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NUTRITIONAL ASSESSMENT AMONG HYPERTENSIVE PATIENTS ATTENDING NUTRITION CLINIC IN BAGHDAD TEACHING HOSPITAL, 2024

[*1]Dr. Zainab Khalfah Mohamed Ali, [2]Dr. Zainab Ghassan Lutfi and [3]Dr. Mohsin Ahmed Jasim

[1]M.B.CH.B.
[2]Family Medicine Specialist, Consultant Family Medicine, M.B.Ch.B/F.I.C.M.S/F.M, Nutrition Research Institute, ministry of Health.
[3]MBChB, FIBMS/ CM; FABHS / SCN, Consultant Clinical Nutrition, Ministry of Health, Nutrition Research Institute, Ministry of Health.

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***Corresponding Author: Dr. Zainab Khalfah Mohamed Ali**
M.B.CH.B.

ABSTRACT

Background: Hypertension, affecting nearly one billion people globally, is a major cause of cardiovascular diseases, stroke, and renal failure, leading to around 10.8 million deaths annually. Emerging research highlights the critical role of diet in preventing and managing hypertension. Diets high in sodium and unhealthy fats, and low in fruits and vegetables, increase hypertension risk. Nutritional assessment helps identify dietary deficiencies and guide personalized interventions. The Dietary Approaches to Stop Hypertension (DASH) diet, proven to lower blood pressure, needs more research in non-Western populations like Iraq, where dietary adjustments can significantly improve hypertension management. The study aims to assess the nutritional status of hypertensive patients through a comprehensive evaluation that included a 24-hour dietary history, bioelectrical impedance analysis, and anthropometric measurements. It sought to determine the association between patients' nutritional status and various sociodemographic variables while also evaluating the relationship between dietary factors and hypertension by comparing patients' dietary intake against the Dietary Approaches to Stop Hypertension (DASH) guidelines. **Methodology:** This study utilized a cross-sectional design with an analytical component at the Nutrition Consultation Clinic of Baghdad Teaching Hospital from March 1 to July 15, 2024. A total of 210 hypertensive patients were recruited through convenience sampling, focusing on individuals aged 18 and above with primary hypertension. Data collection involved direct interviews assessing dietary intake, socio-demographics, and anthropometric measurements. Tools included a 24-hour dietary history, anthropometric measurements, and Bioelectrical Impedance Analysis (BIA) using the InBody device to analyze body composition. A pilot study was conducted to refine data collection methods. Statistical analysis was performed using SPSS, focusing on sociodemographic variables and dietary factors. Ethical considerations included obtaining approvals from relevant committees and ensuring informed consent and data confidentiality. The study aimed to comprehensively evaluate the nutritional status of hypertensive patients, providing insights for better management and intervention strategies. **Results:** The study analyzed 210 participants, predominantly female (73.3%), with a mean age of 49.35 years. Most were married (93.3%), had primary education (45.7%), and were unemployed or housewives (70.4%). A significant portion (68.6%) had low income. The average duration of hypertension was 6 years. Notably, 78.1% reported receiving no dietary advice. Dietary assessments revealed that 57.1% consumed excess calories, with 45.7% maintaining a balanced diet. Body composition analysis showed high rates of obesity, with a mean BMI of 36.6 kg/m² and 97.1% having elevated body fat. Additionally, the study highlighted significant deviations from the DASH diet recommendations and a high prevalence of elevated fat across body regions, indicating a need for targeted nutritional interventions. **Conclusions:** The study reveals that most hypertensive patients are middle-aged, low-income women with low education, who exhibit high rates of obesity and poor adherence to dietary recommendations, particularly the DASH diet. Many have had hypertension without receiving adequate nutrition therapy, leading to excessive calorie intake, low vegetable consumption, and deteriorating health outcomes.

INTRODUCTION

Hypertension, or high blood pressure, is a critical global health issue, affecting nearly one billion people and contributing significantly to serious health complications such as cardiovascular diseases, stroke, and renal failure. Often developing without noticeable symptoms, it is characterized by persistently elevated blood pressure levels. The World Health Organization estimates that hypertension causes approximately 10.8 million deaths annually, emphasizing the urgent need for effective prevention and management strategies.[1,2] Traditionally, hypertension management has focused on pharmacological treatments. While antihypertensive medications can effectively control blood pressure, they often come with side effects and require long-term use. Recent research highlights the important role of dietary patterns in preventing and managing hypertension. Diets high in saturated fats, trans fats, added sugars, and sodium, and low in fruits, vegetables, whole grains, and potassium are strongly linked to increased hypertension risk.[3] The relationship between diet and hypertension is complex. High sodium intake contributes to fluid retention and elevated blood pressure, while excessive saturated fat consumption can impair endothelial function, worsening hypertension. Conversely, diets rich in fruits, vegetables, whole grains, and low-fat dairy provide key nutrients like potassium, magnesium, and calcium, which counteract the negative effects of sodium and support blood pressure regulation.[4, 5] Nutritional assessment plays a crucial role in managing hypertension by evaluating dietary habits and identifying nutritional deficiencies, providing a foundation for personalized dietary recommendations aimed at improving blood pressure control.[5] Despite the effectiveness of antihypertensive medications, achieving optimal blood pressure control remains difficult. Evidence suggests that lifestyle modifications, particularly dietary changes, are essential for improving blood pressure regulation and reducing cardiovascular risks in hypertensive patients.[6,7] One effective dietary intervention is the Dietary Approaches to Stop Hypertension (DASH) diet, which emphasizes fruits, vegetables, whole grains, and low-fat dairy while limiting saturated fats, cholesterol, and sodium. Although the DASH diet has shown significant success in lowering blood pressure, its effectiveness in non-Western populations, such as those in Iraq, remains under-researched.[8] To assess dietary intake, the 24-hour dietary history method is commonly used, capturing a detailed snapshot of an individual's food and beverage consumption over the past 24 hours. This tool helps evaluate adherence to dietary guidelines, identify nutritional imbalances, and make personalized nutritional recommendations. It is particularly useful in clinical and research settings for understanding dietary patterns and their impact on health outcomes.[9] The InBody 270, a bioelectrical impedance analysis (BIA) device, complements nutritional assessments by measuring body composition. It evaluates factors like body fat percentage, muscle mass, and water content, providing segmental analysis of fat and muscle distribution. This non-invasive, portable device is ideal for tracking fitness progress, managing conditions such as obesity and malnutrition, and supporting dietary interventions in clinical and professional health settings.[8, 9]

Aims of the study

1. To assess the nutritional status of hypertensive patients using 24 hours dietary history, bioelectrical impedance analysis (BIA), anthropometric measurement.
2. To find out association between nutritional status of hypertensive patients and sociodemographic variables.
3. To evaluate the relationship between dietary factors and hypertension by comparing intake with DASH guidelines.

2. LITERATURE REVIEW

2.1. Hypertension

Hypertension, commonly known as high blood pressure, is a widespread global health issue, affecting millions of individuals around the world. It is a leading risk factor for cardiovascular diseases like stroke, heart attack, and heart failure. According to the World Health Organization (WHO), over 1.3 billion adults are affected by hypertension globally, with only a small percentage managing to control their condition effectively.[9] The growing prevalence of hypertension is primarily linked to lifestyle factors such as unhealthy diets, lack of physical activity, and excessive alcohol intake. As urbanization and economic development accelerate, the incidence of hypertension continues to rise, placing a heavy strain on healthcare systems and economies worldwide.[10] Diet plays a crucial role in managing and preventing hypertension. High salt intake is a well-known contributor to elevated blood pressure, as it causes the body to retain water, increasing blood volume and pressure.[11] Conversely, diets rich in fruits, vegetables, whole grains, and low-fat dairy products, such as the DASH diet, have been shown to lower blood pressure significantly. The DASH diet emphasizes reducing sodium intake while increasing the consumption of potassium, calcium, and magnesium, which are essential for maintaining healthy blood pressure levels.[12] Studies indicate that patients adhering to the DASH diet experience a marked reduction in both systolic and diastolic blood pressure, highlighting the importance of dietary modifications in hypertension management.[13] Addressing hypertension on a global scale requires comprehensive strategies that include dietary modifications, public health campaigns, and policy interventions. Health organizations advocate for reducing salt consumption and promoting diets rich in nutrients that support cardiovascular health. For instance, the WHO recommends reducing daily salt intake to less than 5 grams per day as a key measure to combat hypertension. Additionally, public health initiatives aim to increase awareness about the benefits of the DASH diet and other heart-healthy eating patterns. By implementing these dietary recommendations and promoting healthier lifestyles, significant progress can be made in reducing the global burden of hypertension and improving overall health outcomes.[9, 12, 13]

2.2. Nutritional assessment

Nutritional assessment is a vital process in healthcare, involving the systematic evaluation of an individual's dietary intake, nutritional status, and related health indicators. This assessment is crucial for identifying malnutrition, guiding dietary interventions, and monitoring the effectiveness of nutritional therapy. Its importance is particularly pronounced in vulnerable populations, including the elderly, chronically ill, and those with specific medical conditions such as hypertension, diabetes, or gastrointestinal disorders.[9,13] One of the primary purposes of nutritional assessment is to identify malnutrition or the risk of Malnutrition, whether resulting from undernutrition or overnutrition, can have severe and far-reaching consequences on an individual's health. It is associated with increased morbidity and mortality, impaired immune function, delayed wound healing, and reduced quality of life. In many clinical settings, malnutrition is often underdiagnosed, leading to inadequate care and poorer outcomes for patients. Regular and comprehensive nutritional assessments are, therefore, essential for early detection of malnutrition and the implementation of timely and appropriate interventions.[14].

