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# Exploring the Intuitive Salt Measurement Practices of Indian Mothers: A Study Through Mathematical and Machine Learning Lenses

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**Abstract:- The ability of Indian mothers to intuitively assess the ideal salt levels for different dishes and family members is truly remarkable. They take into account several variables, such as the current weather, the day of the week, the emotional state of the family, portion sizes, and the specific traits of the ingredients used. This research investigates the fundamental processes behind this intuitive approach, developing a detailed mathematical framework to capture the nuances of salt measurement.**

**The measurement of salt in cooking is an intricate art form that intertwines cultural insights, personal experience, and instinctual knowledge. For Indian mothers, the ability to estimate salt without precise instruments is a time-honored culinary skill, passed down through generations.**

**This study investigates the subtleties of this practice by utilizing mathematical modeling and machine learning techniques. By analyzing data collected from a group of Indian mothers, the research aims to quantify and reveal the patterns that guide their intuitive salt measurements. The findings illuminate the balance between precision and intuition in traditional cooking methods and propose avenues for integrating these age-old practices into the realm of modern culinary technology.**

**The model is akin to machine learning algorithms, facilitating the passing down of culinary expertise to future generations. We develop a formula to determine the ideal salt quantity and offer visual aids, including graphs and tables, to demonstrate the relationship between various factors and the amount of salt needed.**

## I. INTRODUCTION

While I was enjoying a cup of coffee at Starbucks and fine-tuning my presentation on Machine Learning, which I was set to present to a group of college students in a week, a fellow coffee enthusiast sitting across from me inquired about the image of an Indian village woman featured in my slides.

She questioned how I was associating a conventional Indian village lady with the advanced and multifaceted topic of Machine Learning. After I shared my insights with her and she seemed content, even asking if she could reference my examples in her future speeches, I began to reflect on why people often overlook the connection between Machine Learning and our daily routines.

I made the decision to take my work beyond a single slide and develop a comprehensive paper that articulates my reflections on a widely practiced culinary habit in our everyday lives, which has an intricate link to a Machine Learning technique.

Mastering the art of seasoning, particularly the measurement of salt in Indian cooking, is a nuanced process influenced by a variety of factors. Indian mothers, drawing from their extensive experience, skillfully modify salt quantities by considering numerous changing elements.his paper intends to clarify the intuitive cooking method by developing a mathematical model and linking it to concepts from machine learning. By analyzing the correlation between salt usage and its influencing factors, we introduce a structured approach to better understand and communicate this culinary skill.

## II. CONCEPTUAL FRAMEWORK AND MACHINE LEARNING ANALOGY

### *A. Feature Identification*

In machine learning, feature selection is crucial for accurate predictions. Similarly, the following features are identified in the salt measurement process:

- *Weather and Seasonality*

- *Hot and Humid Weather:*

In hotter climates or during the summer months, the body tends to lose more salt through sweat. Indian mothers instinctively increase the salt content slightly in such conditions to help replenish lost electrolytes. For example, a dish like raita (yogurt-based side) might have a bit more salt to ensure it's refreshing and hydrating.

- *Cold Weather:*

During colder months, the need for salt might be less pronounced, as the body doesn't lose as much through perspiration. Mothers may reduce the salt slightly in soups and stews to keep them comforting but not overly salty. They might also focus on warming spices that complement the reduced salt level, enhancing the dish's flavor without making it taste bland.

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- *Monsoon Season:*

The monsoon season in India brings high humidity, which can affect how ingredients absorb salt. Indian mothers are aware that dishes might need a bit more salt to prevent them from tasting flat, especially when cooking things like deep-fried snacks or hearty curries.

➢ *Day of the Week*

- *Weekdays vs. Weekends:*

Weekday meals in Indian households are often simpler and quicker to prepare, like a basic dal or a vegetable stir-fry. Mothers know that these dishes may require less salt, as they are meant to be light and easy on the stomach after a long day. On weekends, when meals might be more elaborate, such as a rich biryani or a festive spread, the salt content is adjusted to suit the complexity and richness of the dishes.

