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*Research article*

# Preliminary analysis of patient assessment within a study on the impact of hydrokinetotherapy on body composition and metabolic disease risk in an adult population segment

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**Abstract:** In clinical and research settings, the accurate and reliable evaluation of body composition is necessary. Existing methods present various challenges, either in measurement methodology or in the assumptions they rely on.The purpose of this study is to conduct a preliminary analysis of patient assessment within a study concerning the impact of hydrokinetotherapy on body composition and metabolic disease risk in an adult population segment. Methods: The research was carried out at the Diabetes Ambulatory Clinic of the Suceava County Hospital in January 2024. An essential component of this investigation involves evaluating body composition parameters measured using the Tanita 738 device and assessing metabolic risk factors such as diabetes mellitus, hypertension, and dyslipidemia. In parallel with this research, a hydrokinetotherapy model adapted to this population is proposed for development. Results: The interpretation of BMI data for women aged 40-60 revealed significant variability in this group's body composition, as was also observed in women aged 61-80. Among women aged 61-80, there was a significant proportion of participants with morbid obesity (BMI $\geqslant$ 40). Similarly, the BMI data for men aged 40-60 indicated notable variability in body composition, consistent with the findings for men aged 61-80. Both age groups in men exhibited significant overweight and obesity, highlighting the need for increased attention to weight management and metabolic health among men. Conclusions: The study on body composition and metabolic disease risk among adults aged 40 to 80, participants at the Diabetes Ambulatory Clinic of the Suceava County Hospital, demonstrated significant findings in both women and men. Implementing a 4-month hydrokinetotherapy program indicates an approach aimed at optimizing participants' health. A personalized approach and careful management of hydrokineto-therapy exercises are necessary. Weight loss through diet and physical exercise is proven to be the most effective treatment strategy for obese and overweight elderly subjects, facilitating the maintenance of muscle mass and promoting functional recovery.

**Keywords:** analysis, evaluation, body composition, hydrokinetotherapy, adult population

## 1. Introduction

The field of human body composition research has reached an advanced level of maturity, playing a crucial role in the study of growth and development, and is relevant to both anthropology and medicine. Quantification of the main body components is essential for evaluating human physical characteristics [1]. In clinical and research settings, accurate and reliable evaluation of body composition is critical. However, current methods present various challenges, either in measurement methodology or in the assumptions on which they are based [2]. Studies show a trend of increasing average weight with age, up to the 70-79 year age group. The average BMI values reflect a significant variation in weight status, with high values across all age groups [3]. The obesity phenotype is complex and cannot be described solely by BMI; detailed measurements of body fat, skeletal muscle, and fat distribution, including hepatic fat, are closely linked to insulin resistance [4]. Obesity prevalence continues to rise, especially among the elderly. By 2035, it is estimated that over 20% of the adult population in the US and more than 25% of the European population will be over 65 years old. Although clear limits for BMI, waist circumference, and body fat percentages for the elderly are lacking, studies indicate that morbidity and mortality significantly increase with a BMI over 30 kg/m² [5].

In a study on optimizing body composition through therapeutic swimming, eight women who met inclusion criteria were evaluated before and after the swimming program to determine its impact on morphological status [6]. The diagnosis and classical understanding of obesity have been based on the concept of excessive fat storage due to a chronic positive energy balance, as reflected by BMI. However, both qualitative and quantitative analysis of lean and adipose tissue compartments suggest that defining obesity solely as "excess fat" does not fully capture the associated health risks [7]. Adiposity and body composition are closely linked to mitochondrial content and electron transport chain function in the skeletal muscles of healthy, sedentary older adults. Specific correlations exist between mitochondrial bioenergetics, gender, and insulin sensitivity [8]. Body components such as total body fat, lean mass, total body water, and ectopic fat are key elements linking obesity to aging and chronic diseases, influencing morbidity and mortality. Body composition assessment methodology relies on complex models, such as the five-level model: atomic, molecular, cellular, tissue system, and whole-body [9].

Older adults exhibit significant reductions in muscle and bone mass, a higher volume of extracellular fluid, and reduced body cell mass compared to younger adults. These non-adipose components of body composition critically impact cognitive and physical functions, nutritional and endocrine status, quality of life, and comorbidities in the elderly [10]. Another study demonstrated that categorizing young individuals by BMI led to differences in explosive strength values. Compared to overweight individuals, those under-weight and of normal weight achieved superior results in lower body explosive strength tests [11]. Overweight and obesity in young adults, as well as those of middle and older ages, are associated with an increased risk of mobility limitations. Those who were over-weight or obese in middle age or earlier, but not in later adulthood, also show an increased risk of mobility limitations compared to those who maintained normal weight. Moreover, a correlation exists between the age at onset of overweight and the risk of mobility limitation. These data suggest that interventions to prevent excess weight in young and middle-aged adults could prevent or delay mobility issues in the elderly [12]. There are studies [13] that show that overweight people have a risk greater to develop chronic diseases such as rheumatoid arthritis.