Nutritional assessment also plays a critical role in the management of chronic diseases. For example, in patients with hypertension, assessing dietary sodium intake, potassium levels, and overall dietary patterns can help tailor dietary recommendations that may improve blood pressure control.[15] Moreover, nutritional assessment is integral to the development and implementation of nutritional support strategies. For hospitalized patients, especially those in critical care, accurate nutritional assessment is crucial for determining the need for enteral or parenteral nutrition, ensuring that patients receive the nutrients necessary for recovery. In long-term care settings, nutritional assessments help in planning meals that meet residents' specific nutritional needs, thereby preventing malnutrition and its associated complications.[16] The InBody 270 is a portable bioelectrical impedance analysis (BIA) device used to measure body composition, including fat percentage, muscle mass, and body water. To prepare for analysis, participants should avoid eating, drinking, and exercising for at least 2-3 hours prior to the test and should remove metal accessories to avoid interference. Inclusion criteria typically include adults aged 18 and above, without pacemakers or metal implants, as these can affect the results. Exclusion criteria include pregnant women, individuals with metal implants or pacemakers, and those with severe medical conditions that could interfere with the accuracy of the BIA results.[17,18]

The use of InBody analysis significantly enhances the accuracy and comprehensiveness of nutritional assessments. These tools facilitate the evaluation of body composition, dietary intake, and various health indicators, providing a holistic view of a patient's nutritional status.[17] Additionally, nutritional assessments are invaluable in research, helping to elucidate the relationship between diet and health outcomes, and contributing to the development of evidence-based dietary guidelines.[18]

Figure 1: The InBody 270 device for bioelectrical impedance analysis (BIA).

2.3. Food Macronutrients

Macronutrients (carbohydrates, proteins, and fats) are fundamental components of the human diet, providing the essential energy and substrates necessary for the body's growth, maintenance, and overall function. Each macronutrient has a distinct and vital role in maintaining health, and an imbalance in their intake can lead to various health problems.[18] Carbohydrates are the primary source of energy for the body, particularly for the brain and muscles during physical activity. They are categorized into simple sugars, like glucose and fructose, and complex carbohydrates, such as starches and fibers. Simple sugars are rapidly absorbed, providing quick energy, while complex carbohydrates are broken down more slowly, offering sustained energy over time. Dietary fiber, a non-digestible type of carbohydrate, is crucial for digestive health, as it helps regulate blood sugar levels and lowers cholesterol.[19] However, excessive intake of simple sugars is strongly associated with obesity, type 2 diabetes, and cardiovascular diseases, highlighting the importance of consuming carbohydrates from whole grains, fruits, and vegetables to maintain a balanced diet.[18,19] Proteins serve as the building blocks of the body, composed of amino acids that are essential for the growth and repair of tissues, the production of enzymes and hormones, and the functioning of the immune system. There are 20 different amino acids, nine of which are essential and must be obtained through diet. High-quality protein sources include meat, fish, dairy, eggs, and plant-based foods like beans, legumes, and soy products. Adequate protein intake is particularly crucial for preserving muscle mass, especially in the elderly and those engaged in regular physical activity. However, excessive protein consumption, particularly from animal sources, can strain the kidneys and increase the risk of chronic conditions like osteoporosis and cardiovascular disease.[20] Fats are another essential macronutrient, providing a concentrated source of energy and acting as carriers for fat-soluble vitamins (A, D, E, and K). Fats are categorized into saturated, unsaturated, and trans fats, each with varying effects on health. Unsaturated fats, found in foods like olive oil, nuts, and avocados, are considered beneficial for heart health, helping reduce the risk of cardiovascular diseases. Conversely, saturated fats, commonly found in animal products and certain oils, along with trans fats found in processed foods, can raise cholesterol levels and elevate the risk of heart disease. Therefore, it is essential to focus on consuming healthy fats while limiting saturated and trans fats to maintain cardiovascular health.[21] The balance of macronutrients in the diet is critical for overall health. Generally, dietary guidelines recommend a distribution of 45-65% of total daily calories from carbohydrates, 10-35% from protein, and 20-35% from fats. However, these proportions can vary based on individual health goals, activity levels, and specific dietary requirements. For instance, athletes might require a higher intake of carbohydrates to meet their energy demands, while patients aiming for weight loss may benefit from a higher protein diet to support muscle retention and satiety.[22] Moreover, the quality of macronutrients consumed is just as important as their quantity. Opting for whole grains over refined grains, lean proteins over fatty cuts of meat, and unsaturated fats over saturated and trans fats can significantly impact health outcomes. This approach not only aids in maintaining a healthy weight but also reduces the risk of chronic diseases such as obesity, diabetes, and heart disease.[23]

2.4. DASH Diet

The DASH diet is a dietary regimen designed to combat high blood pressure. It emphasizes the consumption of fruits, vegetables, whole grains, lean proteins, and low-fat dairy products, while reducing intake of saturated fats, cholesterol, and sodium. This dietary approach was developed following extensive research showing its efficacy in lowering blood pressure and improving overall cardiovascular health. By focusing on nutrient-dense foods rich in potassium, calcium, and magnesium, the DASH diet provides a balanced nutritional profile that supports cardiovascular function and helps regulate blood pressure levels.[24] The DASH diet is particularly significant for hypertension patients due to its proven effectiveness in managing and potentially reducing high blood pressure. Clinical studies have demonstrated that adherence to the DASH diet can lead to significant decreases in both systolic and diastolic blood pressure. This reduction is largely attributed to the diet's low sodium content and high levels of essential nutrients that support vascular health and fluid balance. For patients with hypertension, adopting the DASH diet can be a crucial component of their treatment plan, alongside medications and other lifestyle modifications, to achieve better blood pressure control and reduce the risk of cardiovascular complications.[25] Research supporting the DASH diet underscores its role in hypertension management. For instance, a study published in the New England Journal of Medicine found that participants following the DASH diet experienced a substantial reduction in blood pressure compared to those on a standard diet. The American Heart Association and other health organizations endorse the DASH diet as a cornerstone for dietary management of hypertension, reflecting its robust evidence base and clinical benefits. By integrating the DASH diet into their daily lives, patients with hypertension can enhance their overall health and mitigate the impact of high blood pressure on their well-being.[26].

2.5. Body Composition

Body composition refers to the proportion of fat, muscle, bone, and other tissues in the body. It is a critical aspect of health as it provides insight into the body's overall physical condition beyond mere weight measurements. Body composition is commonly assessed through methods such as bioelectrical impedance analysis (BIA) using the InBody 270 scale, dual-energy X-ray absorptiometry (DEXA), and skinfold measurements. Each method varies in precision and application, but collectively they offer valuable information about fat distribution, lean muscle mass, and bone density. Understanding body composition is essential for designing effective health and fitness programs, managing obesity, and addressing various metabolic conditions.[27]

Assessing body composition is crucial for effective weight management and disease prevention. While traditional weight scales measure total body weight, they do not differentiate between fat mass and lean mass. This distinction is vital because excess fat, particularly visceral fat, is associated with increased risks of chronic diseases such as cardiovascular disease, type 2 diabetes, and hypertension. Conversely, maintaining adequate muscle mass is linked to better metabolic health, improved insulin sensitivity, and enhanced physical function. Monitoring changes in body composition can therefore help patients and healthcare providers make more informed decisions about lifestyle interventions and treatment strategies.[28] Research has highlighted the significance of body composition in both clinical practice and research. For instance, studies have shown that patients with high levels of body fat, especially abdominal fat, have an elevated risk of metabolic syndrome and cardiovascular events.[29] Conversely, maintaining a healthy balance between fat and muscle is associated with improved outcomes in various health conditions, including obesity and frailty. Body composition assessments are increasingly integrated into routine health evaluations to provide a more comprehensive picture of an individual's health status and to tailor interventions that address specific components of body composition.[30]

2.6. 24-Hour Dietary history in Nutritional Assessment

The 24-hour dietary history (24-HDH) is a widely utilized method for assessing dietary intake over a 24-hour period. This dietary assessment tool involves interviewing patients to recall all foods and beverages consumed in the previous day. The process typically includes a structured interview where participants provide detailed information on the type and quantity of foods consumed, along with the time and place of consumption. This method is favored for its simplicity, ease of administration, and ability to provide detailed insights into an individual's dietary patterns. It is crucial for obtaining accurate and representative data on dietary intake for research and clinical purposes.[31]

The 24-HDH is significant for its ability to capture a snapshot of an individual's eating habits and nutritional intake. By collecting detailed information about daily food consumption, this method helps identify dietary patterns, nutrient deficiencies, and potential areas for dietary improvement. It is particularly useful in epidemiological studies and clinical settings to evaluate the effectiveness of dietary interventions, monitor changes in dietary intake over time, and correlate dietary patterns with health outcomes. Despite its reliance on memory and potential for recall bias, the 24-HDH remains a valuable tool in nutritional assessment due to its ability to provide comprehensive dietary data that can be used to guide personalized nutrition advice and public health strategies.[32] While the 24-HDH is a valuable tool, it is not without its challenges. Issues such as recall bias, underreporting of food intake, and variations in dietary habits can impact the accuracy of the data collected. To address these challenges, it is recommended to use the 24-hour recall method or combine it with a photographic Jordanian food atlas for dietary assessment to enhance accuracy.[33] Additionally, interviewer training and the use of standardized protocols can help enhance the reliability of the data. Despite these limitations, the 24-HDH remains a cornerstone of dietary assessment due to its practicality and the depth of information it provides about dietary intake.[33]

3. PATIENTS AND METHODS

3.1 Study Design, Setting, and Timing

This study employed a cross-sectional design with an analytical component, conducted at the Nutrition Consultation Clinic of Baghdad Teaching Hospital. The study was carried out over a specified period from March 1 to July 15, 2024, allowing for a systematic assessment of the nutritional status of hypertensive patients attending the clinic.

