



EFFECTIVENESS OF COMMUNITY-BASED LIFESTYLE INTERVENTIONS FOR OBESITY MANAGEMENT IN THE URBAN ELDERLY

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Abstract:

The elderly population in Bangkok, Thailand, is growing into an aging society, with approximately 1.2 million having chronic health conditions: high blood pressure, high cholesterol, obesity, and diabetes. The food consumption behaviour modification and health exercise programs were created to prevent central obesity and its complications to 200 participants divided into two groups: The first group participated in behaviour modification and participated with the exercise programs for 6 months. The first group had a mean weight loss from 75.4 to 72.3 kg ($p < .01$), and BMI decreased from 29.5 to 27.7 kg/m² ($p < .01$), while the percentage of body fat decreased from 32.1% to 28.9% ($p < .01$). The second group had a mean weight loss from 76.1 to 74.0 kg ($p < 0.05$) and which their BMI decreased from 30.0 to 28.8 kg/m² ($p < .05$). In addition, the assessment of complications found that before joining the program, the number of elderly people with

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complications was 70%, which decreased to 40% in the diet modification group ($p<.01$), and indicates a decrease from 70% to 64% for the second group. Dietary modification programs are more effective in reducing central obesity and its complications. Suggestions the development of health programs combined with exercise to promote long-term health in elderly people.

Keywords: elderly people, food consumption, health exercise, effectiveness program, obesity

1. Introduction

Obesity is a significant health problem for the elderly, including an increased risk of chronic diseases. Obesity is associated with an increased risk of developing cardiovascular disease, diabetes, hypertension, stroke, and other chronic conditions and an increased risk of mortality. Obesity is associated with an increased risk of premature mortality, all-cause mortality, and increased risk of functional limitations. Obesity can lead to functional limitations and disability, making it harder to perform activities of daily living and poorer quality of life. Obesity can lead to a poorer quality of life for the elderly and increased healthcare costs. Obesity can lead to increased public healthcare costs. The prevalence of obesity in older people has increased in recent years, dramatically. In the world, more than 30% of men and women aged 60 years and over are obese. However, it can be challenging to assess obesity in the elderly population, accurately. This is because body composition changes with age, and it can be difficult to distinguish between overweight and obese in older adults (Malenfant & Batsis) [1].

Obesity is an alarmingly increasing global public health issue. Several countries worldwide have witnessed a double or triple escalation in the prevalence of obesity in the last three decades, probably due to urbanization, sedentary lifestyles, and increased consumption of high-calorie processed food. Obesity prevention is a critical factor in controlling Obesity-related non-communicable diseases (OR-NCDs), including diabetes, cardiovascular disease, stroke, hypertension, cancer, and psychological problems (Tiwari & Balasundaram, 2023). Obesity is a growing public health concern affecting both children and adults. Since it involves both genetic and environmental components, the management of obesity requires both, an understanding of the underlying genetics and changes in lifestyle. The knowledge of obesity genetics will enable the possibility of precision medicine in anti-obesity medications to explore health complications and the prevalence of obesity. We discuss disruptions in energy balance as a symptom of obesity, examining evolutionary theories, its multi-factorial origins, and heritability. Also, lifestyle interventions can help the prevention and treatment of obesity by altering the epigenetic signatures (Janaki & Bharadwaj, 2024) [3].

2. Food insecurity as a risk factor for sarcopenic obesity in older adults

Food insecurity has also been proposed as a risk factor in developing sarcopenic obesity [91], as it may be associated with poor diet quality, nutritional deficiencies, physical inactivity, and unfavorable metabolic changes. It is widely recognized that aging and obesity are common public health issues worldwide. According to the World Population Prospect of the United Nations, in 2017, adults older than 65 involved almost 13% of the global population. This percentage is increasing at a more rapid rate compared to the portion of any other age group, and it is due to recent changes in the increase in life expectancy. Along with aging comes a loss of skeletal muscle mass and function, commonly accompanied by body fat (BF) gain. Obesity is considered a worldwide pandemic and is usually diagnosed by body mass index (BMI) above 30 kg/m² (World Health Organization, 2024) [4].

Many factors contribute to obesity, including:

- **Diet:** Consuming more calories than you burn through physical activity.
- **Lack of exercise:** Not getting enough physical activity.
- **Sleep:** Not getting enough good-quality sleep.
- **Stress:** High levels of stress.
- **Genetics:** Genes can account for 40–70% of the likelihood of having obesity
- **Medications:** Some medicines, including steroids, epilepsy and diabetes medications, and some antidepressants and schizophrenia medicines, can contribute to weight gain.
- **Environment:** Environmental factors include: (Lack of access to affordable healthy foods, Oversized food portions, Food advertising, Lack of parks, sidewalks, and affordable gyms).
- **Healthcare access:** People who are obese may not have access to trained providers.
- **Life events:** Events such as pregnancy, illnesses, and medications can influence weight gain

Obesity is a chronic disease that is often multifactorial, and it is caused by a combination of many factors (National Heart, Lung, and Blood Institute, 2022) [5].

3. Factors indicating that elderly people are obese

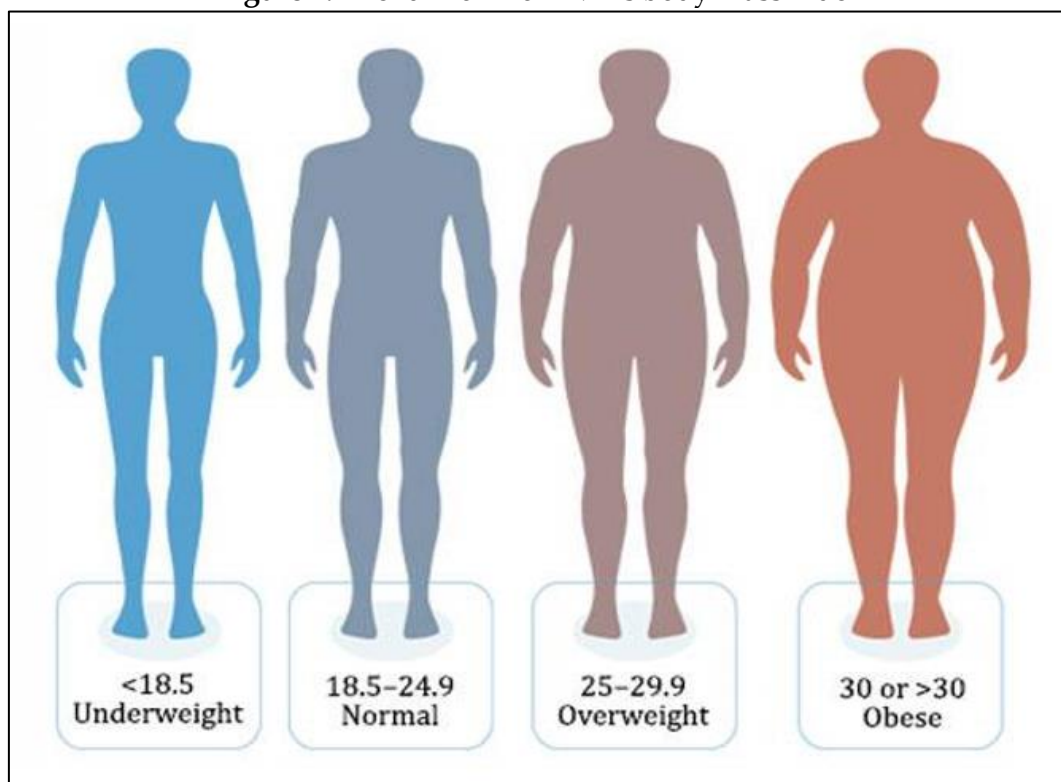
Obesity in elderly people can be caused by several factors, including:

