I. INTRODUCTION

Health is a section of human life that defines quality. Among several challenges in this field, the most common is called hypercholesterolemia. Hypercholesterolemia can be defined as a medical condition of having an abnormally high level of LDL or Low-Density Lipoprotein cholesterol in the blood, a state that easily increases the risk for atherosclerotic cardiovascular disease and stroke [1], [2]. Hypercholesterolemia is a serious concern in global public health. According to the World Health Organization (WHO), around 39% of adults worldwide have total cholesterol levels exceeding normal limits, even exceeding 50% in some developed countries [3]. The number of cases of hypercholesterolemia is still growing worldwide, so proper management is very important [4].

Unhealthy lifestyles, physical inactivity, and a nutritionally imbalanced diet, particularly those rich in high-fat food ingredients, represent the most direct causative factors for hypercholesterolemia. On the other hand, poor knowledge about healthy nutrition among members of the public is one of the reasons why the incidence of the disease has also continued to increase. As expected, good nutrition knowledge imparts highly positive changes in attitudes and behavior related to food choices and hence is directly reflected in health [5]. Patients with hypercholesterolemia are recommended to follow a healthier diet supported by structured dietary guidelines [6].

Along with technological development, technology-based solutions have made a significant contribution to the improvement of healthcare services, including nutrition and diet management. The recommender system is one of the most applied technological approaches to assist users in making choices that suit their needs [7]. One of the fundamental bases in the development of a nutritional recommender system is ontology. Ontology is a formal representation of a knowledge domain that includes concepts, entities, and the relationships among those entities [8]. Ontology allows the system to identify specific nutritional preferences and needs based on individual profiles [9].

The success of using ontology and SWRL in developing a recommender system has been proven in some previous works. Mckensy-Sambola et al. [10] proposed an ontology-based recommender system along with semantic rules to help obese patients choose the right kind of diet. This system takes as input parameters like weight, height, and body mass index in order to come up with a list of recipes that would meet dietary constraints and nutritional needs. For instance, El Massari et al. [11] developed a cardiovascular disease prediction system using ontology and SWRL. The semantic rules integrate the information about patients into ontologies. Al-Nazer et al. [9] also developed an ontology-based personalized food and nutrition recommendation framework for users' health profiles, improving user satisfaction.

Taçyıldız & Ertuğrul [12] designed a decision support system for managing obesity in children and adolescents. Chi et al. [13], while building a dietary consultation system for patients with chronic diseases by using OWL and SWRL ontology, are able to recommend the portions of food intake with high accuracy. Various related studies proved that ontology and SWRL would have the potential to give personalized and effective solutions to society in nutrition recommender systems.

Beyond this, Rahmawati et al. [14] propose an ontology-based conversational recommender system with an explanation facility that allows semantic reasoning in order to arrive at a personalized product recommendation. Their model evidences explanation facilities along with semantic reasoning and develops effectiveness and accuracy. Though applied on the smartphone domain, this conveys important insights on how to make a nutritional recommender system whereby explanations of

chosen food would enhance user confidence and decision-making, especially among the pool of patients dealing with hypercholesterolemia.

Various studies have explored technology-based nutrition recommendation systems, but few have specifically focused on hypercholesterolemia patients. Research that combines ontology and SWRL to provide personalized nutrition recommendations is also very limited. Therefore, this study aims to fill the gap by developing an ontology and SWRL-based nutrition recommendation system specifically designed for hypercholesterolemia patients. The system not only considers the patient's medical data, such as age, gender, weight, height, and activity level, but also considers the patient's food preferences and allergic restrictions. By utilizing these data, the system can provide relevant and practical food and nutrition recommendations. In addition, the system is implemented on the Telegram chat-bot platform to facilitate patient interaction and accessibility, thereby improving user experience in effectively managing hypercholesterolemia conditions.