3.2 Sampling Technique

A convenience sampling method was utilized to recruit a total of 210 hypertensive patients. Participants were selected from individuals visiting the Consultant Nutrition Clinics at Baghdad Teaching Hospital for the first time during the study period. Data collection occurred weekly, specifically on Wednesdays, from March 1 to July 15, 2024.

Inclusion Criteria

- Patients aged 18 years and above.
- Confirmed diagnosis of primary hypertension and currently undergoing treatment.
- Willingness to participate in the study.

Exclusion Criteria

- Pregnant and lactating women.
- Individuals with pacemakers or metal implants.
- Patients with severe medical conditions that could impact the accuracy of Bioelectrical Impedance Analysis (BIA) results.

This sampling strategy was designed to ensure that participants provided relevant and accurate data to meet the study's objectives.

3.3 Data Collection Methods

The study was conducted through direct interviews with patients suffering from primary hypertension. The interview duration was 10 minutes, with an average of 18 to 20 patients per day. Detailed information was collected regarding the food they consumed over the past 24 hours (24h dietary history). The data collected included age, gender, marital status, the duration since their hypertension diagnosis, and the patient's educational level. They were also asked if they received nutritional advice from their physician regarding hypertension during each visit. Additionally, questions were asked about their financial status (monthly income).

Standard tools were used, which consisted of known-sized cups to determine the portion size consumed by the patients, and the Jordanian food atlas was utilized to illustrate the size and shape of food portions for patients who could not estimate portion sizes. The patients' heights were measured using a measuring tape affixed to the wall, and then the InBody device was used to measure the patient's weight, muscle mass, fat mass, and water content in the body, essentially conducting a body composition analysis. Afterward, we calculated the caloric intake for each patient and compared it with the caloric needs based on their weight and height (BMI) to observe any increase or decrease in caloric intake.

So the data collection approach was comprehensive and multifaceted, encompassing several methods to evaluate the nutritional status of hypertensive patients.

Socio-Demographic Questionnaire

Participants completed a standardized socio-demographic questionnaire that collected essential baseline information, including age, gender, education level, income, marital status, and duration of hypertension diagnosis.

24-Hour Dietary History

Each participant provided a detailed account of their dietary intake over the past 24 hours using a dietary history sheet (Appendix B). This method aimed to identify potential nutrient balances or imbalances. To enhance the accuracy of dietary reporting, the study utilized a photographic Jordanian food atlas. This visual tool aids dietary assessment by providing portion-size images of commonly consumed foods in Jordan, facilitating accurate estimation and reporting of food intake. The atlas contains images representing various portion sizes, enabling users to select the closest match to their consumption, thus improving the reliability of dietary recall and portion estimation in nutritional research.

Anthropometric Measurements

Anthropometric measurements, including height and weight, were taken to calculate BMI, a crucial indicator of body composition. Height was measured using a tape affixed to the wall, while weight was assessed using the InBody 270 device, which also provided additional body composition analysis.

Bioelectrical Impedance Analysis (BIA)

The InBody 270 scale was employed to perform Bioelectrical Impedance Analysis, a non-invasive technique for estimating body composition. This method provided detailed measurements of lean muscle mass, body fat percentage, and total body water, essential for understanding the patients' overall nutritional status.

Caloric and Nutrient Intake Assessment

After dietary recall, caloric intake for each patient was calculated and compared with their caloric needs based on weight and height (BMI). This assessment enabled the identification of any discrepancies in caloric intake, whether excess or deficiency. The analysis focused on macronutrient distribution, with parameters established for a balanced diet.

- **Carbohydrates: 45% - 65%**
- **Protein: 10% - 35%**
- **Fats: 20% - 35%**

A diet was considered unbalanced (imbalanced) if any of these macronutrients fell below or exceeded the established percentages.

3.4: InBody Analysis

The InBody analysis is a sophisticated and non-invasive method used to evaluate body composition, offering a comprehensive assessment of an individual's health and nutritional status. Utilizing bioelectrical impedance analysis (BIA), this technique measures various parameters, including body fat mass (BFM), total skeletal muscle mass (SMM), total body water (TBW), and more, to provide a detailed overview of the body's composition.

1. Preparation for the Test

Participants are instructed to avoid heavy meals, alcohol, and intense physical activity for at least 24 hours prior to the test to ensure accurate results. It is also advised that participants hydrate adequately, as dehydration can affect the accuracy of measurements.

2. Conducting the Analysis

The participant stands on the InBody device, which consists of electrodes that are placed on the feet and hands. The device sends a low-level electrical current through the body, measuring the resistance of various tissues to the electrical flow. Different types of tissues (fat, muscle, and water) conduct electricity differently, allowing the device to distinguish between them.

3. Data Interpretation

The InBody analysis provides a detailed report that includes multiple parameters.

- Total Body Water (TBW): Measures the amount of fluid in the body, indicating hydration status and overall fluid balance.
- Body Fat Mass (BFM): Indicates the total fat content in the body, helping to assess obesity and related health risks.
- Total Skeletal Muscle Mass (SMM): Reflects the amount of muscle tissue, crucial for determining physical fitness and metabolic health.
- Body Mass Index (BMI): Calculates weight in relation to height, categorizing individuals into different weight status categories.
- Segmental Lean Analysis: Provides data on lean muscle distribution in various body segments (e.g., arms, trunk, legs), helping to identify imbalances or areas needing improvement.

4. Frequency of Testing

The InBody analysis can be conducted regularly to monitor changes in body composition over time, allowing healthcare providers to assess the effectiveness of dietary interventions, exercise programs, or medical nutrition therapy.

5. Significance

The InBody analysis is invaluable for individuals with specific health conditions, such as hypertension, as it provides insights into body composition that traditional weight measurements do not offer.

3.4 Pilot Study

Prior to the main research, a pilot study was conducted to evaluate the feasibility, methodology, and data collection procedures for assessing the nutritional status of hypertensive patients at Baghdad Teaching Hospital.

This pilot involved a smaller cohort of 10 hypertensive patients who were not included in the final sample. The pilot adhered to the same inclusion criteria and utilized the same data collection instruments as the primary study.

The primary objectives of the pilot study were to refine the data collection process, test the functionality of the InBody analysis equipment, and validate the accuracy and relevance of the questionnaires. Insights gained from the pilot informed necessary adjustments to participant recruitment strategies, improved clarity in survey questions, and refined logistical arrangements, ensuring a more effective implementation of the main study.

3.5. Statistical Analysis

This study employs the Statistical Package for the Social Sciences (SPSS) version 26 for data management and analysis, focusing on sociodemographic variables including sex, age, duration of hypertension, marital status, education, occupation, and income. It also evaluates dietary factors such as adherence to nutritional doctor-advised. The dietary assessment involves variables such as BMI, 24-hour dietary history data, and food group servings, with body composition measured using the InBody device. Descriptive statistics are used to summarize these variables. The Chi-square test is applied to examine associations between variables, with statistical significance determined at a p-value of less than 0.05.

3.6. Official and Ethical Considerations

Official approval was obtained from the Scientific Arab Board for Health Specializations in Family Medicine's ethical committee and the Iraqi Ministry of Health, Supervising Committee of the Arab Board of Health Specializations (Appendix D), confirming compliance with ethical research standards and national health regulations.

3.7. Ethical considerations

The study adhered to stringent ethical guidelines to safeguard participants' rights and ensure data confidentiality. Verbal consent was obtained from all participants prior to enrollment, with clear explanations of the study's objectives provided (Appendix E) to ensure informed and voluntary participation. Data collection was conducted anonymously, with access restricted to authorized personnel, thereby ensuring robust protection of participants' privacy and compliance with ethical standards.