- **Lifestyle:** A less active lifestyle and hormonal changes can increase the risk of obesity.
- **Muscle mass:** As people age, they tend to lose muscle mass, leading to a lower metabolism and making it harder to maintain a healthy weight.
- **Energy intake and expenditure:** An imbalance between energy and expenditure can lead to obesity.
- **Social determinants of health:** These include socio-cultural factors like family eating patterns, food costs, and food preparation skills.

- **Other conditions:** Some conditions and illnesses that can contribute to obesity include hyperthyroidism, Cushing's syndrome, and polycystic ovary syndrome.
- **Sleep:** Lack of sleep can contribute to weight gain.
- **Medications:** Some drugs, like steroids and some antidepressants, can stimulate the appetite or slow the metabolism.

Obesity can lead to disability, morbidity, and mortality in older people. It's associated with an increased risk of hospital admissions for congestive heart failure, coronary atherosclerosis, cardiac dysrhythmias, and acute myocardial infarctions. Obesity is increasing in middle-aged adults and elderly subjects (over 65 years), owing to the concurrence of different factors: inactivity; wrong nutritional habits, basal metabolism, and nutritional need reduction. This condition is becoming a serious problem because of the increasing numbers of all over the world age population. In the past, obesity was considered a 'secondary' pathology of no medical importance in old age; but nowadays, obesity is increasingly being studied in Geriatrics, too, because it causes disability and because of its quality-of-life impairment consequences (Inelmen et al., 2003) [6].

Figure 1: The full form of BMI is body mass index



Source: The Mayo Clinic Diet Bundle Staff, 2023) [6]

4. Literature review

4.1 The causes and effects of obesity in elderly people

There are many reasons why some people have trouble losing weight. Often, obesity results from inherited, physiological, and environmental factors combined with diet,

physical activity, and exercise choices. Body mass index, BMI, is often used to diagnose obesity (Figure 1). For most people, BMI provides a reasonable estimate of body fat. Although there are genetic, behavioural, metabolic, and hormonal influences on body weight, obesity occurs when you take in more calories than you burn through typical daily activities and exercise. Your body stores these excess calories as fat. Many people who live in Western countries now have jobs that are much less physically demanding, so they don't tend to burn as many calories at work. Even daily activities use fewer calories, courtesy of conveniences such as remote controls, escalators, online shopping, and drive-through restaurants and banks.

Obesity often results from a combination of causes and contributing factors: Family inheritance and influences, lifestyle choices, certain diseases and medications, Social and economic issues, and age: obesity can occur at any age, even in young children. But as people age, hormonal changes and a less active lifestyle increase their risk of obesity. The amount of muscle in their body also tends to decrease with age. Lower muscle mass often leads to a decrease in metabolism. These changes also reduce calorie needs and can make it harder to keep off excess weight (The Mayo Clinic Diet Bundle Staff, 2023) [7].

However, food-insecure adults may rely on low-cost, high-energy foods, which can lead to overconsumption of energy and result in obesity. Seniors often have limited income, making it difficult to afford food and other expenses like rent and medicine. It may be influenced by several factors, including income, employment, race/ethnicity, and disability. The risk of food insecurity increases when money to buy food is limited or not available. In 2020, 28.6 percent of low-income households were food insecure, compared to the national average of 10.5 percent (Neto et al., 2023) [8].

4. Impact risks to obesity elderly people

Elderly people with central obesity tend to have a lower quality of life than elderly people with normal weight. Obesity in the elderly is associated with a lower quality of life:

- **Medical complications:** Obesity can lead to several serious medical complications, including type 2 diabetes, heart disease, osteoarthritis, hypertension, and certain cancers
- **Physical impairment:** Obesity can lead to joint dysfunction, mobility impairment, and pulmonary dysfunction. It can also exacerbate age-related declines in physical function
- **Physical impairment:** Obesity can lead to joint dysfunction, mobility impairment, and pulmonary dysfunction. It can also exacerbate age-related declines in physical function;
- **Social isolation:** Obesity can lead to increased isolation
- **Loss of opportunities:** Obesity can lead to loss of opportunities. Central obesity is a type of obesity where there is an excess of visceral fat, which causes the abdomen

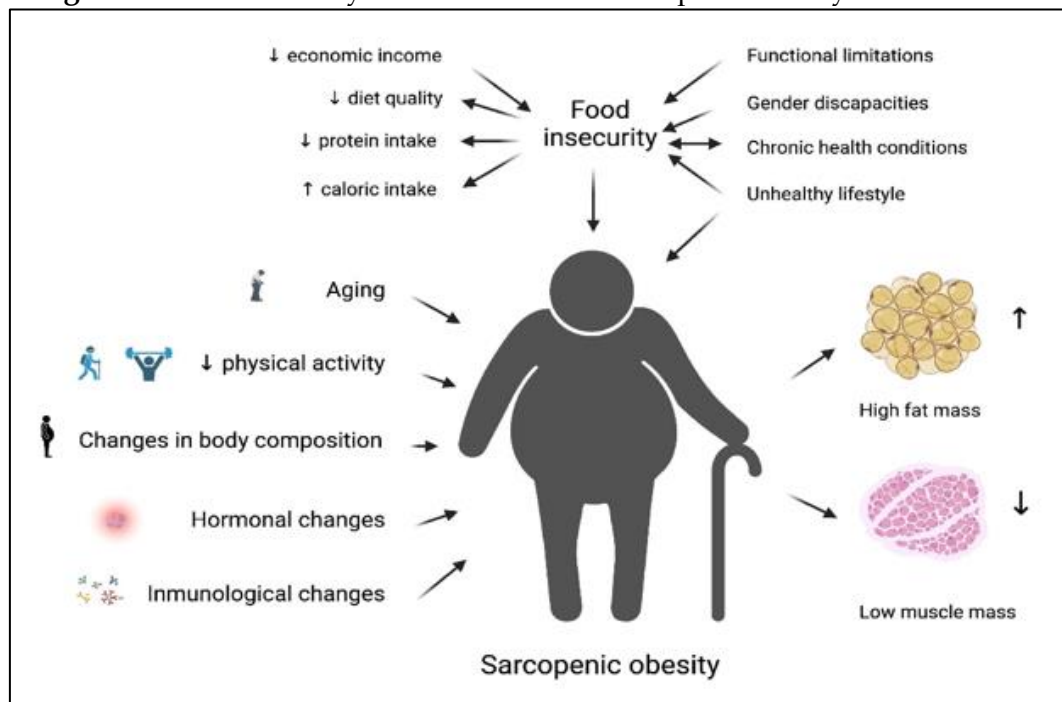
to protrude. Body mass index (BMI) is a common method used to measure fat and define obesity (World Health Organization, 2024) [4].

