Bellabeat Wellness Analysis — Final Report (Draft Without Visuals)

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Google Data Analytics Capstone — Bellabeat Case Study

1. Introduction

Bellabeat is a high-end wellness technology company that designs smart products for women. To support data-driven growth, Bellabeat wants to understand how consumers use smart devices to track their daily activity, movement patterns, and wellness behaviors.

This analysis uses publicly available Fitbit data to uncover insights about user activity, calorie burn, and sedentary behavior. The goal is to identify trends that Bellabeat can leverage to improve product design, user engagement, and marketing strategy.

2. Data Cleaning & Preparation

A comprehensive ETL process was performed to ensure the dataset was accurate, consistent, and analysis-ready.

2.1 Cleaning Steps

- Removed duplicates and validated row counts
- Standardized date formats and extracted DayOfWeek, Month, WeekendFlag
- Cleaned numeric fields and ensured consistent data types
- Removed hidden Unicode and non-breaking space characters
- Validated all engineered columns using helper columns for auditability

2.2 Feature Engineering

To support deeper insights, several new variables were created:

- **ActivityLevel** (Sedentary, Lightly Active, Fairly Active, Very Active)
- **ActivityLevel_Num** (numeric encoding of intensity)
- **StepsCategory** (Low, Moderate, High, Very High)
- **StepsCategory_Num** (numeric encoding of step intensity)
- **DayOfWeek, Month, WeekendFlag** for temporal analysis

These engineered features allow for more flexible modeling and clearer insights into user behavior.

3. Correlation Analysis

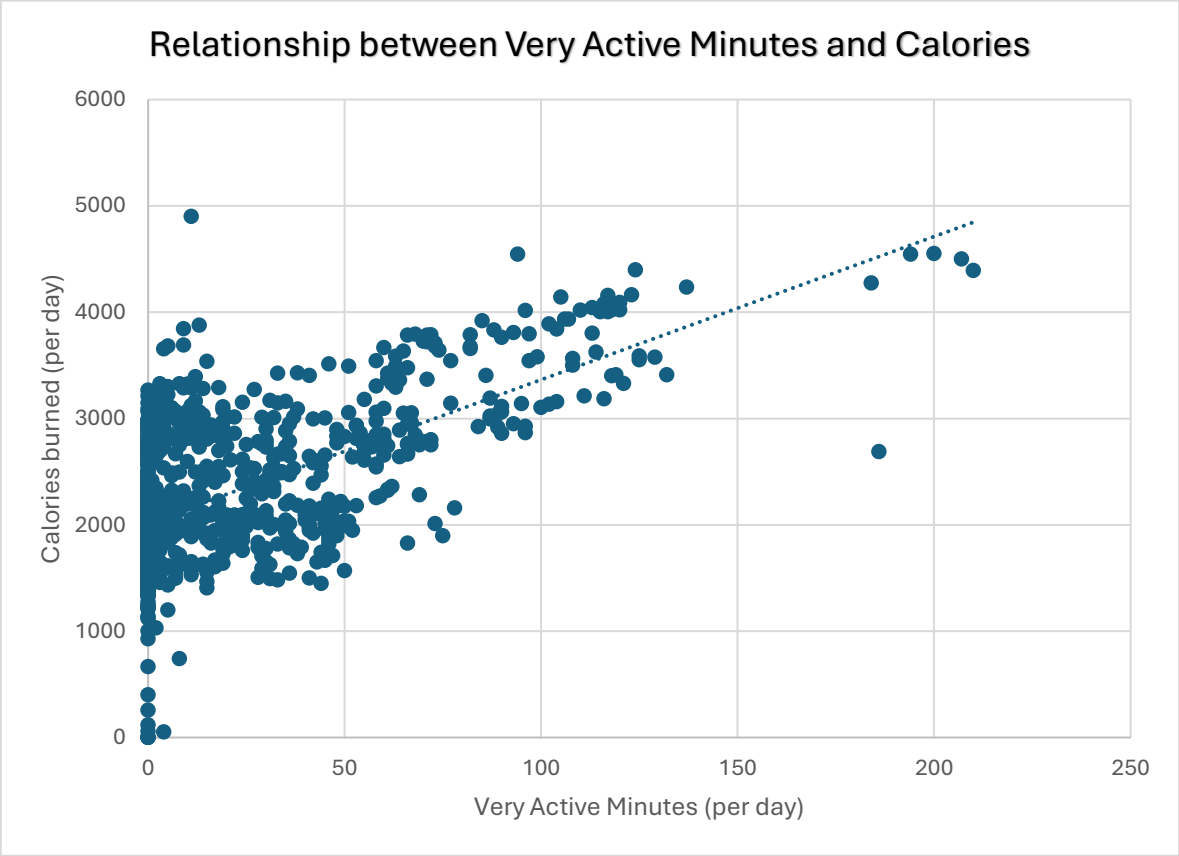
Pearson correlation coefficients were calculated to understand how steps, distance, calories, and activity levels relate to each other.