Measurement of fat mass, lean mass (excluding bone), and body fat percentage in healthy obese adults can be performed by scanning one half of the body using the iDXA scanner. This method has proven comparable to whole-body scans, benefiting from a larger scanning area and an extended table width, which enhances the device’s capability to assess body composition in obese individuals [14]. Body fat can be assessed by various methods, each with advantages and limitations. Commonly used methods to estimate adiposity levels include body mass index (BMI), waist circumference, skinfold thickness measurements, bioelectrical impedance analysis, DEXA, computed tomography (CT), and magnetic resonance imaging (MRI) [15]. Body composition research continues to fill important knowledge gaps in understanding the relationship between health and disease. Studies comparing skeletal muscle masses and adipose tissue deposits across different ages indicate that sarcopenia and sarcopenic obesity are not merely consequences of aging but also aspects of a natural pathogenic process that contributes to the development of obesity and cardiometabolic diseases [16].

Adipose tissue represents one of the largest compartments of the human body; however, there is currently no clear classification defining specific adipose tissue deposits based on anatomical location and associated functions. This lack of standardized taxonomy poses challenges for researchers studying the distribution and functions of adipose tissue [17]. For evaluating changes in body composition related to weight changes, only the four-compartment (4C) model and magnetic resonance imaging (MRI) provide reliable data, according to research by Lynn A. Seabolt, E. Brian Welch, and Heidi J. Silver [16]. Changes in body composition result from an imbalance between nutrient intake and the body's needs. In situations such as wasting or slowed growth, insufficient nutritional in-take can lead to altered body composition [18]. Body composition assessment is an essential component in evaluating nutritional status, providing valuable data for predicting health status and allowing monitoring of the progression of nutrition-related diseases and the impact of nutritional interventions [19]. At a population level, assessment of body fat mass does not offer significant advantages over body mass index (BMI) and waist circumference in predicting metabolic risks associated with obesity [20].

## 2. Results

The results obtained from patient assessments will be presented and analyzed, emphasizing changes in body composition.

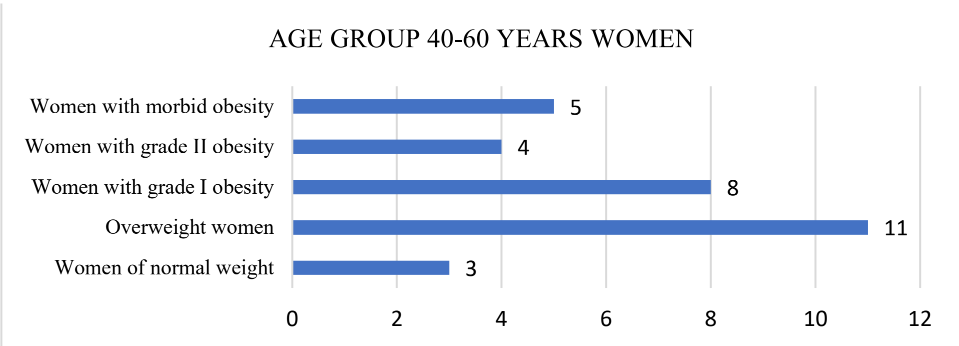


Figure 1: Body Mass Index in Women Aged 40-60 Years

The interpretation of BMI data in women aged 40 to 60 (Figure 1) reveals significant diversity in this group's body composition. Three individuals fall into the normal weight category. A substantial subset, totaling 11 participants, exhibits a BMI ranging between 26.00 and 29.70, classifying them as overweight. Another relevant subpopulation, comprising 8 participants, shows a body composition indicative of Class I obesity, with a BMI ranging between 30.10 and 33.40. Four participants are classified in the Class II obesity category, presenting a BMI between 35.70 and 37.10, while a group of 5 women fall into the category of morbid obesity, with BMI values ranging between 40.10 and 43.30. These findings underscore the significant variability in BMI among adult women aged 40 to 60, highlighting the importance of individualized approaches in managing health and pre-venting metabolic risk.

The interpretation of BMI data for women aged 61 to 80 highlights (Figure 2) a significant variability in body composition within this group. Four individuals present with a BMI within the normal range, with values between 19.90 and 23.90. A larger group of 13 participants shows a body composition associated with the overweight category, with BMI values between 24.70 and 29.70. A notable subgroup of 10 women exhibits Class I obesity, with BMI values ranging from 31.80 to 35.00. Another group of 8 participants presents Class II obesity, with BMI values between 35.10 and 37.30.