The diagnosis of overweight and obesity is made by measuring people's weight and height and by calculating the body mass index (BMI): $\text{weight (kg)}/\text{height}^2 (\text{m}^2)$. The body mass index is a surrogate marker of fatness and additional measurements, such as the waist circumference, can help the diagnosis of obesity. The BMI categories for defining obesity vary by age and gender in infants, children, and adolescents. The diagnosis of overweight and obesity is made by measuring people's weight and height and by calculating the body mass index (BMI): $\text{weight (kg)}/\text{height}^2 (\text{m}^2)$. The body mass index is a surrogate marker of fatness and additional measurements, such as the waist circumference, can help the diagnosis of obesity. (World Health Organization, 2024) [4]. For adults, the WHO defines overweight and obesity as follows: Overweight is a BMI greater than or equal to 25, and obesity is a BMI greater than or equal to 30.

For children under 5 years of age: Overweight is weight-for-height greater than 2 standard deviations above the WHO Child Growth Standards median, and obesity is weight-for-height greater than 3 standard deviations above the WHO Child Growth Standards median. Obesity is a BMI greater than or equal to 30.

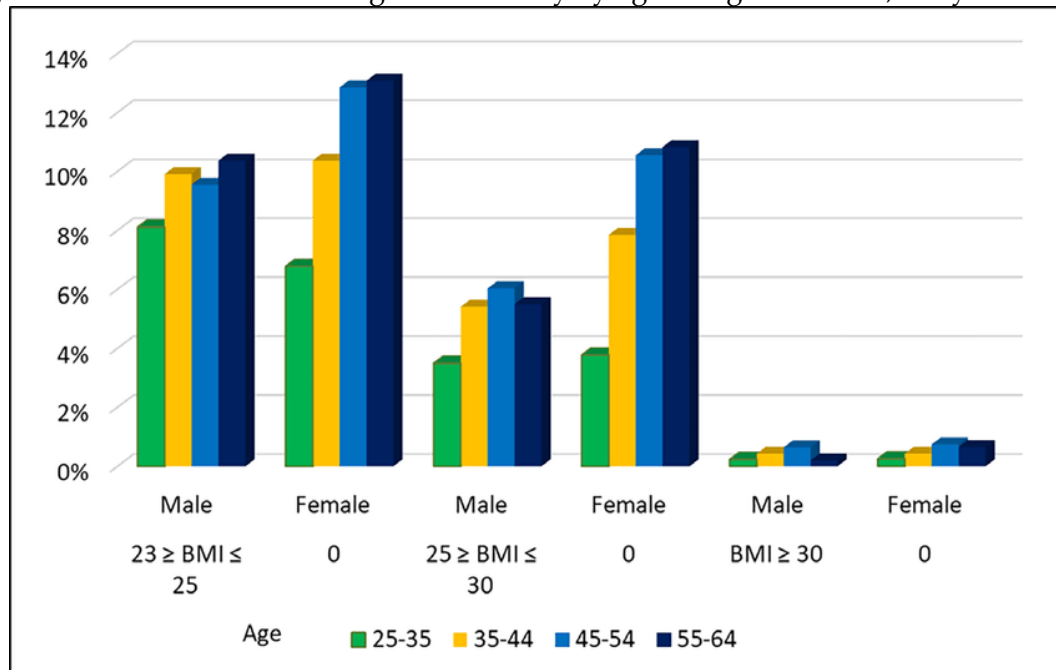
Overweight and obesity are defined as follows for children aged between 5–19 years: Overweight is BMI-for-age greater than 1 standard deviation above the WHO Growth Reference median, and obesity is greater than 2 standard deviations above the WHO Growth Reference median.

Figure 2: Food insecurity as a risk factor for sarcopenic obesity in older adults



Source: Fonseca-Pérez et al., (2022) [7]

Figure 3: Prevalence of overweight and obesity by age and gender. BMI, body mass index



Source: Nguyen & Trevisan (2020) [10]

5. Obesity crisis of human

In 2022, 2.5 billion adults aged 18 years and older were overweight, including over 890 million adults who were living with obesity. This corresponds to 43% of adults aged 18 years and over (43% of men and 44% of women) who were overweight, an increase from 1990 when 25% of adults aged 18 years and over were overweight. Prevalence of overweight varied by region, from 31% in the WHO Southeast Asia Region and the African Region to 67% in the Region of the Americas. In 2022, 1 in 8 people in the world were living with obesity. Worldwide, adult obesity has more than doubled since 1990, and adolescent obesity has quadrupled. Over 390 million children and adolescents aged 5–19 years were overweight in 2022, including 160 million who were living with obesity (World Health Organization, 2024) [4].

6. The complex relationship between obesity and neurodegenerative diseases

Obesity is a global epidemic, affecting roughly 30% of the world's population, and is predicted to rise. This disease results from genetic, behavioral, societal, and environmental factors, leading to excessive fat accumulation due to insufficient energy expenditure. The adipose tissue, once seen as a simple storage depot, is now recognized as a complex organ with various functions, including hormone regulation and modulation of metabolism, inflammation, and homeostasis. Obesity is associated with a low-grade inflammatory state and has been linked to neurodegenerative diseases like multiple sclerosis (MS), Alzheimer's (AD), and Parkinson's (PD). Mechanistically, reduced adipose expandability leads to hypertrophic adipocytes, triggering

inflammation, insulin and leptin resistance, blood-brain barrier disruption, altered brain metabolism, neuronal inflammation, brain atrophy, and cognitive decline. Obesity impacts neurodegenerative disorders through shared underlying mechanisms, underscoring its potential as a modifiable risk factor for these diseases (Neto et al., 2023) [8].