3.8. Operational Definitions

- **Hypertensive Individual:** A hypertensive individual is defined as an adult (≥18 years) with sustained systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg (9, 10), confirmed through multiple readings. Such individuals are typically on antihypertensive medications. The phrase "history of hypertension" refers to the duration of elevated blood pressure, highlighting the chronic nature of the condition and its potential health implications.
- **Doctor-Advised Nutrition:** Doctor-advised nutrition involves dietary recommendations made by a physician to improve health outcomes. This guidance may include dietary modifications, meal planning, weight management strategies, and nutrient supplementation to address deficiencies, particularly for managing hypertension through healthy eating habit.[24, 25]
- **Medical Nutrition Therapy:** Medical Nutrition Therapy is a structured approach to nutrition assessment, diagnosis, and intervention tailored to manage medical conditions. It involves strict adherence to a customized dietary plan, including monitoring and adjusting macronutrient and micronutrient intake, to optimize nutritional status and health, especially in hypertensive individuals.[15, 16]
- **24-Hour Diet History Recall:** The 24-hour diet history recall method requires participants to record all food and beverage intake over the past 24 hours, including timing, quantities, and preparation methods. This detailed record helps assess dietary habits and nutritional intake, identifying patterns that may contribute to health issues like hypertension.[31, 32]
- **Daily Caloric Intake:** Daily caloric intake compares an individual's actual caloric consumption with their estimated daily energy requirement based on age, sex, weight, height, and activity level. This comparison reveals potential caloric excess or deficiency, informing dietary adjustments for better health management.[33]
- **Food Group Serving:** Food group serving refers to standardized portion sizes used to plan dietary intake across six key groups: grains, vegetables, fruits, proteins, dairy, and oils. These guidelines help individuals maintain a balanced diet, ensuring adequate nutrient intake while preventing overconsumption.[18, 22]
- **Total Body Water (TBW):** Total body water (TBW) is estimated using bioelectrical impedance analysis (BIA), measuring tissue resistance to electrical current. TBW reflects the total fluid in the body and is crucial for evaluating hydration status and body composition, especially in individuals with hypertension.[17, 18]
- **Body Fat Mass (BFM):** Body fat mass, estimated via BIA, indicates total fat content in the body. Monitoring BFM is vital for assessing obesity-related health risks, including those linked to hypertension.[17, 18]
- **Total Skeletal Muscle Mass (SMM):** Total skeletal muscle mass, also estimated using BIA, represents the amount of voluntary muscle tissue in the body. Assessing SMM is important for understanding metabolic health and physical performance, particularly in hypertensive individuals.[17, 18]

- **Body Mass Index (BMI):** Body mass index is calculated by dividing weight in kilograms (kg) by height in meters squared (m^2). It serves as a general indicator of weight status, categorizing individuals as underweight, normal weight, overweight, or obese, but does not directly measure body fat percentage.[17, 18]
- **Fat and Lean Tissue Distribution:** Fat and lean tissue distribution refers to the localization of fat and muscle tissue in specific body regions. "Upper limb fat," "trunk fat," and "lower limb fat" denote fat deposits in the arms, torso, and legs, while "upper limb lean," "trunk lean," and "lower limb lean" indicate lean muscle in these areas. Understanding this distribution is essential for evaluating body composition and its associated health risks, particularly regarding cardiovascular health and hypertension.[17, 18]

RESULTS

Table 1 presents the basic characteristics of the study participants, comprising 210 patients. The sample is predominantly female (154, 73.3%) compared to male (56, 26.7%). The average age of participants is 49.35 years with a standard deviation of 11.4 years. The age distribution of the sample reveals that the youngest participant was 25 years old, while the oldest was 75 years old. The majority of participants are aged between 40 and 54 years (110 patients, 52.4%). This is followed by those aged 55 and above (62 patients, 29.5%), and the youngest age group, 25 to 39 years old, comprises 38 patients (18.1%). Marital status reveals a high proportion of married patients (196, 93.3%), with a small percentage being unmarried (6, 2.9%) or divorced/widowed (8, 3.8%). In terms of education, the largest group has primary education (96, 45.7%), followed by secondary education (50, 23.8%), illiteracy (38, 18.1%), and graduate/postgraduate qualifications (26, 12.4%). Regarding occupation, a significant majority are not employed or housewives (148, 70.5%), with fewer participants being governmental employees (32, 15.2%), nongovernmental employees (18, 8.6%), or retired (12, 5.7%). Income levels indicate that most participants have a low income (144, 68.6%), while a smaller number fall into the medium (62, 29.5%) and high (4, 1.9%) income categories.

Table 1: Basic characteristics of study participants

Variables	N= 210 (%)
Gender	
Male	56 (26.7)
Female	154 (73.3)
Age group (years)* Mean ± SD (49. 35 ±11.4)	
25- 39	38 (18.1)
40-54	110 (52.4)
55 +	62 (29.5)
Marital state	
Unmarried	6 (2.9)
Married	196 (93.3)
Divorce & widowed	8 (3.8)
Education level	
Illiterate/ read & write	38 (18.1)
Primary	96 (45.7)
Secondary	50 (23.8)
Graduate & postgraduate	26 (12.4)
Occupation	
Not employee/ house wife	148 (70.5)
Governmental employee	32 (15.2)
Nongovernmental employee	18 (8.6)
Retired	12 (5.7)
Income level	
Low (750,000 ID or Less)	144 (68.6)
Medium (750,000- 1500,000 ID)	62 (29.5)
High (above 1500.000 ID)	4 (1.9)

***The youngest participant was 25 years old, while the oldest was 75 years old**

Table 2 presents an overview of key variables related to the history of hypertension and adherence to medical nutrition therapy among 210 participants. The average duration of hypertension among the sample was 6.0 years. Specifically, 134 participants (63.8%) had a history of hypertension ranging from 1 to 5 years, 50 participants (23.8%) had it for 6 to 10 years, and 26 participants (12.4%) had hypertension for more than 10 years. Concerning doctor advice on nutrition, 164 participants (78.1%) reported that their doctor had not advised them on dietary changes, while 46 participants (21.9%) had received such advice.

Table 2: Duration of hypertension and nutrition-related medical advice in the study population.

Variables	N= 210 (%)
History of the hypertension (years) Mean ± SD (6.0 ± 5.1)	
1-5	134 (63.8)
6-10	50 (23.8)
> 10	26 (12.4)
Doctor advised on nutrition	
No	164 (78.1)
Yes	46 (21.9)

Figure 2: Concerning doctor advice on nutrition, 164 participants (78.1%) reported that their doctor had not advised them on dietary changes, while 46 participants (21.9%) had received such advice.

Figure 3 presents an analysis of dietary intake history among the study population. Out of 210 participants, 120 patients (57.1%) consume calories exceeding their daily requirements, while 90 participants (42.9%) intake fewer calories than needed. The table also highlights the 24-hour dietary intake balance: 96 participants (45.7%) maintain a balanced diet, whereas 50 (23.8%) have an imbalance of fats, 38 (18.1%) exhibit an imbalance in carbohydrates, and 26 (12.4%) demonstrate an imbalance in proteins.

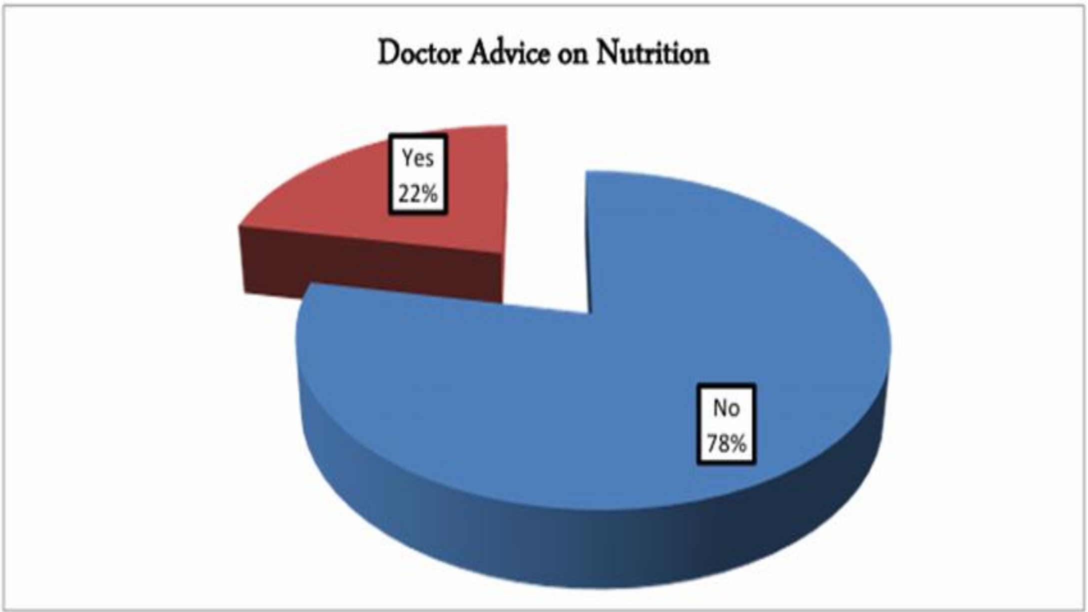

Figure 2: Distribution of the Doctor Advice on Nutrition among Study Participants

