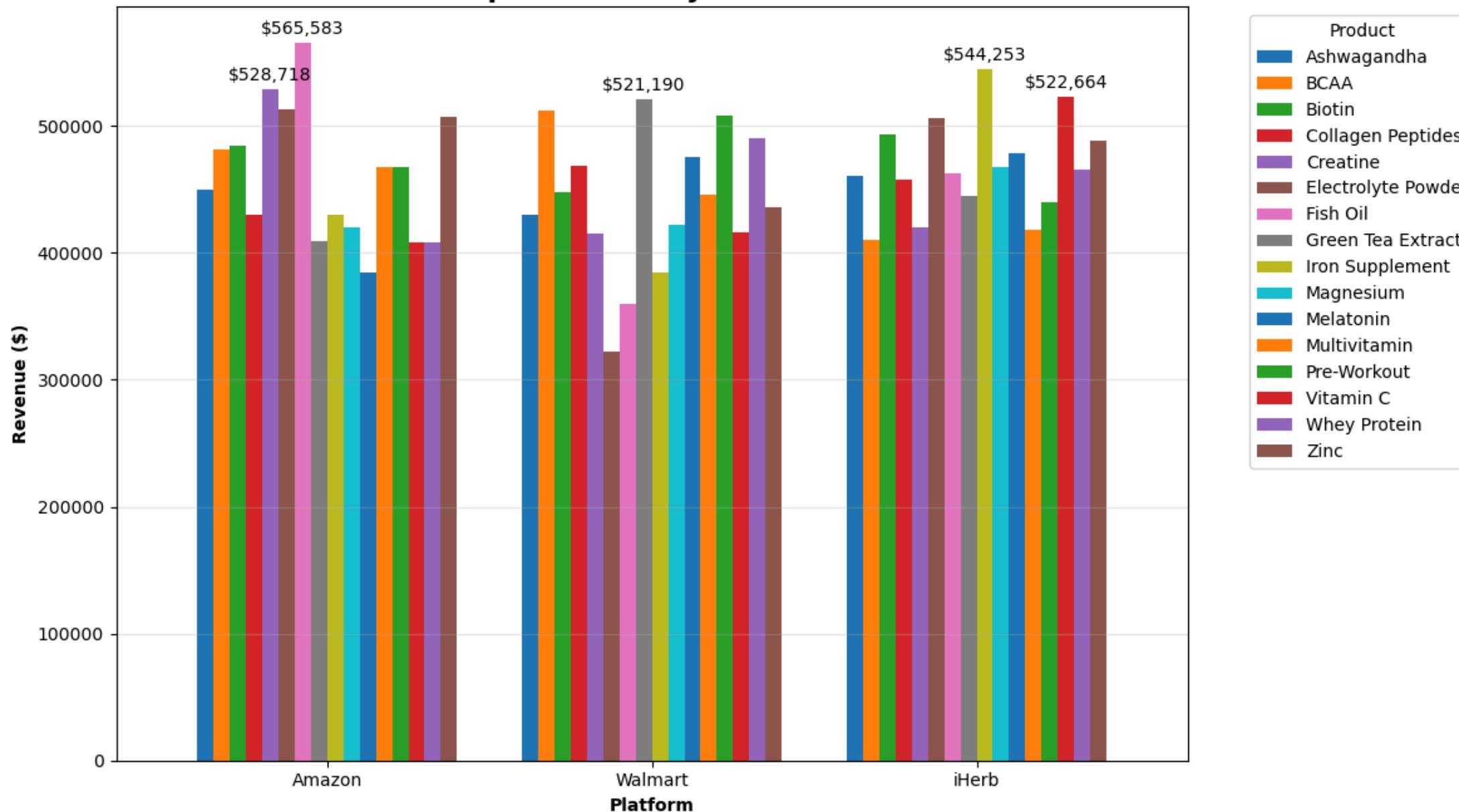
# Platform Performance



Sales are nearly evenly distributed across iHerb, Amazon, and Walmart, with iHerb holding a slight lead. This balance reduces platform dependency and spreads risk. All three are strong channels, indicating broad marketplace reach and customer trust.