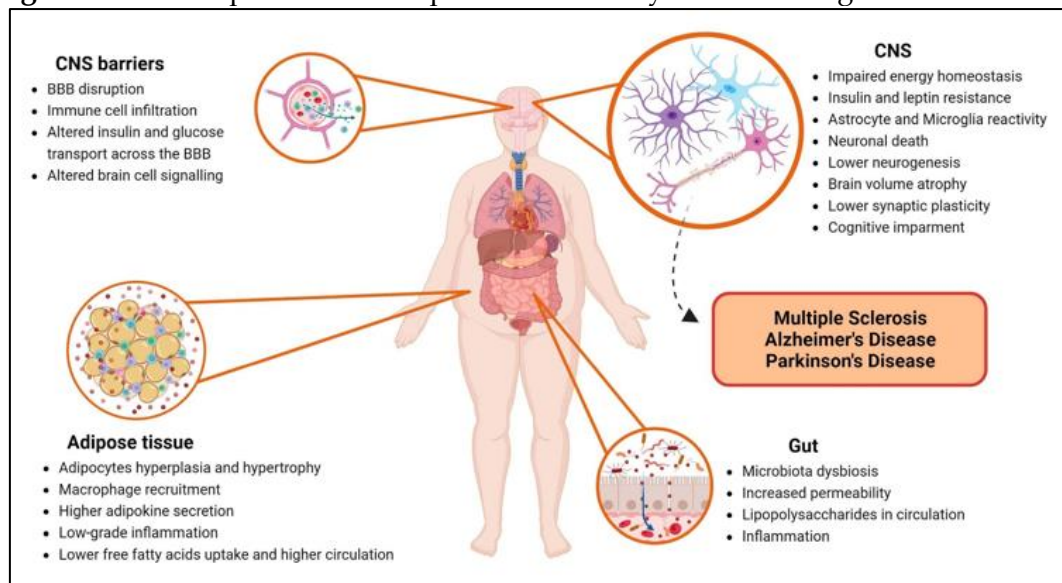
7. Central obesity is associated with a higher risk of serious diseases in the elderly

Central obesity is associated with a higher risk of serious diseases in the elderly, including cardiovascular disease, diabetes, and dementia:

- Cardiovascular disease: Central obesity is associated with an increased risk of cardiovascular disease, including coronary artery disease.
- Diabetes: Central obesity is associated with an increased risk of diabetes, and people with a raised waist circumference are 3-5 times more likely to be diagnosed with diabetes for every 5 cm increase.
- Dementia: Obesity, including central obesity, is associated with an increased risk of dementia and Alzheimer's disease.
- Sarcopenia: Central obesity is associated with sarcopenia, a condition where there is a loss of bone and muscle mass as people age.

Statistical data reviews that approximately 30% of Thai populations aged over 35 have developed central obesity. Compared to neighboring countries in ASEAN, 32.2% of the Thai population have a BMI ≥ 25 , which ranks as the second highest number in the region. The prevalence of central obesity has been rising during recent decades, continuedly (Bangkok Hospital, 2024) [11].

Figure 4: The complex relationship between obesity and neurodegenerative diseases



Source: Neto et al., (2023) [8]

Central obesity is also known as abdominal obesity or truncal obesity. It's characterized by an excessive accumulation of visceral fat around the abdomen, which is more metabolically active than other types of fat (Figure 3).

8. Assessing central obesity

Central obesity is an excess accumulation of fat in the abdominal area, particularly due to excess visceral fat, and is supplied by the portal blood system. The excess fat can lead to the release of fatty deposits into the bloodstream, causing health-related problems. Waist circumference is one of the most accurate indicators of abdominal fat assessment. However, abdominal obesity measurement guidelines and cutoffs vary among different ethnic groups. In combination with the measurement of waist circumference, central obesity can be defined if at least 2 of these criteria are present:

- 1) Blood pressure is greater than 130/85 mmHg.
- 2) Triglyceride level is greater than 150 mg/dL.
- 3) Fasting blood glucose is greater than 100 mg/dL.
- 4) High-density lipoprotein or HDL cholesterol is less than 40 mg/dL in men or 50 mg/dL in women.

The desired goal of treating central obesity is to lower the risks of health-related conditions induced by excessive fat to achieve the treatment goal, body weight must be reduced by at least 5% from the baseline Bangkok Hospital, 2024) [11].

9. Issues of concern

9.1 Public health impact of obesity

Overweight and obesity are major risk factors for several chronic diseases, including cardiovascular diseases such as heart disease and stroke, which are the leading causes of death worldwide. From 1990 to 2022, the percentage of children and adolescents aged 5–19 years living with obesity increased four-fold from 2% to 8% globally, while the percentage of adults 18 years of age and older living with obesity more than doubled from 7% to 16% (World Health Organization, 2023). The increase in obesity worldwide will have an important impact on the global incidence of cardiovascular disease, type 2 diabetes mellitus, cancer, osteoarthritis, work disability, and sleep apnea. Obesity has a more pronounced impact on morbidity than on mortality. Disability due to obesity-related cardiovascular diseases will increase, particularly in industrialized countries, as patients survive cardiovascular diseases in these countries more often than in no industrialized countries. Disability due to obesity-related type 2 diabetes will increase, particularly in industrializing countries, as insulin supply is usually insufficient in these countries (Visscher & Seidell, 2001) [13].

Obesity in Thailand has a significant public health impact, including:

- **Health problems:** Obesity can lead to several health problems, including cardiovascular disease, diabetes, fatty liver disease, and obstructive sleep apnea.

- **Economic costs:** Obesity can cost the Thai health system millions of dollars annually. In 2009, a joint study estimated that the cost of obesity was around \$404 million.
- **Premature deaths:** The number of premature deaths caused by non-communicable diseases (NCDs) increased between 2012 and 2015.
- **Childhood obesity:** Childhood obesity is a growing problem in Thailand, and some say that it could double within 10 years if the government doesn't change its approach.
- **The Thailand Healthy Lifestyle Strategic Plan:** This plan promotes healthy food consumption and physical activity, while also controlling unhealthy consumption and physical inactivity.
- **Local-level measures:** These include providing nutrition education in schools and daycare facilities, and integrating healthy behaviours into learning activities.
- **Central coordination:** A central organization is needed to monitor and evaluate policies and measures, and to report performance to local authorities.