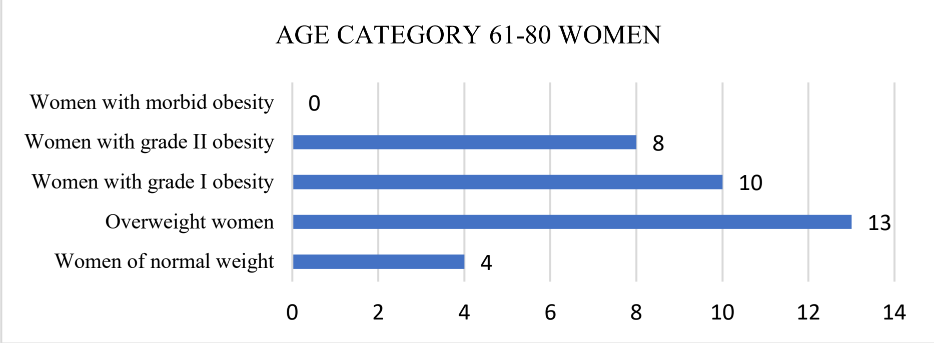


Figure 2: Body Mass Index in Women Aged 61-80 Years

These findings emphasize the substantial diversity in body composition among older women, underlining the need for individualized approaches and weight management strategies that consider the physiological functions associated with aging. In both age categories (40-60 and 61-80), Class I and Class II obesity are present to a significant extent. Furthermore, a considerable proportion of women aged 61-80 exhibit morbid obesity (BMI ≥ 40). This underscores the necessity for increased focus on weight management and obesity prevention among women in these age groups.

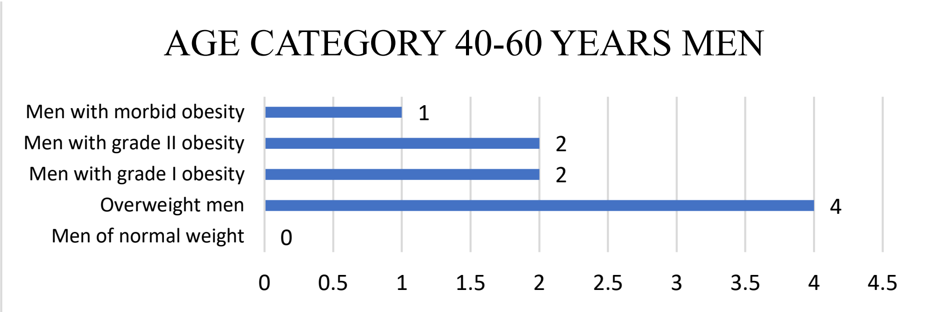


Figure 3: Body Mass Index in Men Aged 40-60 Years

The interpretation of BMI data for this selection of men (Figure 3) reveals significant variability in their body composition. Individuals with a BMI between 26.20 and 29.30 are classified as overweight, indicating a substantial presence in this weight category and an accumulation of adipose tissue beyond normal limits. Participants with a BMI of 30.40 and 31.50 fall into the Class I obesity category, indicating a significant increase in metabolic risk associated with the excessive accumulation of adipose tissue. Participants with BMI values of 38.40 and 38.90 exhibit Class II obesity, reflecting a more severe condition with increased risks of metabolic and health-related complications. The individual with a BMI of 44.50 is classified as having morbid obesity, a severe condition with significant health risks, often requiring medical interventions.

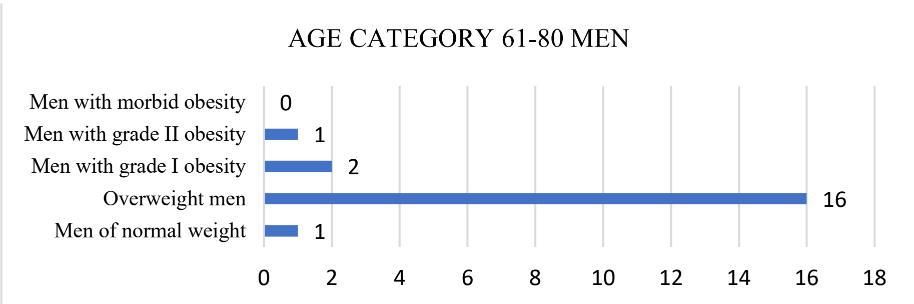


Figure 4: Body Mass Index in Men Aged 61-80 Years

The interpretation of BMI data for this selection of participants reveals significant variability in their body composition (Figure 4). Only one participant, with a BMI of 22.10, falls into the normal weight category, representing an exception compared to the majority of the analyzed participants. The majority of participants, comprising 16 individuals, have a BMI within the overweight range of 24.20 to 29.0. Two participants have a BMI between 30.20 and 31.80, placing them in the Class I obesity category, and one participant presents with Class II obesity, with a BMI of 37.10.