3.1 Summary of Key Correlations

4. Insights

4.1 High-Intensity Activity Drives Calorie Burn

VeryActiveMinutes shows a strong correlation with calories (**0.62**), indicating that intense movement is the most reliable predictor of calorie expenditure.



The scatterplot shows a strong positive relationship between Very Active Minutes and Calories burned. Users who spend more time in high-intensity activity consistently burn more calories, confirming that intensity is a key driver of energy expenditure.

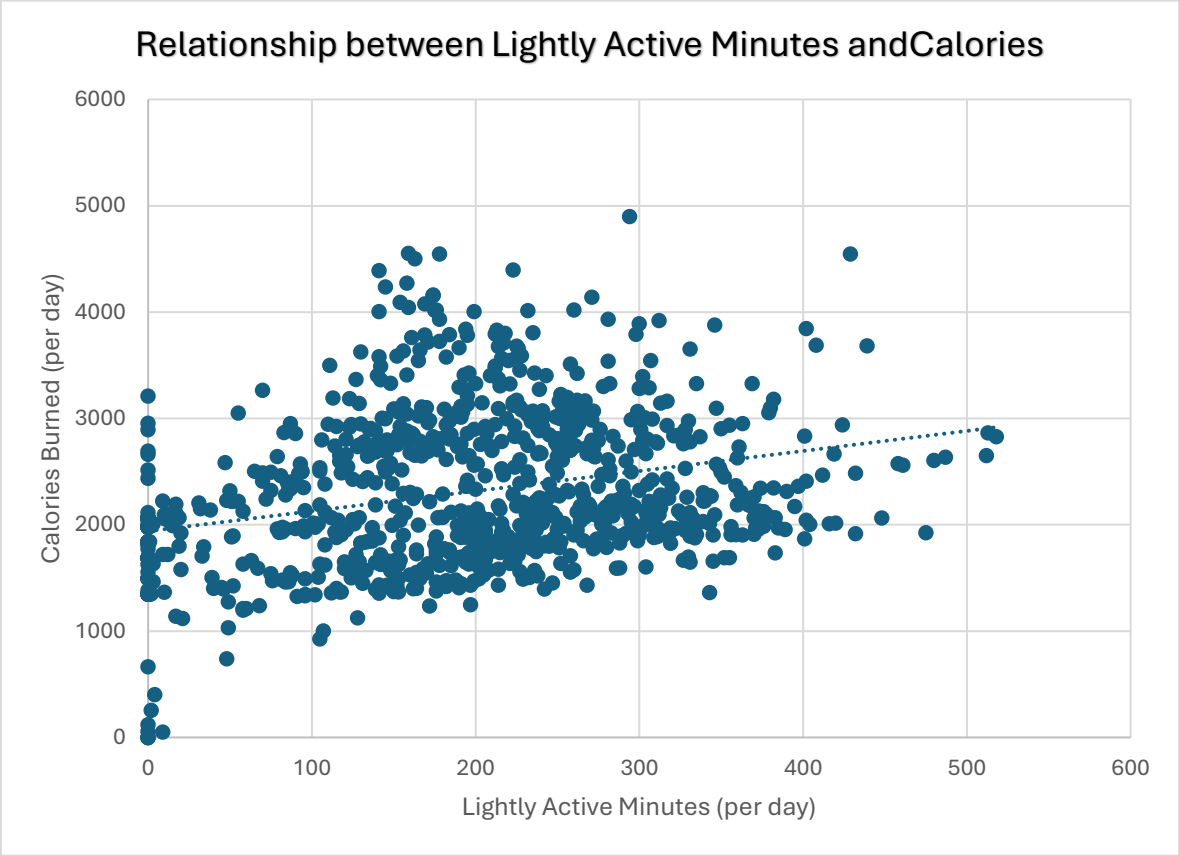
4.2 Steps Alone Do Not Tell the Full Story