9.2 Concerns about obesity among elderly people in Bangkok, Thailand

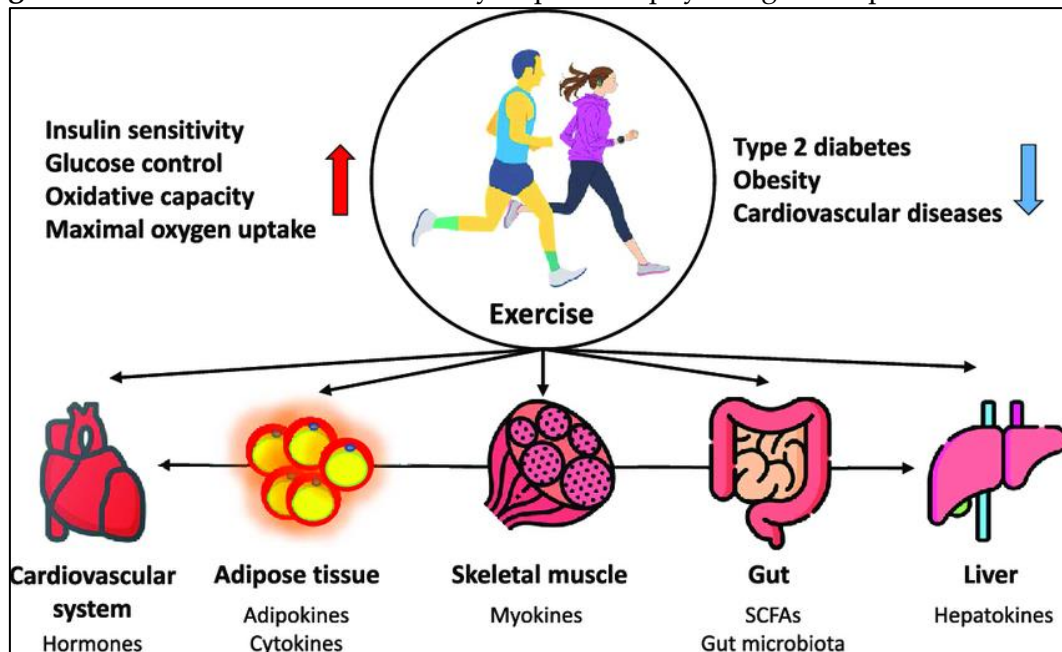
Social and economic factors are linked to obesity. It is hard to avoid obesity. Lower muscle mass often leads to a decrease in metabolism. These changes also reduce calorie needs and can make it harder to keep off excess weight. Many external factors that affect mood and well-being may contribute to obesity. People often seek more high-calorie food during stressful situations. Obesity is an important disease that requires immediate action because it affects 200 other serious complications, such as diabetes, high blood pressure, excess fat, heart disease, dementia, etc. Obesity trends in Thailand continue to rise. According to the results of a survey conducted in 2020, the prevalence of obesity increased as high as 42%, with Bangkok experiencing a much higher increase of 56%. Compared to Bangkok, 50% of the populace is obese. If not properly managed, it will lead to significant public health impacts. Obesity is considered a serious health problem in Thailand. According to the latest report conducted by the Department of Health, Ministry of Public Health, in 2022, the prevalence of being overweight and obese among adults was 47.8%, increasing from 34.75% in 2016. This is in line with the report by the Bureau of Nutrition in 2020, which revealed that obesity in females was 46.4% and 37.8% in males compared to the rates in 2014 of 41.8% and 32.9%, respectively. Bangkok has the highest prevalence of obesity (Virunhagarun, 2023) [14].

anxiety than elderly people of normal weight. It was also found that elderly people with inappropriate nutrition were more likely to have complications that reduced their quality of life, such as limited mobility, increased use of health services, and higher rates of hospitalization.

10. Benefits of exercise for the internal organs of the elderly with obesity

The prevalence of overweight and obesity has increased dramatically over the last several decades. Obesity and physical inactivity increase the risk for cardiovascular disease, Type 2 diabetes mellitus, hypertension, dyslipidemia, and certain cancers. Obesity and low levels of physical fitness are also associated with increased risk of all-cause and cardiovascular mortality. Central and total obesity, insulin resistance, and inactivity increase with age. Exercise training and increased fitness promote positive changes in body composition and improve insulin sensitivity. The effects of exercise training, both aerobic and resistive, on body composition and obesity as well as review studies investigating the effects of exercise training on glucose metabolism and insulin sensitivity in older adults. Adopting a physically active lifestyle should be emphasized in overweight and obese individuals with insulin resistance to reduce the risk for cardiovascular events in the aging population (Ryan, 2011) [18].

Figure 5: Chrono-exercise: Time-of-day-dependent physiological responses to exercise



Source: Hyeon-Ki Kim et al., (2022) [19]

In Figure 5, organs and tissues are affected by exercise. Exercise has tremendous health benefits, including reducing the incidence and severity of metabolic diseases and increasing healthy life expectancy. In addition, peripheral organs and tissues engage in

inter-organ crosstalk through bioactive substances such as hormones and cytokines (Kim et al., 2022) [19].

Exercise can improve our physical and emotional well-being in numerous ways. For instance, exercise can improve the function of our immune system. Exercise is especially important for the elderly - as we age, our risk of chronic health conditions increases dramatically (Australia-Wide First AID, 2022) [20].

Figure 6: Benefits of exercise for the elderly



Source: Australia-Wide First AID (2022) [20].

Figure 6, shows a graphic of the benefits of exercise for elderly people: Exercise is an effective strategy to prevent and improve obesity and related metabolic diseases. Exercise increases the metabolic demand in the body. Although many of the metabolic health benefits of exercise depend on skeletal muscle adaptations, exercise exerts many of its metabolic effects through the liver, adipose tissue, and pancreas: *Improved Brain Function, Improved Sleep Quality, Improved Mobility, Flexibility, and Balance, Improved Cardiovascular Health, Improved Muscle Mass, Improved Bone Density, Improved Immune System/Resistance to Chronic Illnesses, and Improved Mental Health* (Australia-Wide First AID, 2022) [20].

Creating a health-promoting environment for the elderly is important because the elderly period is when care and support are needed to maintain health, especially, in terms of consuming nutritious foods. In addition, there is a widespread trend towards appropriate exercise, which has become a channel to help reduce central obesity and additional complications. Future research is required to examine and develop tangible prevention programs to improve the health of the elderly in Bangkok. Issues of Bias in the conduct of research on the creation of a program to enhance the central obesity of elderly people.

Negative attitudes toward obese persons are pervasive in society. Numerous studies have documented harmful weight-based stereotypes that overweight and obese individuals are lazy, weak-willed, unsuccessful, unintelligent, lack self-discipline, have poor willpower, and are noncompliant with weight-loss treatment (Puhl & Brownell, 2001) [21]. Perhaps because weight stigma remains a socially acceptable form of bias, negative attitudes and stereotypes toward obese persons have been frequently reported by employers, coworkers, teachers, physicians, nurses, medical students, dietitians, psychologists, peers, friends, family members, and even among children aged as elderly people (Puhl & Latner, 2007) [22]. Recent estimates suggest that the prevalence of weight discrimination has increased by 66% over the past decade, 6 and is now comparable to prevalence rates of racial discrimination worldwide (Puhl, Andreyeva, & Brownell, 2008) [23].

Especially, in today's society where lifestyle and nutrition changes. In Bangkok, a city with many neighboring areas, lifestyles have changed from the past. The elderly people are at risk of many complications, such as diabetes, high blood pressure, and heart disease, due to their age and unhealthy lifestyles. Many studies have shown that obesity is associated with a higher risk of serious diseases in the elderly. Researchers have recommended effective implementation projects or programs to prevent and manage this problem, focusing on Bangkok, where population density is high. A study by the World Health Organization (WHO) indicated that the elderly with obesity tend to have a lower quality of life than the elderly with normal weight. because obese individuals are personally responsible for their weight, and that stigma might even serve as a useful tool to motivate obese persons to adopt healthier lifestyle behaviours (Crisler, 2004) [20].

Therefore, the researchers are interested in studying the effectiveness of these programs to gain insights that will inform appropriate planning and implementation. Data from this study will help increase knowledge and understanding about the relationship between dietary changes, exercise, and reducing the incidence of central obesity in the elderly, which will be useful for future health policy development.

11. Methods

Mixed quantitative and experimental research methods to gain insights into the effectiveness of exercise programs for elderly people in Bangkok, Thailand. The two groups of 200 participants were separated and related to their relationship between central obesity and the incidence of non-communicable diseases in the elderly. Using the Behaviour Modification Program (BMP) for eating and exercise to control central obesity in the elderly was assessed. The impact of central obesity on the quality of life and mental health of the elderly was analyzed.