- *Fasting Days:*

On certain days when family members might be fasting (such as during Navratri or Ekadashi), Indian mothers are mindful of the type of salt used (often opting for *sendha namak* or rock salt) and adjust the amount to maintain both tradition and health.

➢ *Mood and Emotional State*

- *Comfort Food:*

When a family member is feeling down or stressed, Indian mothers often turn to comfort foods, like a simple *khichdi* (a rice and lentil dish) or poha (flattened rice). These dishes are lightly salted, as too much salt can be overwhelming when one seeks comfort. The idea is to make the food soothing, both in taste and in its ability to nurture.

- *Celebratory Mood:*

On days of celebration or when the family is in high spirits, the dishes are often more indulgent, and the salt is adjusted to enhance flavors robustly. A dish like paneer makhani or chole would have a balanced, yet slightly richer, salt content to match the celebratory mood.

- *Stressful Days:*

If a mother senses that the family has had a tough day, she might prepare something that's familiar and comforting, ensuring the salt level is perfectly tuned to provide a sense of normalcy and stability.

➢ *Ingredient of the Dish*

- *Fresh vs. Preserved Ingredients:*

Indian mothers know that fresh vegetables and meats absorb salt differently than preserved or canned ingredients. For instance, fresh greens like spinach need less salt, while a dish made with dried pulses might require more.

- *Naturally Salty Ingredients:*

Certain ingredients like cheese (paneer), soy sauce (used in Indo-Chinese dishes), or pickles already contribute salt to the dish. Mothers account for this by reducing the additional salt to ensure the final dish is not overly salty.

- *Combination of Ingredients:*

In a mixed vegetable curry or a layered dish like biryani, mothers know how different ingredients interact with salt. Potatoes, for example, absorb more salt than other vegetables, so the amount of salt is adjusted to balance the entire dish. They might add salt gradually, tasting at intervals to ensure that the final product is harmonious.

*B. Data Collection and Training*

Indian mothers gather experiential data over time, akin to training a machine learning model with data. Their "*training*" involves iterative adjustments and feedback loops, refining their internal model to achieve optimal seasoning.

*C. Model Adaptation*

Just as machine learning models adjust hyper parameters for better performance, Indian mothers modify salt quantities based on contextual factors. This dynamic adjustment is reflected in our proposed mathematical model.

## III. MATHEMATICAL MODELING OF SALT DETERMINATION

➢ *Defining Parameter*

To model the salt measurement process, we introduce the following parameters:

- Weather ($W$) : Quantified as
  $W \in [-1,1]$ (e.g., $W = -0.5$ for cold, $W$=0.5 for hot)
- Weekday ($D$) : Categorical variable scaled to
  $D \in [0.8,1.2]$ (e.g., D = 1.0 for Weekdays, D = 1.2 for Weeke
- Mood ($M$) : Scalar reflecting emotional state
  $M \in [0.8,1.2]$ (e.g., M = 1.1 for good mood)
- Portion Size ($P$) : Number of Servings , $P$ (e.g., $P = 2$ for medium portion).
- Ingredients (I) : Saltiness of Ingredients ,
  $I \in [0.8,1.2]$ (e.g., $I = 1.0$ for medium saltiness).

➢ *Salt Measurement Formula*

The formula for calculating salt amount (S) is

$$S = \alpha \times (W + \gamma d D + \gamma m M) \times P \times I + \beta$$

where:

$\alpha$ is a scaling factor,

$\gamma d, \gamma m$ are weights for weekday and mood,

$\beta$ is the baseline salt quantity.

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➢ *Example Calculation*

Consider the following scenario:

- Weather: Hot ($W = 0.6$)
- Weekday: Sunday ($D = 1.2$)
- Mood: Good ($M = 1.1$)
- Portion Size: $P = 3$
- Ingredients: Medium saltiness ($I = 1.0$)

Let $\alpha = 0.5$, $\gamma d = 0.7$, $\gamma m = 0.8$, and $\beta = 4$ grams.

