

1. INTRODUCTION

Obesity is a critical global issue, with more than 2 billion adults affected and projections indicating a continued rise until 2030 [1], [2]. This condition is characterized by excessive body fat accumulation and results from an imbalance between caloric intake and energy expenditure [3]. Obesity significantly increases the risk of various diseases, making it a severe public health concern [2]. The Body Mass Index (BMI) is a widely used metric to evaluate obesity, with a BMI of 30 kg/m² or higher indicating obesity [4], [5]. Addressing obesity requires adopting healthy dietary habits and increasing physical activity. The Dietary Guidelines for Americans (DGA) emphasize the importance of regulating calorie intake and choosing nutritious foods to maintain an ideal weight [6]. However, managing nutrient balance is challenging, highlighting the need for effective dietary strategies [7]. One approach to achieve this balance is calculating daily caloric needs using Basal Metabolic Rate (BMR) and Total Daily Energy Expenditure (TDEE) [8].

Dietary recommendation systems can be crucial in managing caloric intake and promoting healthy eating habits. Traditional recommendation systems focus on accuracy, sometimes translating to user satisfaction [9]. Recent studies suggest that the effectiveness of recommendation systems is significantly influenced by human interaction rather than merely algorithmic precision [10]. Serendipity, providing unexpected yet relevant recommendations, is crucial for enhancing user engagement and satisfaction by delivering surprising results that evoke positive emotional responses [11].

Several studies have contributed to developing dietary recommendation systems in the past five years. For instance, Agapito et al. [12] proposed DIETOS, a recommender system for adaptive diet monitoring and personalized food suggestions based on individual health profiles and real-time questionnaires. Hamdollahi Oskouei and Hashemzadeh [13] developed FoodRecNet, a comprehensively personalized food recommendation network that integrates various dietary and health factors for practical recommendations. Mat Baseri and Saad [2] introduced a dietary monitoring system using decision tree techniques to help control obesity by classifying food calories and providing dietary guidelines. Yuan and Luo [7] explored a personalized diet recommendation system using K-means clustering and collaborative filtering algorithms to enhance nutritional balance and user satisfaction. Lastly, Trang Tran et al. [1] provided an overview of recommender systems in the healthy eating domain, emphasizing the challenges and opportunities in incorporating user preferences and health data for better dietary recommendations. These studies focused on improving algorithmic accuracy but did not adequately address user experience. However, their study did not fully explore human interaction, and no user evaluations were conducted. So, this research proposes the development of a user-centered diet recommendation system. The system considers the user's calorie intake and favorite foods, so the recommendations generated can generate serendipity to improve the user experience [14] [15].

While these studies have made significant contributions to the field, there remains a notable gap in addressing user interaction and satisfaction, mainly through the lens of serendipity. Serendipity in recommender systems involves providing users with unexpected yet relevant recommendations that meet their needs and introduce an element of surprise and delight. This concept is essential for dietary recommendation systems, as it can lead to more engaging and satisfying user experiences.

The urgency of this research lies in its potential to significantly enhance the effectiveness of dietary recommendation systems by addressing a critical gap in user engagement and satisfaction. Current systems often fall short in maintaining long-term user adherence due to their focus on algorithmic precision without considering the user's experience [11]. Given the growing obesity epidemic and the need for sustainable dietary habits, developing a recommendation system that not only meets nutritional needs but also keeps users engaged and motivated is crucial. By introducing serendipity, this research aims to make dietary recommendations more enjoyable and diverse, thereby improving adherence and overall health outcomes.

This research aims to bridge the gap identified in the existing literature by developing a user-centered dietary recommendation system incorporating serendipity. The proposed system leverages a content-based approach, considering users' caloric needs and food preferences to generate personalized recommendations. By focusing on

human interaction with the system, this study seeks to enhance the user experience and satisfaction. The system is designed to provide a personalized food catalog, specifying the number of calories for breakfast, lunch, and dinner. User feedback, collected through a Likert scale, will be used to evaluate the serendipity aspect of the recommendations.

In addressing the identified research gaps, this study proposes a comprehensive framework for evaluating and enhancing serendipity in dietary recommendation systems. By integrating user preferences and caloric needs with a content-based recommendation approach, the system aims to deliver personalized and unexpected dietary suggestions. The evaluation of serendipity will involve collecting user ratings and comments on the recommendations, providing valuable insights into the system's effectiveness and user satisfaction.

In summary, this research addresses two main problems: developing a dietary recommendation system that enhances user satisfaction through serendipity and evaluating the serendipity aspect of the recommendations. The study aims to contribute to the field by providing insights into the importance of human interaction in dietary recommendation systems and offering a novel approach to incorporating serendipity into these systems. Several studies, such as Agapito et al.'s DIETOS [12], Hamdollahi Oskouei and Hashemzadeh's FoodRecNet [13], and Yuan and Luo's personalized diet recommendation system [7], have made significant contributions to the development of dietary recommendation systems but have primarily focused on algorithmic accuracy rather than user experience. This research builds on these foundations by emphasizing user engagement and satisfaction through unexpected yet relevant recommendations. The goal is to improve the user experience and effectiveness of dietary recommendation systems by introducing elements of surprise and delight, thereby encouraging healthier eating habits and addressing the global challenge of obesity.