11.1 Research procedures

To compare the effectiveness of programs to prevent obesity and its complications among the elderly in Bangkok, with details as follows:

Step I: Sample selection

The sample consisted of elderly people aged 60 years and over living in Bangkok using stratified random sampling from hospitals and communities in the specified area, totaling 200 people, divided into 2 groups according to the program they participated in:

- Group participating in the eating behaviour modification program (100 people)
- Group participating in the exercise program (100 people)

Step II: Selection criteria

Participants in the study must have the following qualifications:

- Age 60 years and above
- No severe or terminal diseases
- Not taking drugs that affect weight loss or fat-burning
- Agree to participate in the study program and sign the consent form

Step III: Designing Exercise Programs

The study was designed the exercise programs in this research were developed from published academic evidence that aims to promote health and help prevent central obesity in the elderly. It is divided into two main programs: The *Food Consumption Behaviour Modification Program* (FCBMP) and the *Health Exercise Program* (HEP), as follows:

- The *Food Consumption Behaviour Modification Program* (FCBMP): the program aims to provide participants with knowledge and skills in proper nutrition management. The program details are as follows:
 - 1) The program will provide a proper eating plan, which includes recommendations for choosing low-calorie, nutritious foods such as fresh vegetables, brown rice, fruits, and low-fat protein sources such as fish, chicken, and beans.
 - 2) Proper meal timing, with a recommendation to eat 5-6 meals a day. Eating small meals will reduce the chances of overeating and help maintain stable blood sugar levels.
 - 3) Participants will be encouraged to keep a record of what they eat throughout the day to promote awareness of their food intake and make it easier to track their intake of food.
 - 4) Workshops will be held to provide knowledge about the impact of unhealthy diets on health, with references to validated research to support understanding.
 - 5) Follow-up sessions will be held Monthly, with nutritionists and psychologists providing advice on identified problems and solutions to improve individual eating behaviours and effectively support participants to be provided.
- This *Health Exercise Program* (HEP) is designed to promote a variety of physical activities, including:

- 1) The program will plan a variety of exercise activities, taking into account the suitability and safety of the elderly, such as brisk walking, which is an easy and free form of exercise; strength training, such as lifting light weights or using your own body weight to exercise muscles, using safe and appropriate techniques; and flexibility exercises, including yoga or stretching, to help increase joint mobility and reduce the risk of injury.
- 2) Group exercise activities, such as exercise camps, are organized to encourage the elderly to be more interested and motivated to exercise.
- 3) Seminars or discussions are organized on exercise and the benefits of regular movement, along with presentations on appropriate exercise for the elderly.
- 4) Participants will be monitored periodically, with physical fitness measurements, such as heart rate measurement during exercise, distance walking assessment, and body flexibility measurement, to monitor the participants' progress over a period of 6 months. This systematic educational program will help create a strong foundation for the elderly in Bangkok and give them a better understanding of how to manage central obesity sustainably.

11.2 Research corrections

The data analyzed by both programs include:

- Baseline data of participants, including age, gender, education level, socioeconomic status
- Weight and height measurement to calculate body mass index (BMI) before and after joining the program
- Body fat measurement using an accurate body fat percentage meter
- Complication assessment by interview and examination of diabetes and hypertension symptoms. All measurements were taken at the beginning of the study (Baseline) and 6 months after joining the program.

11.3 Statistically significant

- Analysis of differences between groups using an independent t-test
- Analysis of the relationship between weight loss and body fat reduction using Pearson correlation
- Analysis of variance (ANOVA) to compare results between groups. The obtained data will be reported to analyze and compare the effectiveness of the food consumption behaviour modification program with exercise in preventing central obesity and complications in the elderly.

11.4 Ethics statement

- The Human Research Ethics Committee has approved this research project. All participants signed an explicit informed consent form to participate, explaining

the purpose, procedures, and participants' rights to withdraw from the study at any time without affecting the treatment or services they received.

- This research design aims to obtain accurate and useful data for effectively developing public health policies and programs for the elderly in Bangkok.

12. Results

Data were collected from 200 elderly people who were divided into two groups: one group participated in a food consumption behaviour modification program (100 people), and the other group participated in an exercise program (100 people). The data were analyzed using statistical methods to examine the effects of each program on central obesity and its complications. The important statistical data are presented in tables as follows.

12.1 General information of the sample group before and after participating in the programs

General information of the sample group before and after participating in the Food Consumption Behaviour Modification Program (FCBMP) and the Health Exercise Program (HEP) programs. The statistical data is reported in Table 1.

Table 1: General information of the sample group before and after participating in the programs

Group	Average weight before joining (kg)	Average weight after joining (kg)	Body mass index (BMI) before (kg/m ²)	Body mass index (BMI) after (kg/m ²)	Average fat percentage before (%BF)	Average fat percentage after (%BF)
FCBMP	75.4 ± 10.2	72.3 ± 9.8	29.5 ± 3.8	27.7 ± 3.5	32.1 ± 5.1	28.9 ± 4.6
HEP	76.1 ± 9.9	74.0 ± 10.1	30.0 ± 3.5	28.8 ± 3.6	33.0 ± 4.5	31.5 ± 4.2

Note: $N_1=100$, $N_2=100$

Table 1 shows both participants in two groups before and after the FCBMP and HEL programs, the diet modification program lost an average of 3.1 kg (10.8 lb.) weight, while the exercise program lost an average of 2.1 kg (14.7 lb.). BMI decreased from 29.5 to 27.7 kg/m² in the diet modification program group and 30.0 to 28.8 kg/m² in the exercise program group. Regarding average body fat percentage: the diet modification program decreased from 32.1% to 28.9%, while the exercise program decreased from 33.0% to 31.5%. This shows that both programs have a significant effect on reducing body fat.

12.2 Complications before and after joining the programs

Elderly people can experience several complications, including chronic health problems, falls, geriatric syndromes, shingles, aspiration, urinary incontinence, and constipation. Common conditions in older age include hearing loss, cataracts and refractive errors, back and neck pain and osteoarthritis, chronic obstructive pulmonary disease, diabetes, depression, and dementia. As people age, they are more likely to experience several

conditions simultaneously. Number of participants with complications before and after joining the FCBMP and HEL programs. The results are reported in Table 2.

Table 2: Number of participants with complications before and after joining the FCBMP and HEL programs

Complications	The FCBMP Group		The HEL Group	
	Before	After	Before	After
Diabetes	35 (35%)	20 (20%)	30 (30%)	28 (28%)
High blood pressure	25 (25%)	15 (15%)	28 (28%)	25 (25%)
Heart disease	10 (10%)	5 (5%)	12 (12%)	11 (11%)
Total	70 (70%)	40 (40%)	70 (70%)	64 (64%)

Note: The numbers represent the number (n) and percentage (%) of patients with complications.

The results in Table 2 show several elderly people with various complications before and after joining the programs in both the eating behaviour modification group and the exercise group. For the eating behaviour modification program, the number of elderly people with complications was significantly reduced, from 70% with complications before joining the program to only 40% after joining the two programs. Meanwhile, the exercise program had a reduction in elderly people with complication numbers from 70% to 64% but did not show a significant change in the detected complications. However, the reductional decrease in diabetes and hypertension from exercise also showed a beneficial effect on health.