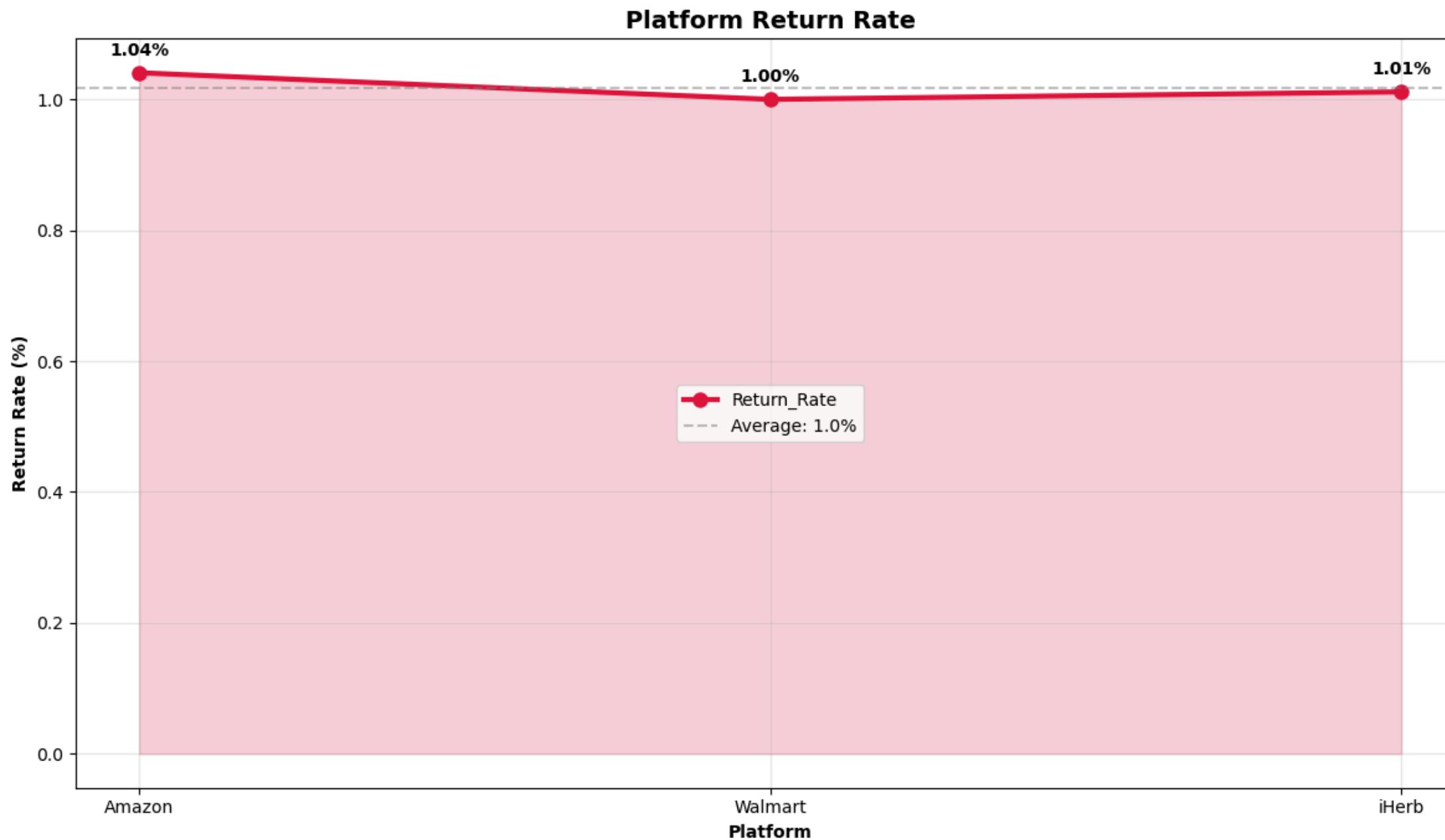
Maintain this balance by allocating marketing spend proportionally. Consider exclusive promotions or bundles per platform to deepen engagement without cannibalizing salesbalance reduces platform dependency and spreads risk. All three are strong channels, indicating broad marketplace reach and customer trust.