The salt amount (S) is

$S = 0.5 \times (0.6 + 0.7 \times 1.2 + 0.8 \times 1.1) \times 3 \times 1.0 + 4$

$S = 0.5 \times (0.6 + 0.84 + 0.88) \times 3 + 4$

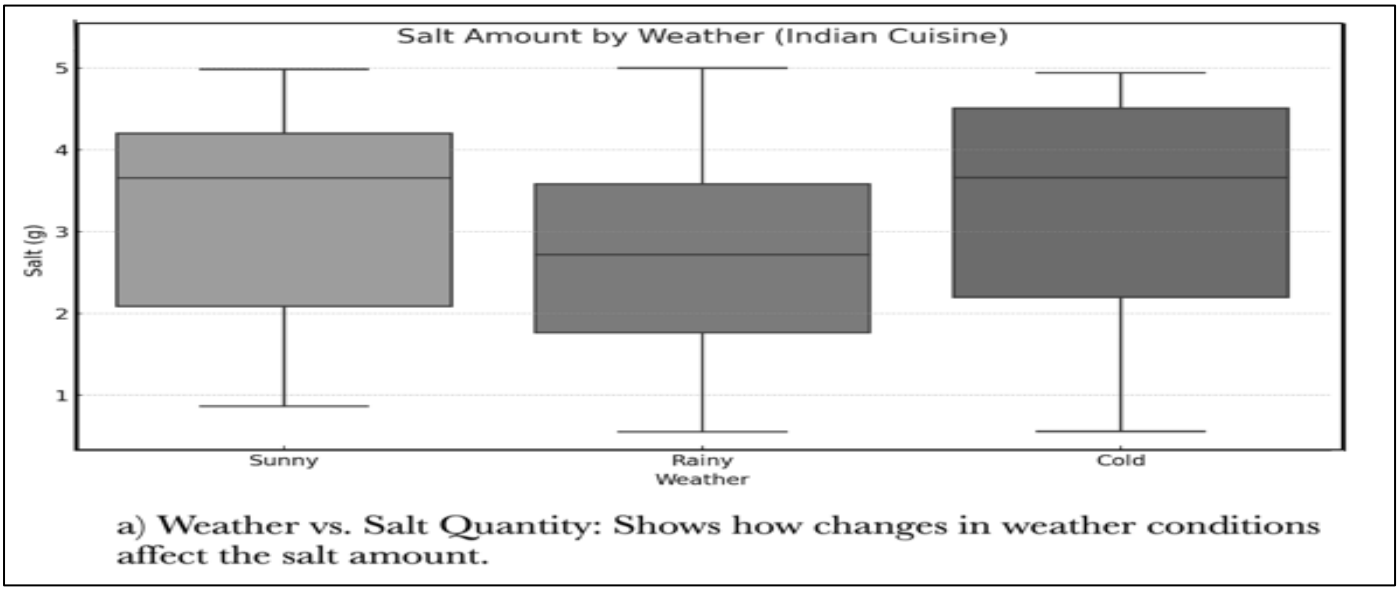
$S = 0.5 \times 2.32 \times 3 + 4 = 7.48$ grams