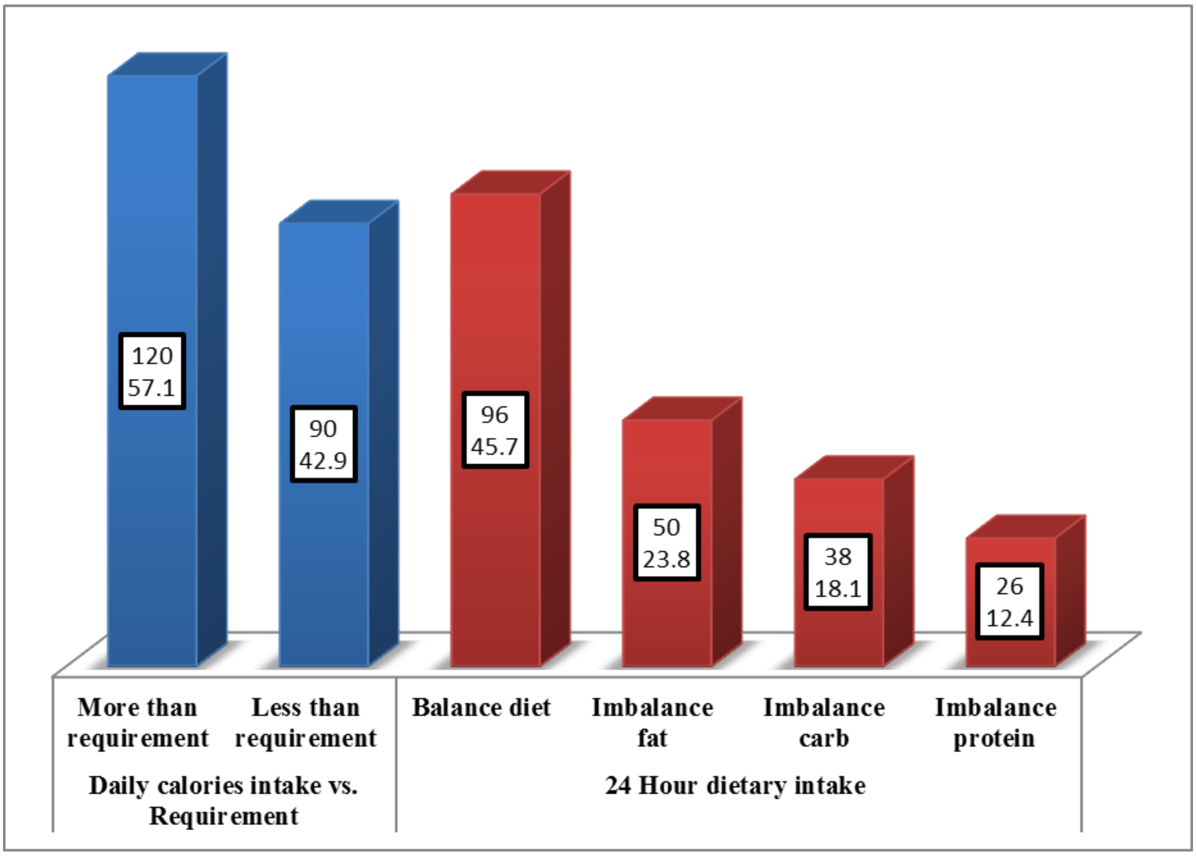

Figure 3: Distribution of daily caloric intake Vs. requirements and 24-Hour dietary intake history among study participants (N=210)

Table 3 presents a comparison of dietary intake between study participants and the recommended values of the DASH diet. The mean daily calorie intake for participants was 2165 kcal, which is significantly higher than the DASH diet recommendation of 2000 kcal (p=0.006). Additionally, participants reported consuming 15.2 servings of bread and sweet per day compared to the DASH recommendation of 7.5 servings (p=0.001). The intake of vegetables and fruits by participants was 3.8 and 4.2 servings per day, respectively, whereas the DASH diet recommends 4.5 servings of each (p=0.001). Milk consumption among participants was 1.5 servings per day, which is below the recommended 2.5 servings (p=0.001). Fat intake was 6.3 servings per day, compared to the DASH recommendation of 2.5 servings (p=0.001). Lastly, participants consumed 4.7 servings of meat daily, exceeding the DASH diet's recommended 2.5 servings (p=0.001). These comparisons highlight significant deviations from the DASH diet recommendations, suggesting areas for dietary improvement among the participants.

Table 3: Dietary intake comparison between participants and DASH diet recommendations.

Daily diet calorie	**Participants diet**	**DASH diet**	**P- value***
Kcal	**Mean =2165 Kcal**	**Mean =2000kcal**	**0.006**
Food group	**Mean serving/day**	**Mean serving/day**	
Bread & sweet serving	15.2	7.5	**0.001**
Vegetable serving	3.8	4.5	**0.001**
Fruit serving	4.2	4.5	**0.001**
Milk serving	1.5	2.5	**0.001**
Fat serving	6.3	2.5	**0.001**
Meat serving	4.7	2.5	**0.001**

*** Significant difference between two means using one sample t-test at 0.05 levels**

Table 4 presents the body composition analysis of the study participants, categorized by Total Body Water, Protein, and Mineral levels, as measured by InBody. Among the 210 participants, 118 (56.1%) had Total Body Water levels classified as 'Over,' indicating a higher than normal amount of body water. In contrast, 86 participants (41.0%) had 'Normal' Total Body Water levels, while only 6 participants (2.9%) had 'Under' levels. For Protein levels, 102 participants (48.6%) were classified as 'Over,' matching the number with 'Normal' levels, and 6 participants (2.8%) had 'Under' Protein levels. Regarding Mineral content, 78 participants (37.1%) had 'Over' levels, 128 (61.0%) had 'Normal' levels, and 4 participants (1.9%) had 'Under' levels. This distribution highlights that a significant portion of the study population exhibits elevated levels of Total Body Water and Protein, with the majority showing normal Mineral content.

Table 4: Body composition analysis of study participants by InBody

Variables	N= 210 (%)
Total Body Water (L)	
Over	118 (56.1)
Normal	86 (41.0)
Under	6 (2.9)
Protein (kg)	
Over	102 (48.6)
Normal	102 (48.6)
Under	6 (2.8)
Mineral (kg)	
Over	78 (37.1)
Normal	128 (61.0)
Under	4 (1.9)

The **table 5** presents an analysis of obesity among the study participants using InBody measurements. The mean Body Mass Index (BMI) was 36.6 kg/m² with a standard deviation of 7.8. Among the 210 participants, a small proportion, 8 patients (3.8%), were classified as having normal weight, while 34 participants (16.2%) were categorized as overweight. The majority exhibited varying degrees of obesity, with 58 participants (27.6%) classified as Obesity I, 44 participants (21.0%) as Obesity II, and 66 participants (31.4%) as having Morbid Obesity. The mean percent body fat was 44.85% with a standard deviation of 8.7. A striking 204 participants (97.1%) had percent body fat levels classified as "over," indicating high levels of body fat, whereas only 6 participants (2.9%) were considered to have normal body fat levels. No participants fell into the "under" category for percent body fat. This data underscores a high prevalence of obesity and elevated body fat levels among the participants, highlighting significant concerns related to obesity within this population.

Table 5: Obesity analysis of study participants by InBody

Variables	N= 210 (%)
Body Mass Index (kg/m^2) Mean ± SD (36.6 ±7.8)	
Normal weight	8 (3.8)
Over weight	34 (16.2)
Obesity I	58 (27.6)
Obesity II	44 (21.0)
Morbid obesity	66 (31.4)
Percent Body Fat (%) Mean ± SD (44.85 ± 8.7)	
Over	204 (97.1)
Normal	6 (2.9)
Under	0 (0.0)

Table 6 presents the segmental lean mass distribution among 210 study participants, as measured by InBody analysis. For skeletal body mass, 108 participants (51.4%) were categorized as having an "over" lean mass, 74 (35.2%) had a "normal" lean mass, and 28 (13.4%) were classified as "under" lean mass. In terms of arm lean mass, the majority, 156 participants (74.3%), had a "normal" classification, while 48 (22.9%) were "over," and 6 (2.9%) were "under." Regarding trunk lean mass, 174 participants (82.9%) fell into the "normal" range, with 28 (13.3%) "over" and 8 (3.8%) "under." Lastly, for legs lean mass, a very small proportion, 2 participants (1.0%), were categorized as "over," whereas 142 (67.6%) were "normal" and 66 (31.4%) were "under." This analysis highlights the variation in lean mass across different body segments among the participants, indicating significant diversity in body composition.

Table 6: Segmental lean analysis of study participants by InBody	
Variables	**N= 210 (%)**
Skeletal Body Mass (kg)	
Over	108 (51.4)
Normal	74 (35.2)
Under	28 (13.4)
Arms lean	
Over	48 (22.9)
Normal	156 (74.3)
Under	6 (2.9)
Trunk lean	
Over	28 (13.3)
Normal	174 (82.9)
Under	8 (3.8)
Legs lean	
Over	2 (1.0)
Normal	142 (67.6)
Under	66 (31.4)

Table 7 provides a comprehensive overview of the body fat mass distribution among the study population of 210 patients. The data reveals that a predominant majority, 190 participants (90.4%), exhibit elevated body fat mass, while only 16 participants (7.6%) are classified within the normal range, and a mere 4 participants (2.0%) fall under the category of having insufficient body fat mass. For arm fat, an even higher proportion, 200 patients (95.2%), have excessive fat accumulation, with only 6 (2.8%) within the normal range and 4 (2.0%) with below-normal levels. The trunk fat data is noteworthy as all 210 participants (100.0%) are categorized with excessive fat, with no cases of normal or under-fat categories. Similarly, leg fat distribution shows 200 participants (95.2%) with over-fat levels, while 10 patients (4.8%) have normal fat levels, and no participants fall into the under-fat category. This table highlights a high prevalence of elevated fat across all body regions among the population studied.

Table 7: Segmental fat analysis of study participants by InBody	
Variables	**N= 210 (%)**
Body Fat Mass (kg)	
Over	190 (90.4)
Normal	16 (7.6)
Under	4 (2.0)
Arms fat	
Over	200 (95.2)
Normal	6 (2.8)
Under	4 (2.0)
Trunk fat	
Over	210 (100.0)
Normal	0 (0.0)
Under	0 (0.0)
Legs fat	
Over	200 (95.2)
Normal	10 (4.8)
Under	0 (0.0)

The **table 8** illustrates the distribution of Body Mass Index (BMI) categories among different demographic variables in a sample of 210 participants. The BMI categories are as follows: normal (3.8%), overweight (16.2%), obese I (27.8%), obese II (21.0%), and obese III (31.4%). Significant differences in BMI distribution were observed across gender (p = 0.001), with a higher prevalence of obesity in females (41.6%) compared to males (3.6%). Age also showed significant variation (p = 0.001), with the 55+ age group exhibiting the highest obesity prevalence (41.4%), while the 25-39 age group had the lowest (42.1%). Marital status was significantly associated with BMI (p = 0.005), where married patients had the highest proportion of obesity (31.6%). Education level showed a significant relationship with BMI (p = 0.035), with illiterate patients showing the highest obesity rates (42.1%). Occupation also influenced BMI (p = 0.001), with housewives or non-employed patients having the highest obesity rates (41.9%). Finally, income level demonstrated a significant correlation with BMI (p

= 0.043), where patients with low income had the highest obesity prevalence (36.1%). These findings highlight the complex interplay between demographic factors and BMI categories, suggesting targeted interventions based on these variables.

