

# Effect of Aerobic and Resistance Training on Body Composition, Strength, and Quality of Life in a Postmenopausal Woman with Type 2 Diabetes: A Case Report

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## ABSTRACT

Type 2 Diabetes Mellitus (T2DM) is a significant metabolic disease that commonly occurs in postmenopausal women and interacts with oestrogen deficiency, which accelerates visceral obesity, muscle loss, and decreases insulin sensitivity. The co-existence of low muscle mass and excessive fat, referred to as sarcopenic obesity, is increasingly prevalent among postmenopausal women with T2DM. This condition is a risk factor for metabolic dysfunction, muscle weakness, reduced muscle mass, and poor quality of life. Structured exercise interventions are required to reverse sarcopenia, enhance glucose disposal, improve cardiorespiratory fitness, and increase insulin sensitivity. Resistance training and aerobic exercise have been shown to positively influence muscle mass, muscle strength, and metabolic control. The authors report the case of a 54-year-old postmenopausal woman with T2DM who was referred for body composition analysis using the InBody 270 analyser due to complaints of body weakness, excessive adiposity, and decreased functionality. Baseline assessment revealed low skeletal muscle mass, reduced muscle strength, poor quality of life, and high fat percentage. The patient underwent a six-week combined resistance and aerobic training program (three sessions per week, including warm-up and cool-down). After six weeks, outcomes showed improvement in body composition, skeletal muscle mass, fat percentage, muscle strength, and quality of life. The present case demonstrates the clinical importance of personalised combined resistance and aerobic training as a non-pharmacological intervention capable of improving muscle strength, body composition, and Quality of Life (QoL) in postmenopausal women with T2DM. It highlights the under-reported significance of evidence-based physiotherapy interventions in this population.

**Keywords:** Adiposity, Insulin resistance, Middle aged, Muscle strength, Sarcopenia

## CASE REPORT

A 54-year-old postmenopausal female with an eight-year history of T2DM presented with constant weakness, progressive weight gain, and gradual loss of functional capacity over the past two years. She reported difficulty performing household duties and walking long distances. The patient had a sedentary lifestyle for approximately five years and engaged in minimal physical activity. She had no history of smoking or alcohol consumption. There was no significant family history of musculoskeletal disorders, although her mother had T2DM.

On systemic examination, the patient did not exhibit cardiovascular or respiratory distress. Her medical history revealed that she was taking metformin 500 mg twice daily, with good glycaemic control and compliance. She had no history of diabetic complications or other systemic diseases. Psychosocial assessment indicated moderate family strain and limited social activity after menopause; however, she was highly motivated to implement lifestyle changes and participate in rehabilitation.

Physical examination showed that the patient was moderately built, weighing 73.1 kg with a height of 158 cm, resulting in a Body Mass Index (BMI) of 29.3 kg/m<sup>2</sup>, indicating overweight. Musculoskeletal assessment revealed reduced muscle mass in both upper and lower limbs, decreased lower limb strength, and diminished grip strength. Systemic examination findings were otherwise normal. Based on symptoms and physical findings, a tentative diagnosis of sarcopenic obesity secondary to postmenopausal status and T2DM was made.

Diagnostic evaluations included body composition analysis using the InBody 270, muscle strength assessment using a back-leg-chest dynamometer and digital hand-held dynamometer, and quality of life assessment using the Sarcopenia and Quality of Life (SarQoL) questionnaire [1]. The patient provided written informed consent to

participate in the present case study and to publish clinically relevant information and outcomes, with the assurance that her personal details would remain confidential.

A six-week exercise program (three sessions per week, 40-50 minutes per session) was structured as follows:

- Warm-up (5 min): Light mobility exercises and stretching.
- Aerobic exercise (10 min): Riding a stationary bicycle at 50-65% of Maximum Heart Rate (HRmax).

**Resistance training with theraband (25-30 min):** Moderate intensity {50-69% of one-repetition maximum, Repetition Maximum (RM)}, two sets of 10 repetitions with a 30-second rest between sets, targeting both upper and lower limb muscles, including shoulder flexion/abduction, biceps curl, triceps extension, seated row, squat, seated leg extension, leg curl, hip abduction, and calf strengthening.

**Cool-down (5 min): Slow walking and stretching:** The patient was also advised to perform stretching exercises at home and maintain a balanced diet rich in protein and low in calories. Pre and postintervention outcomes are presented in [Table/Fig-1].

The intervention resulted in improvements in skeletal muscle mass (+0.9 kg), fat reduction (-2.6%), weight reduction (-1.2 kg), strength (+12 kg in dynamometry, +2.3 kg in grip strength), and QoL (+15 points). The present case demonstrates that even a brief, structured exercise program can positively influence body composition, strength, and QoL in a postmenopausal woman with T2DM.