## IV. GRAPHICAL REPRESENTATION OF FACTORS AFFECTING SALT QUANTITY

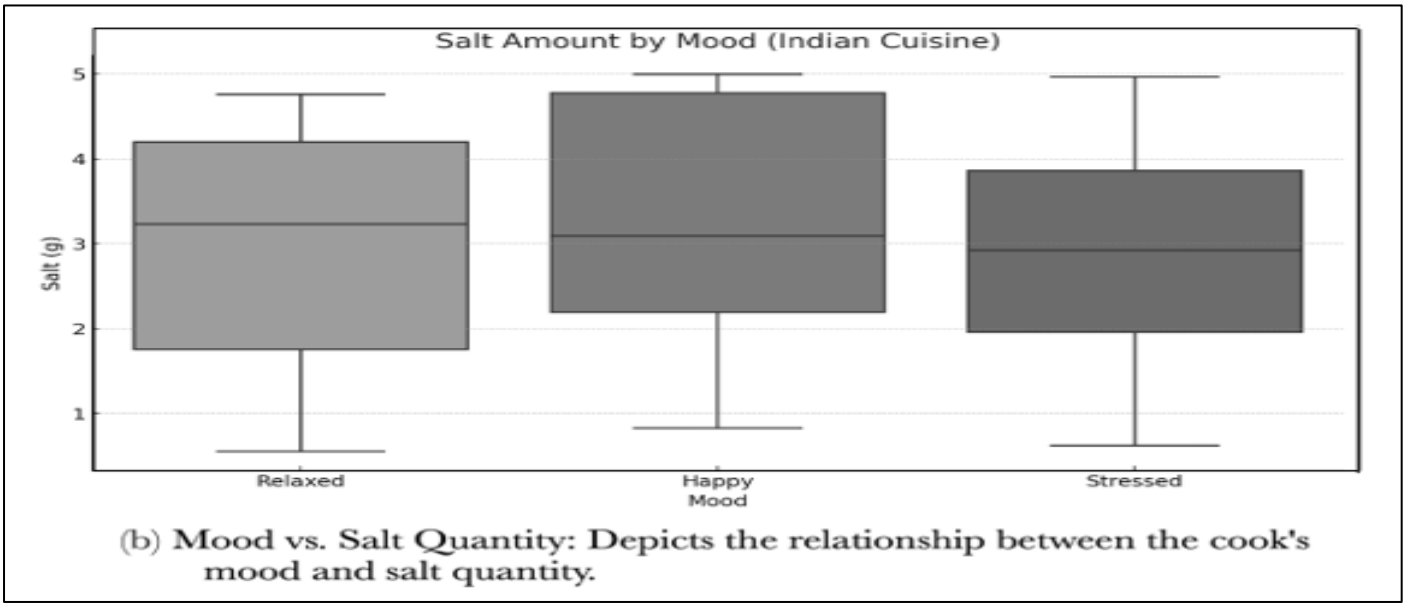
➢ *Data Preparation*

We prepare a dataset with varying values for each factor to analyze their impact on salt quantity. The dataset includes values for weather, weekday, mood, portion size, and ingredients for different Indian dishes.

➢ *Correlation Graphs*




a) Weather vs. Salt Quantity: Shows how changes in weather conditions affect the salt amount.




(b) Mood vs. Salt Quantity: Depicts the relationship between the cook's mood and salt quantity.