Steps correlate moderately with calories (**0.59**), but intensity matters more. Users who take many steps at low intensity burn fewer calories than users who perform shorter, high-intensity workouts.

The scatterplot illustrates a moderate positive relationship between daily step count and calories burned. While higher step totals generally correspond to higher calorie expenditure, the wide vertical spread of points shows that people with similar step counts often burn very different amounts of calories. This variability indicates that steps alone are not a reliable predictor of energy burn. Many users accumulate large numbers of steps at low intensity, while others achieve higher calorie burn through shorter periods of vigorous activity. This supports the conclusion that **intensity**, not just step volume, plays a critical role in determining daily calorie expenditure.

4.3 Light Activity Has Limited Impact

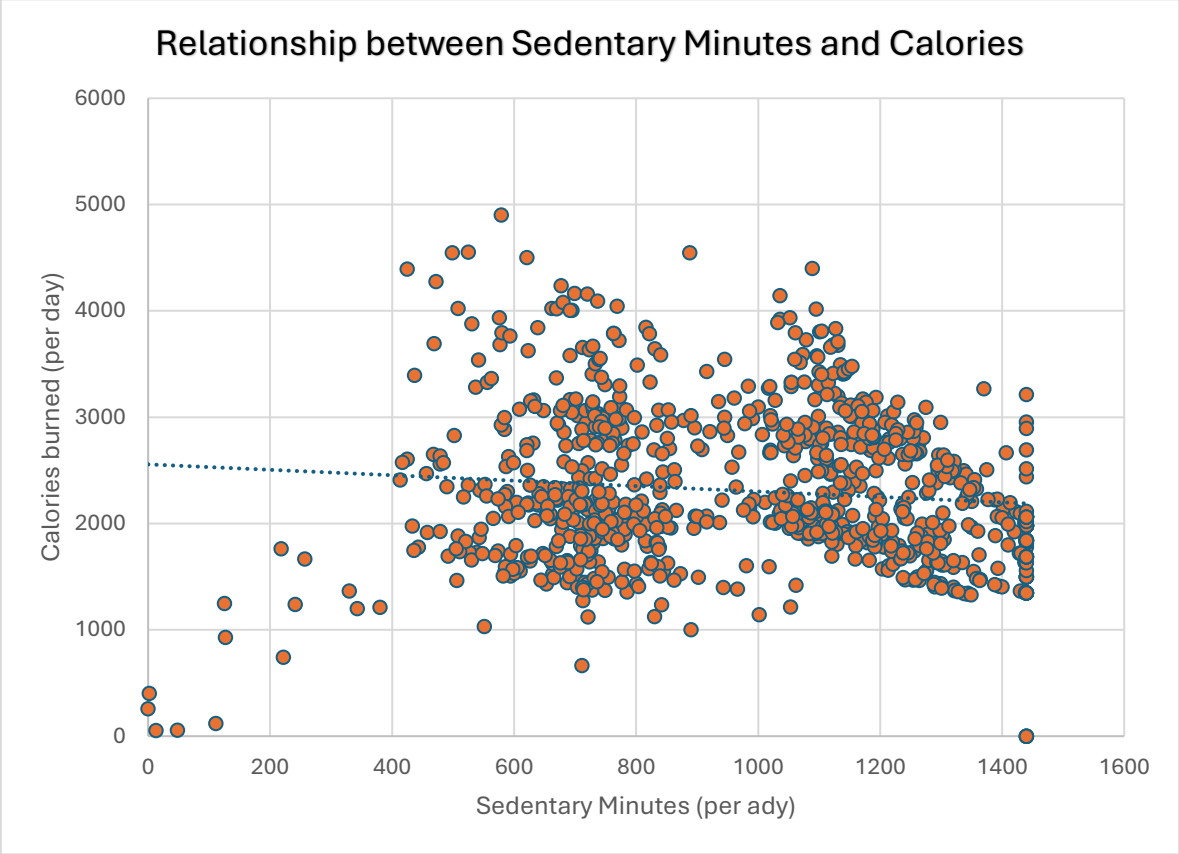
LightlyActiveMinutes shows only a weak correlation with calories (**0.29**).
This suggests that casual walking and low-effort movement contribute minimally to calorie burn.