Table 8: Distribution of BMI categories by Socio-demographic variables.

Variable	BMI category						P value
	normal 8 (3.8)	overweight 34 (16.2)	obese I 58 (27.8)	obese II 44 (21.0)	obese III 66 (31.4)	Total 210 (100.0)	
Gender							
Male	6 (10.7)	22 (39.3)	22 (39.3)	4 (7.1)	2 (3.6)	56 (26.7)	**0.001**
Female	2 (1.3)	12 (7.8)	36 (23.4)	40 (26.0)	64 (41.6)	154 (73.3)	
Age group (years)							
25- 39	0 (0.0)	4 (10.5)	4 (10.5)	14 (36.8)	16 (42.1)	38 (18.1)	**0.001**
40-54	4 (3.6)	16 (14.5)	36 (32.7)	10 (9.1)	44 (40.0)	110 (52.4)	
55 +	4 (6.5)	14 (22.6)	18 (29.0)	20 (32.3)	6 (9.7)	62 (29.5)	
Marital state							
Unmarried	0 (0.0)	0 (0.0)	2 (33.3)	0 (0.0)	4 (66.7)	6 (2.9)	**0.005**
Married	8 (4.1)	32 (16.3)	56 (28.6)	38 (19.4)	62 (31.6)	196 (93.3)	
Divorce & widowed	0 (0.0)	2 (25.0)	0 (0.0)	6 (75.0)	0 (0.0)	8 (3.8)	
Education level							
Illiterate	0 (0.0)	2 (5.3)	12 (31.6)	8 (21.1)	16 (42.1)	38 (18.1)	**0.035**
Primary	4 (4.2)	12 (12.5)	26 (27.1)	18 (18.8)	36 (37.5)	96 (45.7)	
Secondary	4 (8.0)	12 (24.0)	14 (28.0)	10 (20.0)	10 (20.0)	50 (23.8)	
Graduate & postgraduate	0 (0.0)	8 (30.8)	6 (23.1)	8 (30.8)	4 (15.4)	26 (12.4)	
Occupation							
Not employee/ house wife	4 (2.7)	8 (5.4)	42 (28.4)	32 (21.6)	62 (41.9)	148 (70.4)	**0.001**
Governmental employee	2 (6.3)	12 (37.5)	8 (25.0)	6 (18.8)	4 (12.5)	32 (15.2)	
Nongovernmental employee	0 (0.0)	6 (33.3)	8 (44.4)	4 (22.2)	0 (0.0)	18 (8.6)	
Retired	2 (16.7)	8 (66.7)	0 (0.0)	2 (16.7)	0 (0.0)	12 (5.7)	
Income level							
Low	4 (2.8)	16 (11.1)	40 (27.8)	32 (22.2)	52 (36.1)	144 (68.6)	**0.043**
Medium	4 (6.5)	16 (25.8)	16 (25.8)	12 (19.4)	14 (22.6)	62 (29.5)	
High	0 (0.0)	2 (50.0)	2 (50.0)	0 (0.0)	0 (0.0)	4 (1.9)	

The table 9 presents the distribution of Body Mass Index (BMI) categories among 210 participants, analyzed in relation to their history of hypertension, daily calorie intake versus requirement, 24-hour dietary intake, and percent body fat. The BMI categories are classified as normal (3.8%), overweight (16.2%), obese I (27.8%), obese II (21.0%), and obese III (31.4%). A significant association is observed with the history of hypertension (p = 0.002), where the majority of participants with hypertension for more than 5 years fall into the obese categories (63.8%). Daily caloric intake versus requirement also shows a significant association (p = 0.001), with 57.1% of those consuming more than their caloric requirement falling into higher BMI categories. Dietary intake balance reveals a significant correlation (p = 0.012), with 54.3% of participants on an imbalanced diet having higher BMIs. Lastly, percent body fat is significantly associated with BMI categories (p = 0.001), with a vast majority (97.1%) of participants having excessive body fat corresponding to higher BMI categories, while only 2.9% are within the normal range.

Table 9: Association Between BMI Categories and Hypertension History, Caloric Intake, Dietary Balance, and Percent Body Fat.

Variable	BMI category						P value
	normal 8 (3.8)	overweight 34 (16.2)	obese I 58 (27.8)	obese II 44 (21.0)	obese III 66 (31.4)	Total 210 (100.0)	
History of the hypertension (years)							
1-5	6 (4.5)	18 (13.4)	36 (26.9)	24 (17.9)	50 (37.3)	134 (63.8)	**0.002**
6-10	2 (4.0)	6 (12.0)	20 (40.0)	14 (28.0)	8 (16.0)	50 (23.8)	
+10	0 (0.0)	10 (38.5)	2 (7.7)	6 (23.1)	8 (30.8)	26 (12.4)	

Daily calories intake Vs. Requirement							
More than requirement	2 (1.7)	10 (8.3)	38 (31.7)	32 (26.7)	38 (31.7)	120 (57.1)	**0.001**
Less than requirement	6 (6.7)	24 (26.7)	20 (22.2)	12 (13.3)	28 (31.1)	90 (42.9)	
24 Hour dietary intake							
Balance diet	4 (3.5)	12 (10.5)	26 (22.8)	30 (26.3)	42 (36.8)	96 (45.7)	**0.012**
Imbalance diet	4 (4.2)	22 (22.9)	32 (33.3)	14 (14.6)	24 (25.0)	114 (54.3)	
Percent Body Fat (%)							
Over	2 (1.0)	34 (16.7)	58 (28.4)	44 (21.6)	66 (32.4)	204 (97.1)	**0.001**
Normal	6 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	6 (2.9)	

Table 10 presents the distribution of daily caloric intake among the study population, categorized by various demographic variables. Out of the total 210 participants, 120 (57.1%) consumed more than their caloric requirement, while 90 (42.9%) consumed less. Gender analysis reveals that 26 (46.4%) males and 94 (61.0%) females consumed more than their requirement, with a p-value of 0.058, indicating no significant gender difference. Regarding age, the proportion of patients consuming more than their requirement was highest in the 25-39 years group (26 out of 38, or 68.4%), though the overall p-value of 0.303 suggests age is not a significant factor. Marital status showed that 114 (58.2%) married patients had higher caloric intake compared to 4 (66.7%) unmarried and 2 (25.0%) divorced or widowed, with a p-value of 0.177, indicating marital status does not significantly affect caloric intake. Education level analysis shows no significant difference, as p-values across education categories range from 0.870 to 0.870. Occupational status revealed a significant difference (p=0.007); 14 (77.8%) of non-governmental employees and 88 (59.5%) of non-employed/housewives had higher intake compared to 16 (50.0%) of governmental employees and 2 (16.7%) of retirees. Income level did not significantly impact caloric intake with a p-value of 0.053; 86 (59.7%) low-income patients and no high-income patients had excessive caloric intake.

Table 10: Distribution of Daily calorie intake by socio-demographic variables.

Variable	Daily calories intake			P- value
	More than requirement 120 (57.1)	Less than requirement 90 (42.9)	Total 210 (100.0)	
Gender				
Male	26 (46.4)	30 (53.6)	56 (26.7)	0.058
Female	94 (61.0)	60 (39.0)	154 (73.3)	
Age group (years)				
25- 39	26 (68.4)	12 (31.6)	38 (18.1)	0.303
40-54	60 (54.4)	50 (54.5)	110 (52.4)	
55 +	34 (54.8)	28 (45.2)	62 (29.5)	
Marital state				
Unmarried	4 (66.7)	2 (33.3)	6 (2.9)	0.177
Married	114 (58.2)	82 (41.8)	196 (93.3)	
Divorce & widowed	2 (25.0)	6 (75.0)	8 (3.8)	
Education level				
Illiterate	24 (63.2)	14 (36.8)	38 (18.1)	0.870
Primary	54 (56.3)	42 (43.8)	96 (45.7)	
Secondary	28 (56.0)	22 (44.0)	50 (23.8)	
Graduate & postgraduate	14 (53.8)	12 (46.2)	26 (12.4)	
Occupation				
Not employee/ house wife	88 (59.5)	60 (40.6)	148 (70.4)	**0.007**
Governmental employee	16 (50.0)	16 (50.0)	32 (15.2)	
Nongovernmental employee	14 (77.8)	4 (22.2)	18 (8.6)	
Retired	2 (16.7)	10 (83.3)	12 (5.7)	
Income level				
Low	86 (59.7)	58 (40.3)	144 (68.6)	0.053
Medium	34 (54.8)	28 (45.2)	62 (29.5)	
High	0 (0.0)	4 (100.0)	4 (1.9)	

Table 11 presents the distribution of 24-hour dietary intake in relation to various socio-demographic variables, with a total of 210 participants, of whom 54.3% had an imbalanced diet, and 45.7% maintained a balanced diet. Gender shows a significant difference (p=0.012), where 59.7% of females had an imbalanced diet compared to 39.3% of males. Regarding age, a highly significant relationship (p=0.002) is observed, with younger participants (25-39 years) exhibiting a higher imbalance in diet (78.9%), while the 40-54 age group had a higher proportion of balanced diets (54.5%). Marital status does not present a significant association with dietary intake (p=0.439), although divorced/widowed participants had the highest rate of imbalanced diets (75%). Education level, while not statistically significant (p=0.115), indicates that illiterate patients had a higher percentage of imbalanced diets (63.2%), whereas those with secondary education had a more balanced intake (60.0%). Similarly, occupational status was not significantly linked to dietary balance (p=0.318), though non-employed patients and housewives had a higher prevalence of imbalanced diets (66.7%). Lastly, income level approached significance (p=0.069), with the low-income group exhibiting a nearly equal distribution between imbalanced (54.2%) and balanced (45.8%) diets, while the high-income group had all participants maintaining a balanced diet (100.0%).