In both age groups, there is significant variability in overweight and obesity, indicating the need for increased attention to weight management and metabolic health among men. The possible trend of increased diversity in body composition among older men could be associated with physiological and lifestyle changes as they age. Overweight and obesity are significant concerns in both genders and age groups, necessitating hydrokinetotherapy programs that consider individual characteristics and the peculiarities associated with aging.

The average age of the participants is 52.19 years, with a coefficient of variability of 8.50%. The age range between 43 and 59 years indicates a relatively homogeneous group. The average height is 163.93 cm, with a coefficient of variability of 3.51%, indicating a relatively uniform height within the group. The average weight is 84.46 kg, with a coefficient of variability of 19.23%, indicating significant diversity in the participants' weight. Weight varies between 59.30 kg and 120.10 kg, reflecting a broad range of body compositions among the analyzed women (Table 1).

**Table 1.** Age category 40-60 years women

| Statistical indicators | Age | Height | Weight | BMI |
|---|---|---|---|---|
| averange | 52.19 | 163.93 | 84.46 | 31.45 |
| standard deviation | 4.44 | 5.76 | 16.24 | 5.86 |
| coefficient of variability% | 8.50 | 3.51 | 19.23 | 18.62 |
| max | 59.00 | 180.00 | 120.10 | 43.30 |
| min | 43.00 | 148.00 | 59.30 | 20.80 |

The average body fat percentage is 35.39%, with a significant variation indicated by a coefficient of variability of 21.37%, highlighting considerable diversity in the amount of fat relative to total body mass. The average fat mass is 30.87 kg, exhibiting substantial variation with a coefficient of variability of 39.40%, reflecting significant differences in the absolute amount of fat recorded among participants. The average muscle mass is 50.87 kg, with a coefficient of variability of 11.23%, indicating diversity in the muscle mass measu measured within the group (Table 2).

**Table 2.** Age category 40-60 years women

| Statistical indicators | Fat Mass % | Fat Mass Kg | Muscle Mass Kg | Visceral Fat Nivel | Bone Mass Kg | Fat free mass kg | Body Water kg |
|---|---|---|---|---|---|---|---|
| averange | 35.39 | 30.87 | 50.87 | 8.77 | 2.71 | 53.59 | 35.54 |
| standard deviation | 7.56 | 12.17 | 5.71 | 3.19 | 0.30 | 6.01 | 3.51 |
| coefficient of variability% | 21.37 | 39.40 | 11.23 | 36.35 | 11.11 | 11.22 | 9.88 |
| max | 48.90 | 56.80 | 63.70 | 16.00 | 3.40 | 67.10 | 42.40 |
| min | 23.20 | 16.20 | 39.40 | 4.00 | 2.10 | 41.50 | 28.80 |

The average level of visceral fat is 8.77, with a coefficient of variability of 36.35%, indicating notable variations in fat deposits in the visceral area. The average bone mass is 2.71 kg, showing moderate variation with a coefficient of variability of 11.11%, reflecting relative consistency in bone mass within the group. The average fat-free mass is 53.59 kg, with a coefficient of variability of 11.22%, highlighting significant differences in total body mass excluding fat. The average body water mass is 35.54 kg, with a coefficient of variability of 9.88%, indicating significant differences in water content within the group.

The average age of participants in this category is 68.40 years, indicating a concentration of the population within the older age segment. The relatively low coefficient of variability of 6.96% suggests a relative uniformity in age within this group. The average height is 160.04 cm, with a relatively low variability of 3.29%. Although moderate, this variability indicates some diversity in height within the group. The average weight is 78.09 kg, with a coefficient of variability of 15.32%, reflecting significant diversity in the weight of women within this category. This variability suggests possible differences in body composition and lifestyle habits among participants (Table 3).

**Table 3.** Age category 60-80 years women

| Statistical indicators | Age | Height | Weight | BMI |
|---|---|---|---|---|
| averange | 68.40 | 160.04 | 78.09 | 30.53 |
| standard deviation | 4.76 | 5.26 | 11.96 | 4.78 |
| coefficient of variability% | 6.96 | 3.29 | 15.32 | 15.67 |
| max | 80.00 | 169.00 | 98.20 | 37.30 |
| min | 61.00 | 148.90 | 48.30 | 19.90 |

The average body fat percentage is 34.06%, indicating significant diversity in fat content relative to total body mass, as reflected by a coefficient of variability of 24.41%. The average fat mass is 27.29 kg, showing substantial differences in absolute fat amount among participants, with a coefficient of variability of 34.18%.