## Top Products by Platform



Each platform attracts different customer preferences: Amazon shoppers buy trusted staples (Fish Oil), Walmart leans toward wellness (Green Tea Extract), and iHerb buyers seek specialized supplements (Iron, Ashwagandha).

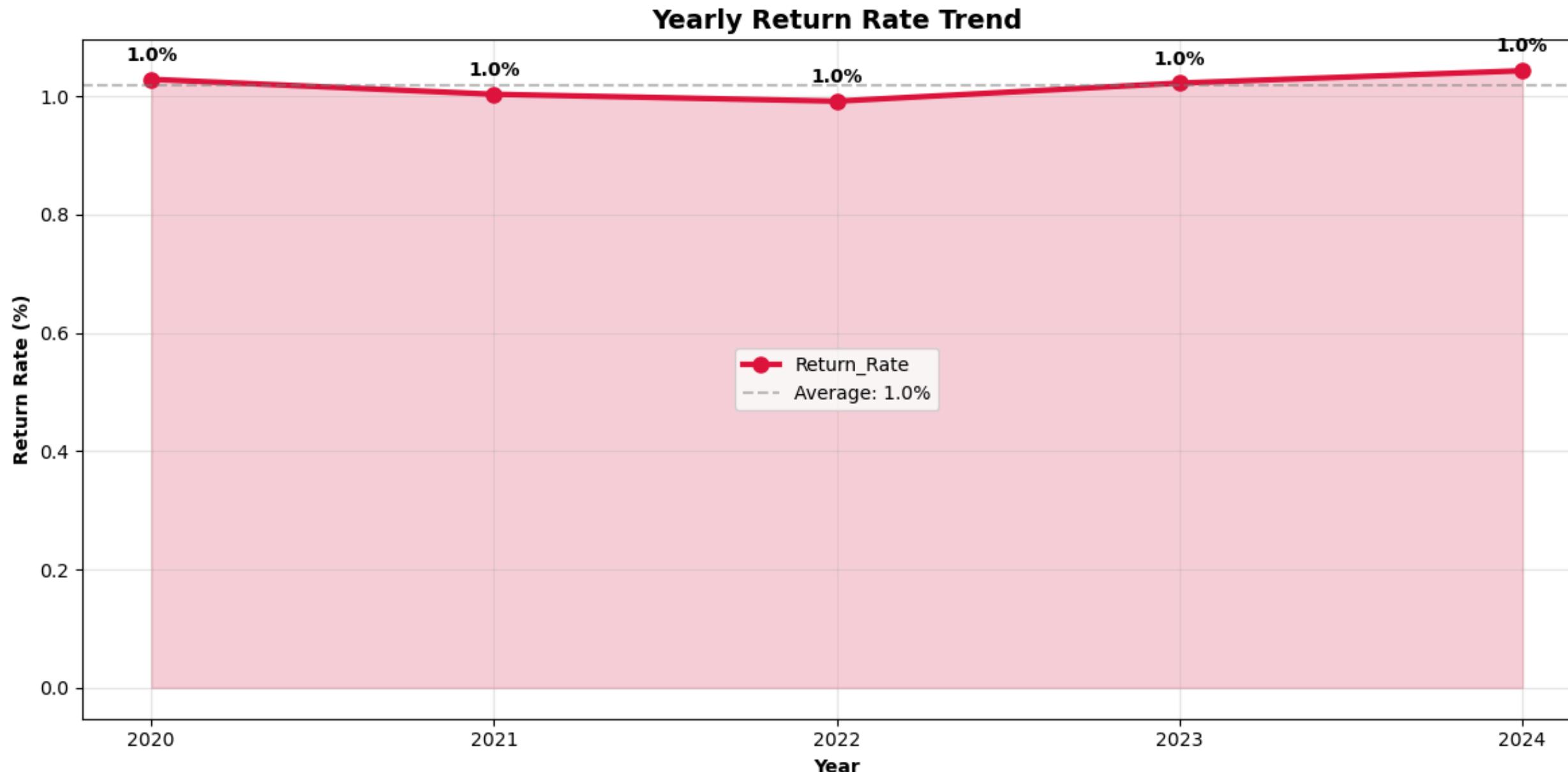
Tailor product listings and ads to each platform's audience: highlight Fish Oil and best-sellers on Amazon, weight management on Walmart, and specialty/herbal on iHerb.