Table 11: Distribution of 24 hour dietary intake by socio-demographic variable.

Variable	**24 hour dietary intake**			**P- value**
	Imbalance diet 114 (54.3)	**Balance diet 96 (45.7)**	**Total 210 (100.0)**	
Gender				
Male	22 (39.3)	34 (60.7)	56 (26.7)	**0.012**
Female	92 (59.7)	62 (40.3)	154 (73.3)	
Age group (years)				
25- 39	30 (78.9)	8 (21.1)	38 (18.1)	**0.002**
40-54	50 (45.5)	60 (54.5)	110 (52.4)	
55 +	34 (54.8)	28 (45.2)	62 (29.5)	
Marital state				
Unmarried	4 (66.7)	2 (33.3)	6 (2.9)	0.439
Married	104 (53.1)	92 (46.9)	196 (93.3)	
Divorce & widowed	6 (75.0)	2 (25.0)	8 (3.8)	
Education level				
Illiterate	24 (63.2)	14 (36.8)	38 (18.1)	0.115
Primary	56 (58.3)	40 (41.7)	96 (45.7)	
Secondary	20 (40.0)	30 (60.0)	50 (23.8)	
Graduate & postgraduate	14 (53.8)	12 (46.2)	26 (12.4)	
Occupation				
Not employee/ Hose wife	12 (66.7)	6 (33.3)	148 (70.4)	0.318
Governmental employee	16 (50.0)	16 (50.0)	32 (15.2)	
Unemployed	82 (55.4)	66 (44.6)	18 (8.6)	
Retired	4 (33.3)	8 (66.7)	12 (5.7)	
Income level				
Low	78 (54.2)	66 (45.8)	144 (68.6)	0.069
Medium	36 (58.1)	26 (41.9)	62 (29.5)	
High	0 (0.0)	4 (100.0)	4 (1.9)	

5. DISCUSSION

5.1 Demographic characteristics and their impact on hypertension: The present study's findings provide a comprehensive overview of the sociodemographic profile of participants and its relationship with hypertension and obesity, conditions that are highly prevalent in the population studied. The predominance of female participants (73.3%) aligns with other regional studies that have shown a higher participation rate among women in health-related research.[36] This gender distribution also corresponds to the observed higher prevalence of obesity in females, consistent with the findings of other studies conducted in Iraq and the Middle East, where cultural and social factors contribute to differences in lifestyle and health behaviors between genders.[37] The age distribution, with a majority of participants falling between 40-54 years, is significant as it represents a critical period for the onset of chronic diseases like hypertension and obesity.[38] The finding that the majority of participants is married (93.3%) and has primary education (45.7%) is notable as it reflects the general population's sociodemographic characteristics in Iraq, where marriage and primary education are common among middle-aged adults.[39] These sociodemographic factors, particularly marital status and education level, have been shown to influence health outcomes, including dietary habits and adherence to medical advice, as corroborated by similar studies conducted in the region.[40]

5.2 Hypertension and Medical Nutrition Therapy Adherence

The study found that a significant proportion of participants (63.8%) have had hypertension for 1 to 5 years, with a smaller group experiencing hypertension for over 10 years.[41] These findings are disagree with global trends where the duration of hypertension correlates with age, and longer durations are associated with increased complications and comorbidities.[42]

Notably, a large proportion of participants (78.1%) reported not receiving dietary advice from their doctors, and 81.9% did not adhere to medical nutrition therapy. These findings highlight a significant gap in the management of hypertension, emphasizing the need for better communication and support from healthcare providers to promote dietary interventions.[43] This lack of adherence is concerning as dietary management is a cornerstone of hypertension treatment, as evidenced by international guidelines and studies that emphasize the role of nutrition in controlling blood pressure.[44]

5.3 Dietary Intake History and Deviations from DASH Diet Recommendations: The dietary intake analysis reveals substantial deviations from the DASH diet recommendations. Participants consumed significantly more calories, bread, and meat while under-consuming vegetables, fruits, and milk. These deviations are critical as they underscore the potential contributors to the high prevalence of obesity and hypertension observed in the study population.[45, 46]

The excessive calorie intake observed in 57.1% of participants is particularly alarming, as it directly contributes to the obesity epidemic, which is a known risk factor for hypertension and other chronic diseases.[47] Similar findings have been reported in studies from the Middle East and other regions, where dietary habits characterized by high calorie and fat intake have been linked to increased rates of obesity and related health issues.[48].The under-consumption of vegetables and fruits, critical components of the DASH diet, further exacerbates the risk of hypertension and cardiovascular disease.[49] The DASH diet is well-documented for its effectiveness in reducing blood pressure and improving heart health, and the study's findings highlight a need for public health interventions to promote healthier eating patterns.[50]

5.4 Body Composition Analysis and Obesity Prevalence

The InBody analysis provides a detailed understanding of body composition among participants, revealing high levels of Total Body Water, Protein, and Mineral content in a significant portion of the population. This finding indicates possible fluid retention and over-nutrition, which are common in patients with hypertension and obesity.[51, 52] The high prevalence of obesity, with a mean BMI of 36.6 kg/m² and 97.1% of participants classified as having excessive body fat, is a critical public health concern.[53]

These findings align with national and regional studies indicating high obesity rates in Iraq and neighboring countries, which reflect comparable dietary patterns and lifestyle factors.[54] The data revealing higher obesity rates among females and older adults further supports the notion that targeted interventions are necessary to address these at-risk groups.[55]

The distribution of segmental lean mass and body fat highlights the variation in muscle and fat distribution across different body regions, which can have significant implications for health outcomes. The study shows the prevalence of elevated trunk fat, in particular, is concerning as it is associated with increased cardiovascular risk and metabolic syndrome.[56]

5.5 Impact of Sociodemographic Variables on BMI and Dietary Intake: The study's analysis of BMI categories in relation to demographic variables reveals significant associations with gender, age, marital status, education, occupation, and income level. The higher prevalence of obesity among females, married patients, and those with lower education levels reflects the complex interplay between social determinants and health outcomes.[58, 59]

These findings are supported by other studies[60, 61] that have identified similar patterns, where lower socioeconomic status and education are linked to poorer health outcomes, including higher rates of obesity and chronic diseases.[60] The significant association between occupation and caloric intake also highlights the role of occupational status in influencing dietary behaviors, with non-governmental employees and housewives showing higher caloric intake compared to other occupational groups.

The marginal significance of income level in affecting dietary balance suggests that while income plays a role, other factors such as education and occupation may have a more direct impact on dietary habits.[62] This finding aligns with research that emphasizes the multifactorial nature of diet-related health issues, where socioeconomic factors intersect with cultural and environmental influences.[63]

5.6 Implications for Public Health and Future Research

The findings of this study underscore the urgent need for public health interventions to address the high prevalence of hypertension in this population. The significant deviations from DASH diet recommendations and the lack of adherence to medical nutrition therapy suggest that educational programs and policy initiatives are needed to promote healthier eating patterns and improve the management of chronic diseases.[64, 65]

Moreover, the study highlights the importance of considering sociodemographic factors in designing targeted interventions.[66] Programs aimed at improving dietary intake and reducing obesity should be tailored to address the specific needs of at-risk groups, such as women, older adults, and patients with lower education and income levels.[67]

Future research should explore the underlying factors contributing to the observed dietary patterns and non-adherence to medical nutrition therapy.[68] Longitudinal studies could provide insights into the long-term effects of these behaviors on health outcomes and inform the development of more effective interventions.[69]

6. CONCLUSIONS

1. Demographic Profile: The study participants are primarily female, with a significant majority in the 40-54 age groups. Most of the participants are married, and a considerable portion has only completed primary education, along with many reporting low-income levels.
2. Hypertension History: Many participants have a history of hypertension lasting 1 to 5 years, and a significant number reported not receiving dietary advice from their healthcare provider. This highlights a gap in patient education regarding nutrition management.
3. Dietary Intake Patterns: Many participants consume calories that exceed their daily requirements. There is a pronounced imbalance in dietary intake, especially regarding fats, carbohydrates, and proteins.
4. DASH Diet Comparison: The dietary intake of participants shows a significant deviation from the recommended DASH diet. The average calorie intake surpasses the recommended amount, with higher consumption of bread, sweets, fats, and meats. Conversely, the intake of vegetables and fruits falls below the recommended levels.
5. Body Composition: The analysis reveals high levels of Total Body Water and Protein among participants. However, most individuals exhibit normal mineral content, suggesting variations in hydration and protein status.
6. Obesity Prevalence: The study indicates a significant obesity issue, with an average BMI that reflects a high prevalence of obesity. A vast majority of participants have elevated body fat levels, with many classified as experiencing various degrees of obesity.
7. Segmental Lean and Fat Distribution: The analysis indicates diversity in lean mass across body segments, with a notable percentage classified as having excessive skeletal mass. In ontrast, body fat distribution is alarmingly high, with most participants exhibiting excessive body fat.