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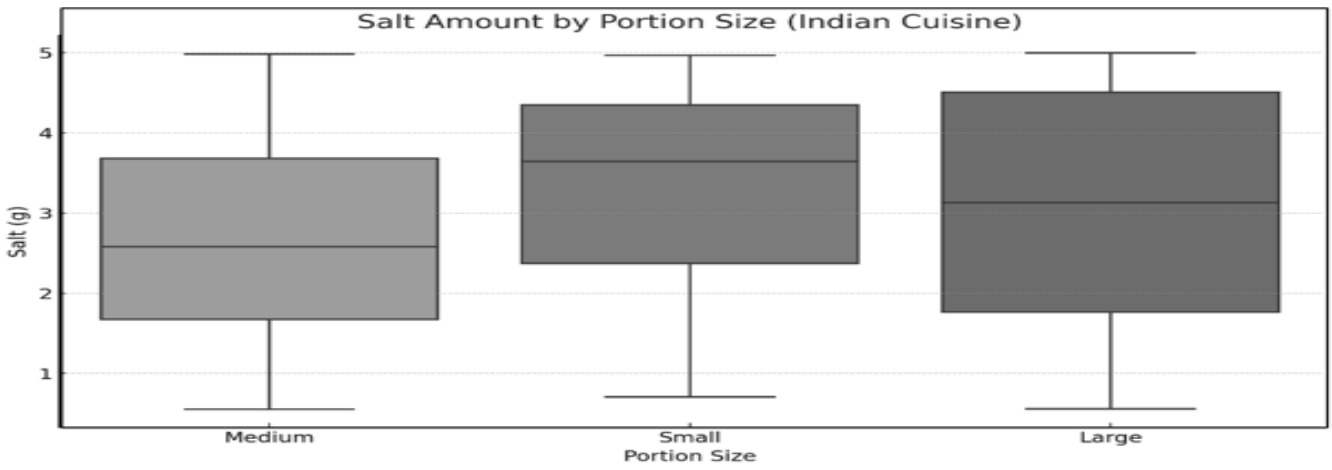
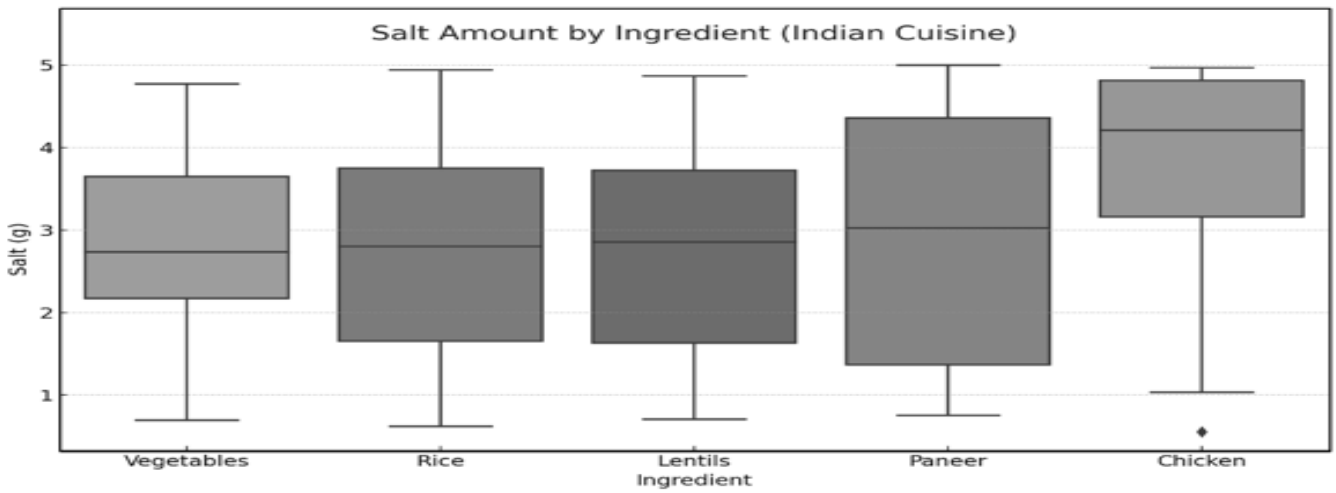
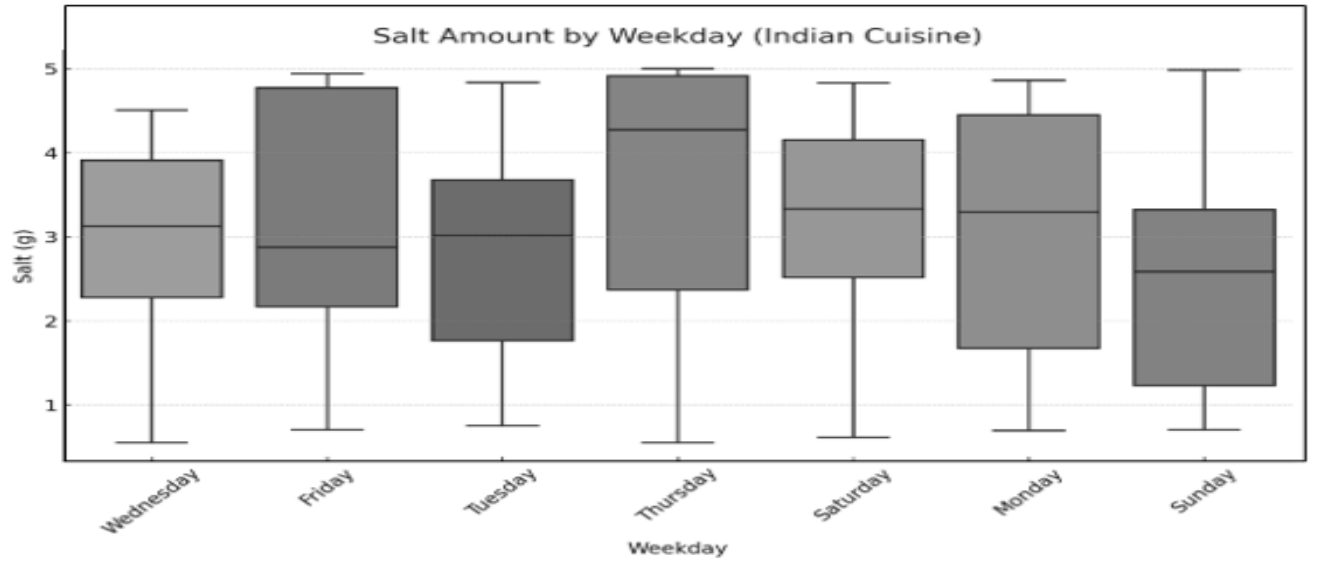