The scatterplot shows a weak positive relationship between Lightly Active Minutes and Calories burned. Although calorie expenditure increases slightly as light activity accumulates, the points are widely scattered with no strong upward trend. This indicates that casual walking and low-effort movement contribute only minimally to daily calorie burn. Many users spend long periods in light activity without a meaningful increase in energy expenditure, reinforcing the conclusion that **light activity alone is not an effective driver of calorie burn** compared to higher-intensity movement.

4.4 Sedentary Time Does Not Predict Calories

SedentaryMinutes has almost no relationship with calories (**–0.11**).
Users can sit for long periods and still burn calories if they exercise intensely later.

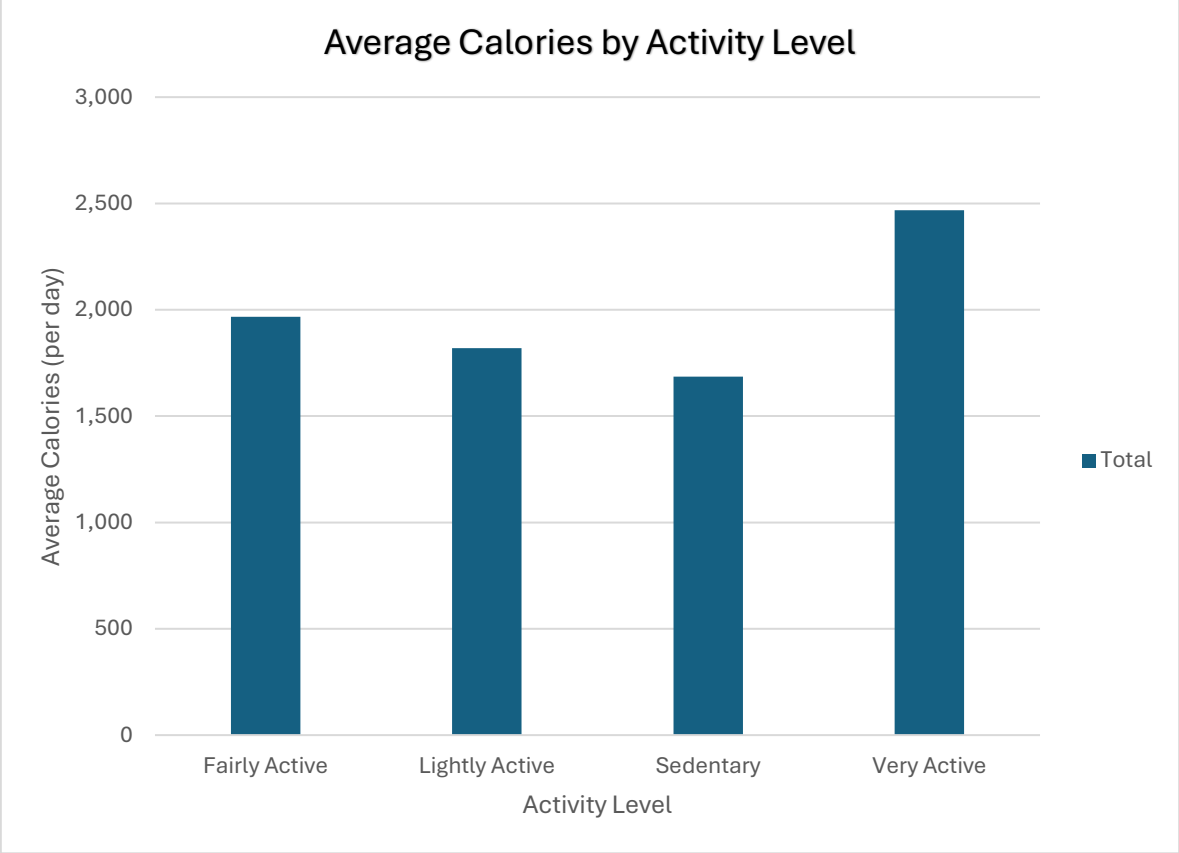


The scatterplot shows almost no relationship between Sedentary Minutes and Calories burned. Users can spend long periods sedentary yet still burn calories through short, high-intensity activity sessions, resulting in a near-flat trendline.

4.5 Engineered Features Are Meaningful

StepsCategory_Num and ActivityLevel_Num correlate strongly (**0.68**), confirming that:

- Engineered categories capture real behavioral patterns
- They provide useful structure for analysis and recommendations



The bar chart shows a clear increase in average calorie burn across ActivityLevel categories. Users classified as “High” intensity burn substantially more calories than those in “Moderate,” “Light,” or “Sedentary” categories. This confirms that the engineered ActivityLevel feature captures meaningful behavioral differences and provides a strong foundation for personalized recommendations in the Bellabeat app.

5. Recommendations for Bellabeat