12.3 The qualities of life of elderly people

Quality of life (QoL) for older people can include a variety of factors. Some factors that can contribute to better QoL include: Preventing uncomfortable symptoms, having a healthy body image, and feeling satisfied with financial arrangements for health care. The quality of the participants' lives indicates that before and after joining the FCBMP and HEP programs were compared. The results are reported in Table 3.

Table 3: Comparisons between the quality of the participants' lives indicate that before and after joining the FCBMP and HEP programs

Quality of life	The FCBMP Group		The HEL Group	
	Before	After	Before	After
Physical scale	3.5 ± 1.2	4.2 ± 1.0	3.6 ± 1.1	4.0 ± 1.1
Mental scale	3.8 ± 1.1	4.5 ± 0.9	3.7 ± 1.0	4.2 ± 0.9
Social	3.7 ± 1.0	4.4 ± 0.8	3.8 ± 1.0	4.3 ± 0.9

Note: $N_1=100$, $N_2=100$

Table 3 shows the quality-of-life assessment and found that both groups had an increase in scores in all dimensions of quality-of-life after joining the program. Both programs showed good results in improving the quality of life of the elderly, with the FCBMP Group being the committee that created significant changes in quality of life. In terms of physical well-being, stress management, and social participation.

12.4 Physical competency of elderly people

Physical competence in older adults is the ability to move and the developed movement patterns that result from an individual's physical abilities. It is a core component of physical literacy and is important for maintaining an independent lifestyle. Creative before-and-after-assessment of the physical fitness participating in the FCBMP and HEP programs using a Walking Distance of 6 minutes and Hand Strength activities were assessed. The results are reported in Table 4.

Table 4: The physical fitness participating in the FCBMP and HEP programs

Activity trial	The FCBMP Group		The HEL Group	
	Before	After	Before	After
A Walking Distance of 6 minutes	300 ± 50m	450 ± 60 m	320 ± 55 m	500 ± 70 m
Hand Strength	20 ± 3 kg	24 ± 4 kg	21 ± 3 kg	28 ± 5 kg

Note: $N_1=100$, $N_2=100$.

Physical fitness measurements showed that the exercise program is more effective in increasing walking distance and hand strength. Both programs can improve physical fitness in elderly adults, with the exercise program showing a better trend toward improving walking performance and muscle strength.

12.5 Food consumption: Its impact on the good health of elderly people

Healthy eating can have a significant impact on the health of elderly people, helping to prevent chronic diseases, improve quality of life, support bone and muscle health, or support medications. In this study, participants who took fruits and vegetables (times/day), and fast food (times/week), and their impact and responses to their health were compared. The results are reported in Table 5.

Table 5: Comparisons between the impact and responses of the elderly people in their health

Food type	The FCBMP Group		The HEL Group	
	Before	After	Before	After
Fruits and vegetables (times/day)	2.5 ± 1.0	4.5 ± 1.5	2.7 ± 1.2	3.5 ± 1.0
Fast food (times/week)	4.0 ± 1.5	1.5 ± 0.8	3.8 ± 1.4	2.0 ± 1.0

Note: $N_1=100$, $N_2=100$

Table 5 shows the dietary surveys found that participants in the diet modification program significantly increased their vegetable and fruit intake and decreased their fast-food intake. The diet modification program was affected in promoting a good diet, while the exercise group maintained only modest, significant improvements.

12.6 The psychological impact of the elderly

Older adults may experience several psychological impacts, including depression and anxiety, bereavement, dementia, memory changes, insomnia, health anxiety, or social isolation. This study focused on Depression and Anxiety's psychological impacts were assessed. The results are reported in Table 6.

Table 6: Assessment of the psychological impact of the elderly

Psychological impacts	The FCBMP Group		The HEL Group	
	Before	After	Before	After
Depression	3.6 ± 0.9	2.5 ± 0.8	3.5 ± 0.8	3.2 ± 0.7
Health and mind anxiety	3.4 ± 0.8	2.6 ± 0.7	3.3 ± 0.8	3.1 ± 0.6

Note: $N_1=100$, $N_2=100$

Both programs were effective in reducing psychological symptoms such as depression and anxiety, with the eating behaviour modification program showing greater and more appropriate improvements, as indicated in Table 6.

12.7 Satisfaction with the programs of elderly people's perceptions

Healthcare for the aging population has become a crucial issue in Bangkok, Thailand, to maintain the elderly's quality of life, and physical activity is of primary importance for older adults. This study evaluated the *Food Consumption Behaviour Modification Program* (FCBMP) and the *Health Exercise Program*. The elderly people were responses of their satisfaction who participated in physical activity programs provided by the Specialized Physician, Cardiovascular and Metabolic Center, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand. The results are reported in Table 7.

Table 7: Satisfaction with the programs of elderly people's perceptions

Satisfaction	The FCBMP Group	The HEL Group
Overall Satisfaction	8.5 ± 1.2	7.8 ± 1.3
Satisfaction with the advice provided	8.7 ± 1.1	8.0 ± 1.0

Note: $N_1=100$, $N_2=100$

Satisfaction assessment was divided into two dimensions: overall satisfaction and satisfaction with the counseling, with the eating behaviour modification program having a significantly higher overall score, as reported in Table 7.

12.8 Monitoring behavioural changes after 6 months

Impulsive and reckless behaviour are also common personality changes that occur in seniors. These behaviour changes usually result from neurological disorders or other physical health problems that the personality and behaviour impact their risks. They might notice their aging loved one making inappropriate comments, refusing to take their medication, or engaging in other reckless or self-destructive behaviours. Monitoring behavioural changes after 6 months to the participants who used to participate and attend the Food Consumption Behaviour Modification Program (FCBMP) and the Health Exercise Program. The results are reported in Table 8.

Table 8: Monitoring behavioural changes after 6 months

Changed behaviour	The FCBMP Group		The HEL Group	
	Before	After	Before	After
Exercise at least 150 minutes/week	20 (20%)	80 (80%)	25 (25%)	60 (60%)
Eat a low-salt diet	30 (30%)	70 (70%)	35 (35%)	45 (45%)

Note: $N_1=100$, $N_2=100$

Table 8, follow-up of behavioural change, showed that the diet modification program had significantly greater physical activity and dietary salt reduction, increasingly, while the exercise group had smaller changes.

12.9 Survey findings

Survey findings of the elderly people who attended the Food Consumption Behaviour Modification Program (FCBMP) and the Health Exercise Program (HEP). Obesity and overweight are a major public health problem all over the world. The major cause of being overweight is related to an excess of calorie intake and insufficient physical activity, especially for the elderly. This study compared the food consumption and exercise behaviour of the overweight elderly living in Bangkok, Thailand. Most participants were females, married, and had a primary school level of education.