Return rates are consistently low across all platforms (1%), indicating high product satisfaction and accurate listings. This is a strong operational metric that supports scalability.

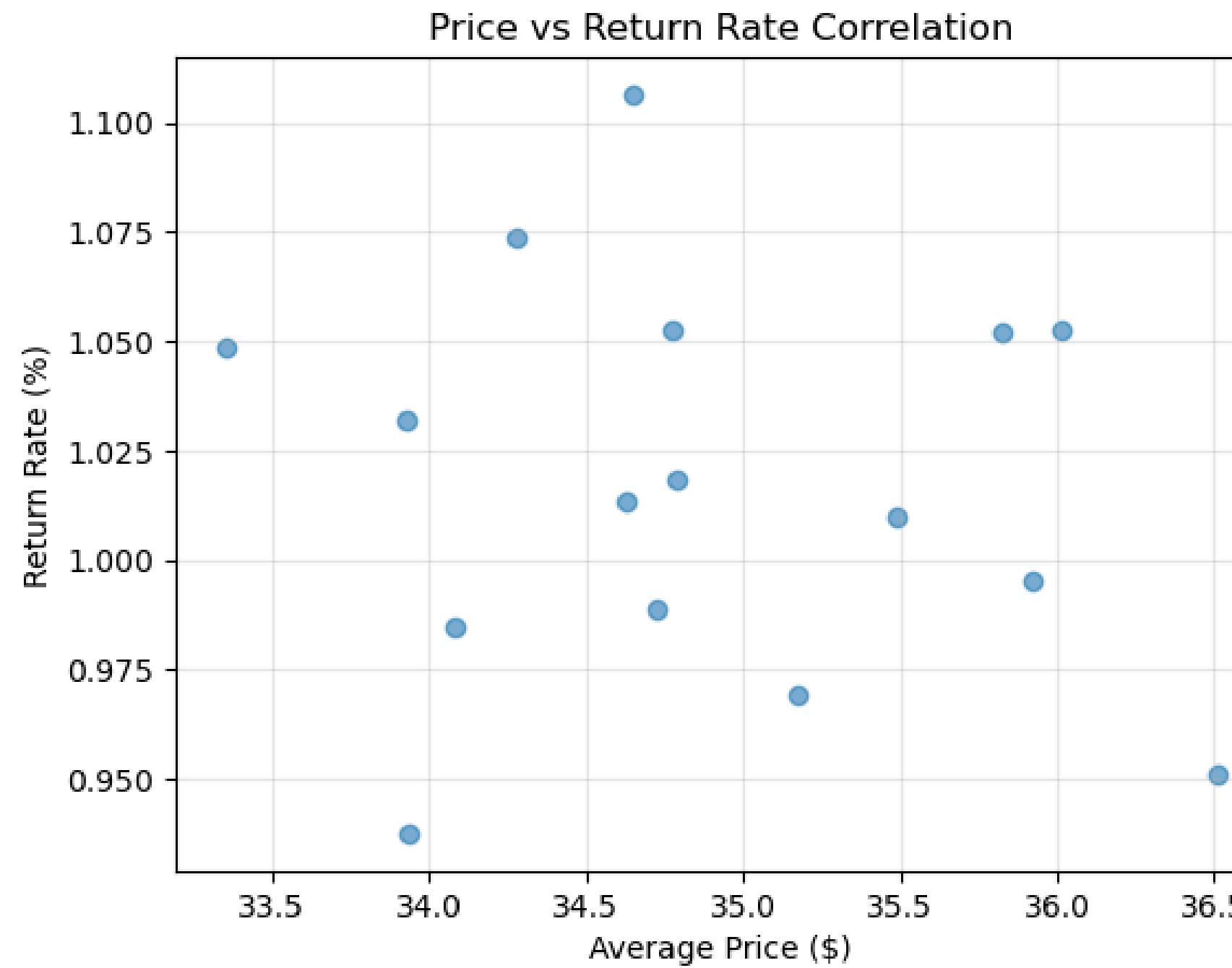
Continue quality control and clear product descriptions to maintain low return rates. Since returns aren't a pain point, focus resources on growth and conversion optimization instead.