**Table 4.** Age category 60-80 years women

| Statistical indicators | Fat Mass % | Fat Mass Kg | Muscle Mass Kg | Visceral Fat Nivel | Bone Mass Kg | Fat free mass kg | Body Water kg |
|---|---|---|---|---|---|---|---|
| averange | 34.06 | 27.29 | 48.22 | 8.57 | 2.58 | 50.79 | 33.82 |
| standard deviation | 8.32 | 9.33 | 5.58 | 2.73 | 0.29 | 5.87 | 3.31 |
| coefficient of variability % | 24.41 | 34.18 | 11.56 | 31.83 | 11.40 | 11.55 | 9.78 |
| max | 46.30 | 44.90 | 58.20 | 13.00 | 3.10 | 61.30 | 42.50 |
| min | 10.20 | 5.30 | 34.00 | 2.00 | 1.80 | 35.80 | 26.40 |

The average muscle mass is 48.22 kg, indicating diversity in muscle mass within the group, with a coefficient of variability of 11.56% (Table 4).

The average visceral fat level is 8.57, reflecting significant variations in visceral fat deposits, with a coefficient of variability of 31.83%. The average bone mass is 2.58 kg, showing relative consistency in bone mass within the group, with a moderate coefficient of variability of 11.40%. The average fat-free mass is 50.79 kg, highlighting significant differences in total body mass excluding fat, with a coefficient of variability of 11.55%.

The average body water mass is 33.82 kg, indicating substantial variations in water content among participants, with a coefficient of variability of 9.78% (Table 4).

The average age of participants in this category is 51.00 years, indicating a concentration within the middle-aged segment. The relatively low coefficient of variability of 7.16% suggests a relatively uniform age distribution within this group. The average height is 178.54 cm, with a low coefficient of variability of 2.87%, indicating relative consistency in participants' height (Table 5)

**Table 5.** Age category 40-60 years men

| Statistical indicators | Age | Height | Weight | BMI |
|---|---|---|---|---|
| averange | 51.00 | 178.54 | 103.64 | 32.61 |
| standard deviation | 3.65 | 5.12 | 17.49 | 6.08 |
| coefficient of variability% | 7.16 | 2.87 | 16.88 | 18.63 |
| max | 55.00 | 187.60 | 130.50 | 44.50 |
| min | 45.00 | 171.20 | 81.50 | 26.20 |

This reduced variability points to a relatively uniform stature among the group members. The average weight is 103.64 kg, with a coefficient of variability of 16.88%, showing significant diversity in the weight of men within this category. This variability indicates differences in body composition and lifestyle factors among the participants (Table 5).

The average body fat percentage is 27.50%, indicating significant variability in fat content relative to total body mass. The coefficient of variability of 21.19% suggests substantial diversity within this category. The average fat mass is 29.33 kg, with a coefficient of variability of 37.74%, reflecting significant differences in the absolute amount of fat recorded among participants. The average muscle mass is 70.67 kg, with a coefficient of variability of 11.20%, indicating diversity in muscle mass within the group (Table 6).

**Table 6.** Age category 60-80 years men

| Statistical indicators | Fat Mass % | Fat Mass Kg | Muscle Mass Kg | Visceral Fat Nivel | Bone Mass Kg | Fat free mass kg | Body Water kg |
|---|---|---|---|---|---|---|---|
| averange | 27.50 | 29.33 | 70.67 | 14.44 | 3.64 | 74.31 | 52.48 |
| standard deviation | 5.83 | 11.07 | 7.92 | 5.19 | 0.38 | 8.30 | 6.30 |
| coefficient of variability % | 21.19 | 37.74 | 11.20 | 35.92 | 10.52 | 11.17 | 12.01 |
| max | 40.10 | 52.30 | 83.80 | 26.00 | 4.30 | 88.10 | 62.10 |
| min | 21.60 | 18.10 | 57.30 | 10.00 | 3.00 | 60.30 | 42.90 |

The average visceral fat level is 14.44, with a coefficient of variability of 35.92%, pointing to significant variations in fat deposits in the visceral area. The average bone mass is 3.64 kg, with a coefficient of variability of 10.52%, indicating relative consistency in bone mass within the group. The average fat-free mass is 74.31 kg, with a coefficient of variability of 11.17%, highlighting significant differences in total body mass excluding fat. The average body water mass is 52.48 kg, with a coefficient of variability of 12.01%, indicating notable differences in water content among the participants (Table 6).

The average body fat percentage is 25.04%, reflecting significant diversity in fat content relative to total body mass, with a coefficient of variability of 18.24%, suggesting moderate variation in this category. The average fat mass is 21.45 kg, with a coefficient of variability of 28.36%, indicating substantial differences in the absolute amount of fat recorded among participants. The average muscle mass is 59.98 kg, showing significant diversity in muscle mass within the group, with a coefficient of variability of 10.35% (Table 7)