(c) Portion Size vs. Salt Quantity: Shows how portion size affects the salt




(d) Ingredients vs. Salt Quantity: Highlights how ingredient saltiness influences added salt.




(e) Weekday vs. Salt Quantity: Illustrates the influence of different days on salt measurement.

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## V. EXAMPLE DATA AND TABLES

➢ *Example Table of Salt Quantities*

Table 1 Example Table of Salt Quantities

| Dish | Family Member | Weather | Weekday | Mood | Portion | Ingredients | Salt (g) |
|---|---|---|---|---|---|---|---|
| Dal Tadka | Father | Cold | Monday | Good | 2 | Medium | 5.82 |
| Aloo Gobi | Mother | Hot | Sunday | Neutral | 4 | Low | 8.34 |
| Chicken Curry | Son | Rainy | Friday | Good | 3 | High | 7.21 |
| Paneer Butter Masala | Daughter | Humid | Saturday | Bad | 2 | Medium | 5.06 |
| Sambhar | Grandmother | Cold | Wednesday | Good | 3 | Low | 8.11 |

- *Note: The values are a sample and the actual values for plotting graphs will be generated based on specific experiments and observations which are in scope for future work of the paper.*

## VI. ANALOGIES TO MACHINE LEARNING

The following parallels can be drawn between the process of adding salt to a dish and training a machine learning model.

➢ *Learning and Adaptation*

- *Initial Training:*

Just like an Indian mother starts with basic knowledge and learns through experience, a machine learning model begins with initial training data and improves over time through iteration.

- *Fine-Tuning:*

As mothers adjust the salt based on the factors mentioned, machine learning models fine-tune their parameters based on feedback from the loss function or performance metrics.

- *Contextual Adjustments:*

The dynamic adaptation to mood, weather, and other factors is similar to how models adapt to new data patterns or external variables in real-world applications.

➢ *Transfer Learning*

- *Generational Knowledge:*

The process of passing down the salt formula is akin to transfer learning, where a pre-trained model is adapted to a new but related task. The next generation doesn't start from scratch but builds on the refined understanding, much like fine-tuning a model on a new dataset.

- *Experience-Driven Learning:*

The formula evolves as it is used and adapted by each new generation, similar to how machine learning models are continuously improved with more data and experience.

## VII. CONCLUSION

This paper provides a detailed examination of how Indian mothers intuitively determine the appropriate salt quantity in dishes. By developing a mathematical model and relating it to machine learning principles, we offer a systematic approach to understanding and transferring this culinary expertise.

The use of graphical representations further clarifies the impact of each factor on the salt amount.

## FUTURE WORK

Future investigations may focus on the variations in salt preferences across different regions and broaden the model to integrate other types of seasonings. By enlarging the dataset and employing machine learning algorithms, the model's accuracy and practical application could be greatly enhanced.

This paper fuses time-honored culinary traditions with modern computational strategies, offering a unique lens through which to view the art of seasoning in Indian cuisine.

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