# Return Analysis



Return rates have remained consistently low and stable around 1% from 2020–2024, even as sales volume increased. This indicates strong product quality, accurate marketing, and reliable fulfillment over time. The slight uptick in 2024 is minimal but worth monitoring.

Maintain current quality and transparency standards to keep returns low. Investigate the minor 2024 increase, was it due to new products, a supply change, or seasonal factors?



Contrary to expectation, higher-priced supplements have slightly lower return rates. This suggests that customers buying premium products are more committed, better informed, or more satisfied. Lower-priced items may see more impulse buys or mismatched expectations.

Consider premium pricing strategies for high-quality products, as they don't increase return risk. For lower-priced items, improve product descriptions and images to set accurate expectations and reduce returns.

# Summary of Key Findings

## Overall Sales Trends

Sales grew modestly from 2020–2024 with a CAGR of 0.61%, showing resilience but not aggressive growth. Revenue is highly seasonal, peaking in March, May, and August (fitness cycles) and dipping in April and November (post-holiday and pre-holiday lulls). Year-over-year growth has been inconsistent, with declines in 2021 and 2024 requiring investigation.

## Product Performance

The top 10 best-selling products are closely clustered in revenue, indicating a balanced portfolio. Zinc and Biotin lead sales, but Pre-Workout is a dual concern, it's a top seller but also has one of the highest return rates. Ashwagandha, Zinc, and Fish Oil have the lowest returns, making them high-efficiency products.

## Category Insights

Vitamins and Minerals dominate in volume, trading the top revenue spot year over year. Protein is the highest revenue-contributing category (27% share) and shows steady growth. Performance supplements have declined since 2020 and require revitalization. The category mix suggests foundational health drives volume, fitness drives revenue.

## Geographic Performance

- Canada: Most stable and growing market.
- USA: Steady growth, lowest return rate, favors wellness products like Ashwagandha.
- UK: Volatile revenue, highest return rate (34.62%), needs operational review.

Regional preferences are clear: Canada (Creatine), UK (BCAA), USA (Ashwagandha).

## Platform Performance

Sales are evenly split among iHerb (34.18%), Amazon (33.60%), and Walmart (32.22%).

- Amazon buyers prefer staples like Fish Oil.
- Walmart leans toward wellness (Green Tea Extract).
- iHerb attracts specialty shoppers (Iron Supplement, Ashwagandha).

Return rates are uniformly low (~1%) across all platforms, indicating strong operational health.

## Return Analysis

Return rates have remained consistently low (~1%) from 2020–2024. Contrary to common belief, higher-priced items have slightly lower return rates (correlation: -0.148), suggesting premium buyers are more committed and satisfied.

# Recommendations

- Address UK volatility – Investigate the 2024 sales drop and high return rate to stabilize revenue.
- Fix Pre-Workout returns – Gather customer feedback to reduce churn on this top-selling product.
- Bundle low-return favorites – Promote Zinc, Ashwagandha, and Fish Oil in bundled offers to boost loyalty.
- Introduce premium pricing – Launch higher-priced bundles or formulations without fear of increased returns.
- Boost low-season sales – Target February, April, and November with promotions to smooth revenue.
- Localize platform listings – Highlight Fish Oil on Amazon, Green Tea on Walmart, and specialty herbs on iHerb.

# Thank you

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