13. Discussions

This study demonstrated the effectiveness of a dietary modification program and an exercise program in reducing abdominal obesity and its complications in elderly people in Bangkok. Both programs significantly reduced weight, body fat percentage, and improved participants' quality of life. The dietary modification showed significant improvements, especially in reducing complications related to diseases such as diabetes and hypertension. This is consistent with previous studies that indicated that proper nutrition can reduce the risk of serious diseases in the elderly. Increasing the consumption of vegetables and fruits, along with reducing high-fat foods, are important components that can improve the quality of the diet and help participants control their weight. This study demonstrated the effectiveness of a dietary modification program and an exercise program in reducing abdominal obesity and its complications in elderly people in Bangkok. Both programs significantly reduced weight and body fat percentage, and improved participants' quality of life. The dietary modification showed significant improvements, especially in reducing complications indicated to be related to diseases, such as diabetes and hypertension. This is consistent with previous studies indicating that proper nutrition can reduce the risk of serious diseases in the elderly. Increasing the consumption of vegetables and fruits, along with reducing high-fat foods, are important components that can improve the quality of the diet and help participants control their weight. Life review therapy can also be used to increase QoL in the elderly. A research study reported that this therapy helps people resolve past conflicts, reconstruct their life stories, and accept their present conditions (Stefanacci, 2024) [24].

These results of the quality-of-life evaluation showed that a program focusing on dietary modification significantly reduced stress and depression, which is consistent with research that has addressed the relationship between dietary behaviour and mental health. Building mental resilience and engaging in social support groups can provide better measures and support for mental health. Meanwhile, self-administered exercise programs have shown the ability to improve physical fitness and overall health in older adults, reduce weight, and increase muscle strength.

Some research studies reported that Quality of life (QoL) evaluations for elderly people can include a variety of factors, such as physical health, mental health, social health, and education level. Education level: Higher education levels are associated with higher QoL. Living situation: Living with a spouse is associated with higher QoL. Health: Chronic diseases, fractures, surgery, and hospitalization are associated with lower QoL. Physical performance: A community study found that 40.7% of elderly people were below average in elderly physical performance. Mental health: A community study found that 18.9% of elderly people were below average in their mental health. Social performance: A community study found that 17% of elderly people had low social performance. Health-related quality of life: This includes the presence of distressing physical symptoms, emotional well-being, and the ability to participate in social activities (Khalaf & Değer, 2023) [25].

The research results showed that exercise plays an important role in improving the quality of life in the elderly, but the program had a lower efficacy than the diet modification program. However, both programs showed valuable improvements in the health of the elderly, indicating the importance of combining the two programs for better future outcomes. It is also suggested that programs that link dietary modification and exercise can be developed to promote comprehensive health care for the elderly. In this special issue of *BioMed Research International*, the focus is on lifestyle, in particular physical activity (PA), as a driver for a healthy and long life for older people. PA is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. PA encompasses exercise, sports, and physical activities performed as part of daily living, occupation, leisure, or active transportation. Exercise is a subcategory of PA that is planned, structured, and repetitive and that has as a final or intermediate objective for improvement or maintenance of physical fitness. Physical function is the capacity of an individual to perform the physical activities of daily living. Physical function reflects motor function and control, physical fitness, and habitual PA (Langhammer, Bergland, & Rydwick, 2018 [26]).

This study also has limitations, including the sample size that may not be representative of the entire elderly population in the country, and the study period may not be sufficient to see sustainable long-term results. However, the results certainly help increase the database and provide recommendations for developing effective and appropriate health programs for the elderly. This study confirms the importance of providing nutrition and health education and support to the elderly, which are directly related to the outcomes of the programs. Both the food consumption behaviour

modification program and the health exercise program show that access to accurate information and social experiences can significantly support behaviour change.

Reducing weight and body fat plays an important role in reducing the risk of developing complications such as diabetes and high blood pressure. Diet modification programs have been found to produce significant changes in overall health, particularly in reducing complications. It is not surprising that studies that provide activities to promote quality food and appropriate nutrition have helped raise health awareness among older adults. Research has been done on how reducing weight and body fat can help older people maintain muscle mass, improve physical function, and prevent disease. Exercise: Being active can help older adults maintain muscle mass and make it easier to do daily activities. The American College of Sports Medicine and the American Health Association recommend that older adults get at least 150 minutes of moderate-intensity aerobic activity each week. They can also try muscle-strengthening, flexibility, and balance exercises. Diet: As people age, their calorie needs decline, so it's important to eat nutrient-dense- diet. The Dietary Guidelines for Americans recommend that older adults get enough protein and vitamin B12. Elderly people can also try to include foods rich in calcium and Vitamin D for healthy bones. Hydration: Drinking enough water is essential for digestion and absorbing nutrients. Dehydration is a common health risk for older people (Gill, Bartels, & Batsis, 2015) [27].

In terms of exercise programs, despite significant improvements in physical fitness, the number of complications was not as significant as expected. This may be due to the physical limitations of older adults, which prevent them from exercising to their full potential as prescribed by the program. The results of the study showed that the decline in fitness may be due to the lack of support in the group context and the lack of opportunities for exercise tailored to older adults with illness or physical limitations. Having a social support network among older adults is not to be overlooked. Research has shown that older adults who participate in groups or communities can be more motivated, and help them change their behaviour more effectively. Group activities, which involve exercise, excitement, and acceptance, can significantly improve feelings of well-being.

14. Conclusions

The SAGER guidelines were developed over a 3-year period by a multidisciplinary group of academics, scientists and journal editors utilizing literature reviews, expert feedback and public consultations at conferences. Authors, journal editors, publishers, reviewers and other members of the scientific community all have a role in addressing the neglect of the sex and gender dimension in scientific publishing.

This study highlights the need to create a balanced program between dietary modification and physical activity for holistic health, focusing on promoting health and improving quality of life, which could be a guideline for managing the problem of central obesity and its complications among the elderly in Bangkok and nationwide. The analysis

of this study also found that both the diet modification program and the exercise program played an important role in promoting health behaviours in the elderly. In addition, there are interesting aspects that can be further analyzed. The most significant is that diet modification can positively impact weight management and physical health more than the group that exercises alone. Promoting the consumption of healthy foods and reducing the intake of foods high in fat or calories can also help prevent complications. Therefore, it shows the importance of providing nutrition education to the elderly to help them make decisions about their health in their daily lives.

Changing eating habits has an evident influence on improving feelings of good health. Better health leads to increased confidence and satisfaction with quality of life. Previous research has shown that older adults with a clear awareness of consuming health-promoting foods can achieve higher weight loss rates. On the other hand, exercise programs, despite improving physical fitness, don't have a significant effect on complications. This may be due to the difficulty of participating in continuous physical activities due to the mobility limitations of the sample, such as joint or muscle problems. In addition, exercise interventions and facilities, such as the location or trainers knowledgeable about the elderly, also play a role in exercise effectiveness. Further analysis should consider the importance of participation in exercise groups or communities, which may help create motivation to maintain health and continue exercising. In addition, providing activities with psychological support should be considered to increase the intention and enjoyment of activities in the elderly.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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