**Table 7.** Age category 60-80 years men

| Statistical indicators | Fat Mass % | Fat Mass Kg | Muscle Mass Kg | Visceral Fat Nivel | Bone Mass Kg | Fat free mass kg | Body Water kg |
|---|---|---|---|---|---|---|---|
| averange | 25.04 | 21.45 | 59.98 | 12.25 | 3.15 | 63.13 | 44.44 |
| standard deviation | 4.57 | 6.08 | 6.21 | 2.79 | 0.30 | 6.50 | 4.07 |
| coefficient of variability% | 18.24 | 28.36 | 10.35 | 22.78 | 9.39 | 10.30 | 9.16 |
| max | 38.50 | 38.40 | 69.10 | 22.00 | 3.60 | 72.70 | 51.10 |
| min | 17.00 | 13.30 | 43.70 | 9.00 | 2.40 | 46.10 | 32.40 |

The average level of visceral fat is 12.25, with a coefficient of variability of 22.78%, indicating considerable variations in visceral fat deposition. The average bone mass is 3.15 kg, with a coefficient of variability of 9.39%, indicating relative consistency in bone mass within the group. The average fat-free mass is 63.13 kg, with a coefficient of variability of 10.30%, reflecting significant differences in total body mass excluding fat. The average body water mass is 44.44 kg, indicating substantial variation in water content among participants, with a coefficient of variability of 9.16% (Table 7).

It was observed that men aged 40-60 years have a higher fat percentage compared to those aged 60-80 years. Younger men showed significantly higher fat mass compared to the older group. Men aged 40-60 years also had a higher average muscle mass than those aged 60-80 years. The significant diversity indicates notable individual differences in muscle mass. The younger group exhibited a higher level of visceral fat, although both groups displayed significant variability. The difference in bone mass between the two groups is relatively small, but both present moderate variability. The relative consistency in bone mass indicates stability in this measurement. Younger men showed greater fat-free mass, but significant variability reflects notable individual differences. Fat-free mass includes elements such as muscle and bone, with substantial variability in both age groups. The 40-60 age group displayed higher body water mass, but the significant variability indicates considerable differences between individuals, with significant variation in body water content in both age groups.

The significant differences identified between age categories in both women and men underscore the importance of adapting approaches to body composition management. In this context, a detailed study is proposed, integrating a hydrokinetotherapy program conducted over a four-month period (March-June 2024) for participants.

This initiative aims to investigate how hydrokinetotherapy exercises can influence body composition parameters and, implicitly, the risk of metabolic diseases among adults in these age groups.

## 3. Discussions

The results of the participant surveys in the study by Vizitiu and Constantinescu [24] revealed that the subjects exhibited appropriate temporal and spatial orientation, memory, and age-appropriate attention, as well as the ability to read and write adequately. Body composition was determined using the "Tanita" device, yielding an average group composition of 43.13% fat, 25.80% muscle mass, 6.83% bone mass, and 42.22% water. Body composition analysis through bioimpedance, according to the research by Mocanu et al. [25] highlighted a clear relationship between body components, emphasizing cases with a high percentage of body fat. Although many of the girls classified as normal weight according to BMI had low muscle mass and excessive fat, this led to their reclassification into Chubby or Obese categories. The results confirmed the increasing percentage of over-weight and obese children in the final stage of puberty.

The differences in body composition between metabolically healthy obese adults (MHO) and metabolically abnormal obese adults (OA) were investigated by Camhi and Katzmarzyk [26], using a sample of 395 obese adults classified based on cardiovascular risk factors. In evaluating BMI as an indicator of body fat percentage (%BF) and fat-free mass (FFM), [27] employed statistical analyses to demonstrate a stronger correlation between BMI and %BF among men and women with higher BMI, highlighting the limitations of BMI as a diagnostic indicator of obesity. The authors of the study by Frankenfield et al. [28] emphasized that, although individuals with a BMI ≥ 30 kg/m² are considered obese, a significant number of individuals with a BMI below this value can also be misclassified as having a healthy body composition. They argued that evaluating body fat would be a more appropriate method for diagnosing obesity in this cohort.

In conclusion, the study by Beavers et al. [29] demonstrated that the loss of body fat mass is the main factor responsible for improved mobility associated with weight loss, while the loss of lean mass was correlated with a reduction in physical strength. Gadduci's study [30] pointed out that people with severe obesity should focus on achieving higher absolute values in terms of fat-free mass, especially the fat-free mass of the lower limbs, to prevent functional limitations and physical incapacity.

Our study on body composition and the risk of metabolic diseases recorded significant results, similar to a study by De Cleva [31] which suggests that simple, accessible, and low-cost methods such as bioelectrical impedance analysis (BIA) and body adiposity index (BAI) facilitate clinical assessment and allow for a better evaluation of morbid obesity (MO) before and after clinical or surgical interventions for severe obesity [31].

Additionally, the systematic review conducted identified limited evidence suggesting that long-term weight loss and favorable changes in body composition and chronic disease risk factors are more pronounced when diet is combined with aerobic exercise [32]. Physical exercises facilitate the maintenance of muscle mass and functional recovery. However, it is still unclear what specific type of exercise should be prescribed in the case of sarcopenic obesity, highlighting the need for further research to provide conclusive answers [33].