5.1 Promote High-Intensity Activity

Since intense movement drives calorie burn:

- Encourage short, guided high-intensity workouts
- Add “Active Minutes” challenges in the Bellabeat app
- Provide personalized intensity-based goals

5.2 Support Users with Low Light Activity

Light activity contributes little to calorie burn, but it improves overall wellness.
Bellabeat can:

- Offer gentle movement reminders
- Encourage walking breaks
- Provide low-barrier activity suggestions

5.3 Reduce Long Sedentary Blocks

Even though sedentary time doesn’t strongly predict calories, long sedentary periods are harmful for health.
Bellabeat can:

- Add hourly movement nudges
- Provide micro-stretch routines
- Offer “break streak” badges

5.4 Personalize Goals Based on Behavior Patterns

Users with high VeryActiveMinutes may benefit from:

- Intensity-based goals
- Heart-rate-based challenges

Users with high steps but low intensity may benefit from:

- Encouragement to add short bursts of vigorous activity

5.5 Use Engineered Categories in the App

Bellabeat can adopt similar categories:

- Step intensity levels
- Activity intensity scores
- Daily movement “profiles”

These features help users understand their behavior more clearly.

7. Conclusion

This analysis reveals clear patterns in how Fitbit users move and burn calories. High-intensity activity is the strongest driver of calorie expenditure, while light activity and sedentary time play smaller roles. The engineered features (StepsCategory and ActivityLevel) provide meaningful structure and support deeper insights.

These findings can help Bellabeat design more effective wellness features, personalize user goals, and create marketing strategies that highlight the importance of intensity-based movement.