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(Appendix A) Questionnaire

A- Demographic Part

1- Gender: ☐Male ☐Female

2- Age: …………. years

3- How many years you have been diagnosed with Hypertension: Year

4- Marital Status: ☐Single ☐Married ☐Divorced ☐Widow

5- Educational level:

☐illiterate

☐Primary School

☐High School

☐Bachelor's degree or higher

6- Occupation:

☐Government employee

☐Private Sector employee

☐Self-Employed

☐Retired

7- Income level (per month):

☐750 000 or less

☐750 000-1 500 000

☐Above 1 500 000

8- Do you receive dietary recommendations and healthy diet advices from your physician:

☐Yes, in every visit

☐Yes, from time to time

☐No

9- Do you consider yourself following a healthy diet:

☐Yes, my diet is very strict, and I don't eat unhealthy food

☐Partially, I am trying to follow a healthy diet but not always

☐No, I don't care for the type of food and eat all types of diet

B- Part two

1- 24 Hours dietary recall

2- Weight, height

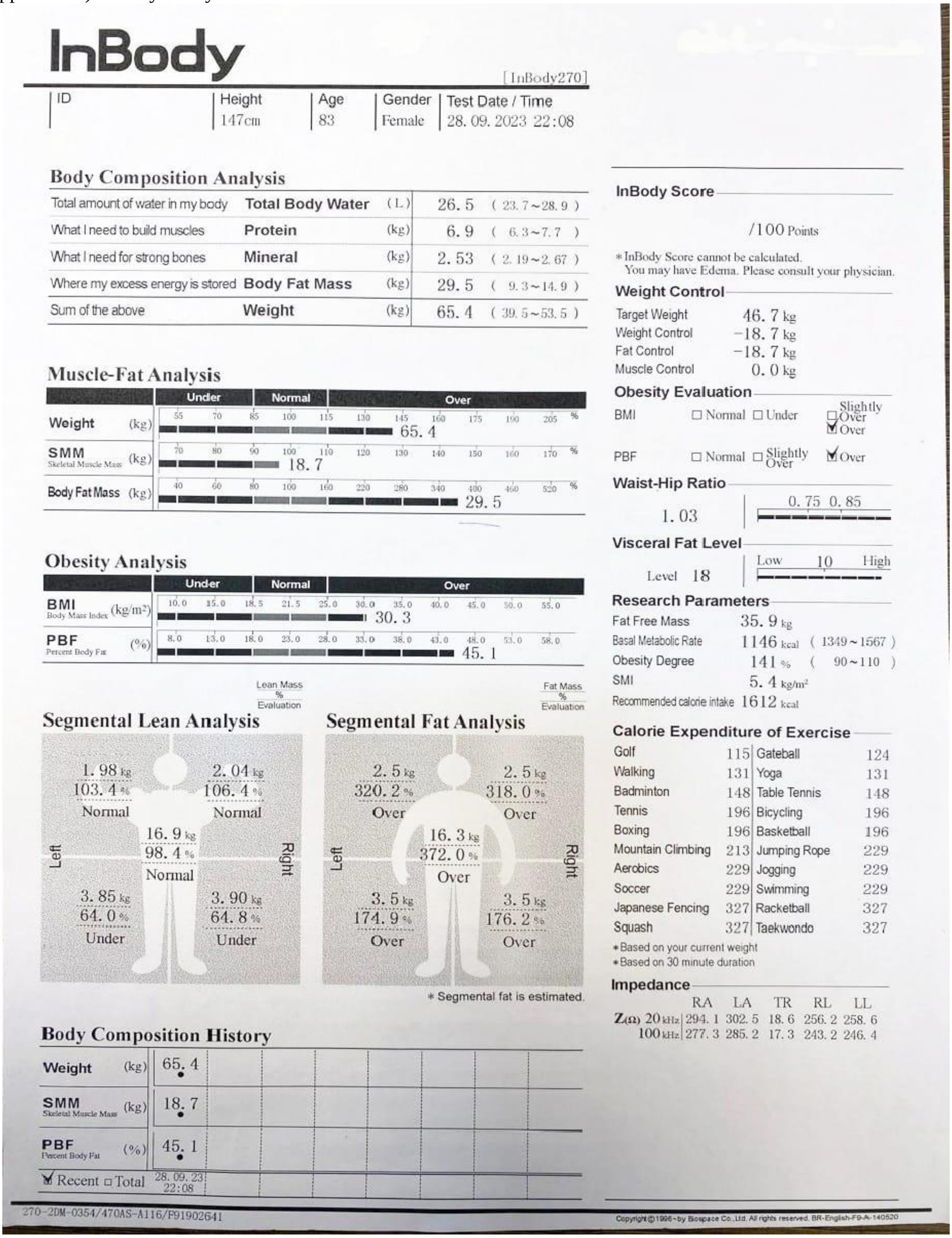
3- InBody analysis

(Appendix B) 24 Hours dietary recall

24-hour dietary recall **Date:** ____________ **Time:** __________ **Participant name (or study ID):** __________________________

Meal	Time	Place (to jog their memory)	Detailed description of food and drink	Brand/Product name and/or how prepared	Amount (serving size)
Breakfast					
Morning tea					
Lunch					
Afternoon tea					
Dinner					
Dessert					
Supper					
Other (snacks, supplements, 'forgotten foods'					

(Appendix C) InBody Analysis



InBody [InBody270]

ID	Height	Age	Gender	Test Date / Time
	147cm	83	Female	28. 09. 2023 22:08

Body Composition Analysis

Total amount of water in my body	Total Body Water	(L)	26. 5	(23. 7 ~ 28. 9)
What I need to build muscles	Protein	(kg)	6. 9	(6. 3 ~ 7. 7)
What I need for strong bones	Mineral	(kg)	2. 53	(2. 19 ~ 2. 67)
Where my excess energy is stored	Body Fat Mass	(kg)	29. 5	(9. 3 ~ 14. 9)
Sum of the above	Weight	(kg)	65. 4	(39. 5 ~ 53. 5)

Muscle-Fat Analysis

	Under	Normal	Over	
Weight (kg)	55 70 85	100 115	130 145 160 175 190 205 %	65. 4
SMM Skeletal Muscle Mass (kg)	70 80 90	100 110	120 130 140 150 160 170 %	18. 7
Body Fat Mass (kg)	40 60 80	100 160	220 280 340 400 460 520 %	29. 5

Obesity Analysis

	Under	Normal	Over	
BMI Body Mass Index (kg/m²)	10.0 15.0 18.5	21.5 25.0	30.0 35.0 40.0 45.0 50.0 55.0	30. 3
PBF Percent Body Fat (%)	8.0 13.0 18.0	23.0 28.0	33.0 38.0 43.0 48.0 53.0 58.0	45. 1

Segmental Lean Analysis (Lean Mass % Evaluation)

	Left	Right
Arm	1. 98 kg, 103. 4 %, Normal	2. 04 kg, 106. 4 %, Normal
Trunk	16. 9 kg, 98. 4 %, Normal	
Leg	3. 85 kg, 64. 0 %, Under	3. 90 kg, 64. 8 %, Under

Segmental Fat Analysis (Fat Mass % Evaluation)

	Left	Right
Arm	2. 5 kg, 320. 2 %, Over	2. 5 kg, 318. 0 %, Over
Trunk	16. 3 kg, 372. 0 %, Over	
Leg	3. 5 kg, 174. 9 %, Over	3. 5 kg, 176. 2 %, Over

* Segmental fat is estimated.

Body Composition History

Weight (kg)	65. 4
SMM Skeletal Muscle Mass (kg)	18. 7
PBF Percent Body Fat (%)	45. 1
☑ Recent ☐ Total	28. 09. 23 22:08

InBody Score

/100 Points

* InBody Score cannot be calculated. You may have Edema. Please consult your physician.

Weight Control

Target Weight	46. 7 kg
Weight Control	−18. 7 kg
Fat Control	−18. 7 kg
Muscle Control	0. 0 kg

Obesity Evaluation

BMI ☐ Normal ☐ Under ☐ Slightly Over ☑ Over

PBF ☐ Normal ☐ Slightly Over ☑ Over

Waist-Hip Ratio

1. 03 (0. 75 0. 85)

Visceral Fat Level

Level 18 (Low 10 High)

Research Parameters

Fat Free Mass	35. 9 kg
Basal Metabolic Rate	1146 kcal (1349 ~ 1567)
Obesity Degree	141 % (90 ~ 110)
SMI	5. 4 kg/m²
Recommended calorie intake	1612 kcal

Calorie Expenditure of Exercise

Golf	115	Gateball	124
Walking	131	Yoga	131
Badminton	148	Table Tennis	148
Tennis	196	Bicycling	196
Boxing	196	Basketball	196
Mountain Climbing	213	Jumping Rope	229
Aerobics	229	Jogging	229
Soccer	229	Swimming	229
Japanese Fencing	327	Racketball	327
Squash	327	Taekwondo	327

* Based on your current weight
* Based on 30 minute duration

Impedance

Z(Ω)	RA	LA	TR	RL	LL
20 kHz	294. 1	302. 5	18. 6	256. 2	258. 6
100 kHz	277. 3	285. 2	17. 3	243. 2	246. 4

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