## 4. Materials and Methods

**4.1**.Research Methods Used:

- Scientific Documentation Method: Utilized to establish the theoretical foundation of the research and identify existing trends and conclusions.

- Observational Method: Provided detailed information on the body composition of participants, offering concrete data essential for the analysis and interpretation of study results.
- Experimental Method: Applied using the Tanita 738 device, where controlled variables included precise measurements of body composition.
- Mathematical-Statistical Method: Employed for data analysis and interpretation.
- Graphical Method: Assisted in clear presentation and interpretation of data for a better understanding of the study results.

**4.2.** Objectives of the Study:

1. Identification and Assessment of Different Body Composition Components within the investigated sample (such as fat percentage, muscle mass, the ratio between adipose and muscle tissue, etc.).

2. Determination of Parameters Associated with Metabolic Risk in this adult population segment (such as blood glucose levels, cholesterol, blood pressure, or other relevant indicators of metabolic conditions).

3. Analysis and Evaluation of Statistical Relationships between different body composition components and the risk of metabolic diseases in this specific adult group.

4. Analysis of the Impact of Known or Possible Risk Factors (e.g., age, sex, family history, etc.) related to body composition and the risk of metabolic diseases in this adult population subset.

5. Development of a Preventive or Interventional Hydrokinetotherapy Program to reduce the risk of metabolic conditions.

**4.3.** Hypothesis: The study hypothesis is based on the premise that, given initial assessment information of the participating adults, the implementation of hydrokinetotherapy could have a significant influence on body composition and, consequently, the risk of metabolic diseases over a four-month period.

Purpose of the Study

The aim of this study is to conduct a preliminary analysis of patient evaluations within the context of research focused on the impact of hydrokinetic therapy on body composition and the risk of metabolic conditions in a segment of the adult population. The study took place at the Outpatient Diabetes Clinic of Suceava County Hospital in January 2024. A core component of this investigation involves assessing body composition parameters, measured with the Tanita 738 device, and evaluating metabolic risk factors such as diabetes mellitus, hypertension, and dyslipidemia.

In parallel, the study proposes the development of a hydrokinetic therapy model tailored to this population. This model aims to provide an effective and personalized intervention tool for improving body composition and managing metabolic risk. Hydrokinetic therapy, with its benefits for general health and body composition, may play a significant role in the prevention and management of metabolic conditions within this adult group.

**Inclusion Criteria for the Study**: Age Group: Individuals aged over 40; Gender: Both female and male participants; Health Status: Individuals without known or diagnosed chronic diseases; Physical Activity History: Maintenance of a moderate level of physical activity; Informed Consent: Participants must voluntarily provide informed consent to participate in the study.

**Exclusion Criteria for the Study**: Age Group: Individuals younger than 40 or older than 80; Health Status: Individuals with chronic conditions such as diabetes mellitus, hypertension, or cardiovascular diseases; Recent Medical Interventions: Individuals who have undergone major surgeries or significant medical treatments in recent months; Contraindications: Individuals with medical contraindications for intense physical activity; Protocol Non-compliance: Participants who do not adhere to the study protocol.

### **4.4.** Organization and Research Execution

The research was conducted at the Diabetes Ambulatory Clinic of the Suceava County Hospital in January 2024. Seventy-one women and thirty men participated in the testing session, providing informed consent following ethical and deontological research standards. Body composition data were collected using the Tanita 738 device. After applying the inclusion and exclusion criteria, a final group of sixty-six women and twenty-nine men was selected for the study. The research was conducted in accordance with ethical standards, including voluntary informed consent from participants. The testing took place in a clinical setting, ensuring confidentiality and respecting the individual rights of participants. The study protocol was approved by the scientific research committee of our university, and all procedures were carried out in accordance with local and international guidelines and regulations.

### **4.5.**Exercise and Body Composition

Short-term moderate-to-high intensity exercise can produce modest improvements in body composition in overweight and obese individuals without leading to significant changes in body weight. Studies have shown that high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) have similar efficacy regarding body composition measures, suggesting that HIIT could be an effective component in long-term weight management programs [21]. Furthermore, individuals with obesity are encouraged to participate consistently in physical exercise to achieve significant improvements in their health status [22]. Weight loss programs should focus more on maintaining long-term weight loss rather than achieving short-term weight reduction. In this regard, regular moderate-intensity exercise, combined with a low-calorie and relatively high-protein diet, can particularly help postmenopausal women maintain fat-free mass [23].

### **4.6.**General Objectives of the Program

- Weight Control: Through specific exercises, aim to burn calories and reduce body weight.
- Improvement of Cardiovascular Function: Aquatic exercises will help increase cardio-vascular capacity and control blood pressure.
- Increased Flexibility and Mobility: Aquatic activities will facilitate movement and reduce the risk of injuries.
- Improvement of Muscle Strength: Aim to strengthen muscles to support daily functionality and reduce risks associated with obesity and hypertension

**Table 8.** Hydrokinetic Therapy Program

| Program Period | Objectives | Duration - 3 sessions/week, 40-50 minutes/lesson |
|---|---|---|
| Weeks 1-2 | Acclimatization to water<br>Control of movement in water<br>Improvement of blood circulation<br>Monitoring blood pressure | Warm-up: 5 minutes of walking in chest-deep water, moving arms in various directions through the water to prepare the body for exertion.<br>Core Exercise Session: 30 minutes focusing on basic exercises, including face float, back float, forward walking in water, backward walking, high-knee walking, and low-intensity crawl exercises, with 30 seconds to 1 minute of rest between exercises.<br>Cool-down: 5 minutes of gentle walking in water followed by 10 minutes of stretching. |
| Weeks 3-4 | Improvement of cardiovascular function<br>Calorie burning<br>Weight reduction | Warm-up: 5 minutes of light jogging or cycling in water (using an aquatic rod).<br>Core Exercise Session: 30 minutes of backstroke exercises at moderate intensity (60-70% capacity), with 1-minute rest intervals between exercises.<br>Cool-down: 5 minutes of slow cycling (using an aquatic rod) and 10 minutes of flexibility-focused stretching. |
| Weeks 5-6 | Increased muscle strength<br>Muscle toning<br>Enhanced metabolism | Warm-up: 7 minutes of gentle walking in water with high-knee lifts and arm movements in different directions.<br>Core Exercise Session: 35 minutes of strength exercises, including pushing against different swimming aids with arms, backward leg pendulum running, and breaststroke movements at moderate intensity, with 30-second rest intervals between exercises.<br>Cool-down: 5 minutes of slow cycling (using an aquatic rod) and 10 minutes of stretching focused on muscle relaxation. |
| Weeks 7-8 | Increased physical endurance<br>Stress reduction<br>Continued weight loss | Warm-up: 10 minutes of walking in water up to mid-chest level with ample arm movements along the body.<br>Core Exercise Session: 35 minutes of varied exercises, including combinations of lateral steps forward and backward and balance exercises at moderate intensity.<br>Cool-down: 5 minutes of slow walking, followed by 10 minutes of stretching focused on the back and shoulders. |

**4.7.** Statistical Analysis

The preliminary analysis carried out indicates a good baseline on body composition and risk of metabolic disorders in the target group before the application of the hydrokinetotherapy program. At this stage, the following statistical indicators were calculated: mean, standard deviation, coefficient of variability, minimum and maximum value limits for each measured parameter. These indicators provide a clear picture of the distribution of values within the group and the variability of each parameter, highlighting initial individual differences.

The mean values show the central tendency of each parameter, providing information about the general state of the group, while the standard deviation measures the degree of variation from the mean, reflecting the homogeneity or heterogeneity of the group. The coefficient of variability allows a standardized comparison of the variability between different indicators, providing a clearer picture of the relative stability of each parameter in the group under analysis.

The minimum and maximum values of each parameter highlight extremes within the group, indicating cases that may require additional attention in the recovery stages. These baseline parameters will thus facilitate a realistic comparison between the reference values and the results obtained after the implementation of the hydrokinetotherapy program, allowing an objective and detailed assessment of the impact on body composition and risk of metabolic disorders.

## 5. Conclusions

1. Body Composition and Metabolic Risk: The initial evaluation using the Tanita 738 device revealed significant differences across age groups for both men and women, emphasizing the need for simple, accessible, and cost-effective methods for clinical assessment and management of obesity-related morbidity.

2. BMI Categories: A significant prevalence of overweight and obesity was observed in both age groups, with substantial individual variations. The detailed analysis highlighted the importance of individualized strategies in body composition management.

3. Hydrokinetotherapy Program: A tailored hydrokinetotherapy program implemented over four months presents an approach aimed at optimizing participant health.

4. Evaluation of Changes: Through the collection and analysis of data during the hydrokinetotherapy program, changes in body composition, BMI, fat percentage, muscle mass, and visceral fat levels will be evaluated, offering essential insights into the program's effectiveness and its correlation with metabolic disease risk reduction.

5. Risks Associated with Fat Mass Analysis: Potential difficulties in maintaining adherence to the hydrokinetotherapy program, variability in results among participants, and uncertainties regarding long-term benefits indicate the necessity for a personalized approach.

6. Weight Loss Strategy: Weight loss through diet and physical exercise remains the most effective treatment strategy for obese and overweight elderly subjects, with specific attention to the reduction of visceral and intramuscular fat, highlighting the need for further re-search on effective exercise prescriptions for sarcopenic obesity.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Not applicable

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