Baseline outcomes confirmed low skeletal muscle mass, high fat percentage, and reduced strength, supporting the diagnosis of sarcopenic obesity. Hypothyroidism and diabetic neuropathy were considered as differential diagnoses but were excluded based on biochemical analysis and clinical examination. The final diagnosis

Outcome measures	Preintervention	Postintervention
InBody (270) overall score	53/100	61/100
Weight (kg)	73.1	71.9
Skeletal muscle mass (kg)	19.3	20.2
Body fat percentage (%)	50.8	48.2
Back-leg-chest dynamometer (kg)	20	32
Grip strength (kg)	23.7	26.0
SarQoL questionnaire score	50/100	65/100

[Table/Fig-1]: Pre and post change in musculoskeletal health.

was sarcopenic obesity in a postmenopausal woman with T2DM and a sedentary lifestyle.

The present case highlights the clinical efficacy of a short-term, structured, and individualised exercise intervention in improving muscle health, functional capacity, and quality of life in postmenopausal women with T2DM-a population in which physiotherapy-based interventions are under-reported.

## DISCUSSION

Postmenopausal women with T2DM are vulnerable to reductions in muscle mass and function due to oestrogen deficiency, aging, and metabolic changes associated with T2DM [2-5]. This condition, known as sarcopenic obesity, is characterised by reduced lean mass accompanied by overweight [1]. Sarcopenic obesity is strongly associated with insulin resistance, disability, and poor survival [2,3].

Early signs of musculoskeletal deterioration can be identified using body composition analysis, dynamometry, and disease-specific instruments such as the SarQoL questionnaire [1]. Combined resistance and aerobic exercise interventions have been shown to improve body composition, strength, glycaemic control, and QoL in postmenopausal women with T2DM [6-8].

The present case indicates that an exercise program can positively impact body composition, strength, and QoL in postmenopausal women with T2DM, even with short-term implementation. The patient reported feeling more energetic, confident, and motivated to adopt an active lifestyle following the intervention. She was satisfied with the visible improvements in her physical performance and overall well-being.

These results align with existing literature demonstrating the therapeutic value of structured physical activity in combating sarcopenic obesity and metabolic dysfunction. Randomised controlled trials have shown that resistance training performed two to three times per week significantly improves muscle strength, functional outcomes, and metabolic control in older adults with T2DM [6,7]. These benefits are further enhanced by aerobic training, which reduces fat mass and improves cardiovascular fitness [8]. The improvements in back-leg-chest strength and grip strength observed in the present case reflect previous findings, indicating that neuromuscular adaptations can occur rapidly, even during a brief training period. Changes in body composition, such as increased skeletal muscle mass and reduced fat percentage, are consistent with literature demonstrating that combined resistance and aerobic exercise helps preserve lean mass while decreasing adiposity in patients with sarcopenic obesity [3,8].

Khodadad Kashi S et al., reported that gains in lean mass and strength, as observed in this patient, align with studies showing early neuromuscular adaptations and modest hypertrophy within 6-12 weeks of training [9]. Combined exercise strategies are particularly effective in postmenopausal women with T2DM, who often exhibit anabolic resistance along with visceral adiposity [7].

The improvement in the SarQoL score from 50/100 to 65/100 further supports evidence that exercise interventions positively impact health-related QoL in patients with sarcopenia. The SarQoL instrument has been validated in studies to be sensitive to changes following structured rehabilitation, demonstrating its applicability as an outcome measures in both research and clinical practice [1,10]. Similar studies are summarised in [Table/Fig-2] [1-3,6-10].

Although the present study demonstrated measurable benefits after six weeks, systematic reviews and meta-analyses indicate that longer interventions ( $\geq 12$  weeks) generally result in greater hypertrophy, larger reductions in adiposity, and improved glycaemic control [2,3,9]. Therefore, while short-term interventions can initiate meaningful changes, long-term musculoskeletal and metabolic health requires continued exercise participation.

Overall, the present case contributes to the growing evidence supporting the effectiveness of targeted physiotherapy programs combining aerobic and resistance training to address the dual

Authors name and year of study	Place of study	Population	Objective	Outcome measures	Key findings
Khodadad Kashi S et al., (2023) [9]	Iran	Ageing adults (>60 yrs)	Meta-analysis aimed to explore resistance training efficacy on the QoL, depression, muscle strength, and functional exercise capacity among older adults	Muscular strength	Strength in older adults increased significantly
Demonceau C et al., (2024) [1]	Belgium	Older adults with sarcopenia	To strengthen the evidence on the questionnaire SarQoL with reference to the content validity	SarQoL score	Developed disease-specific QoL tool
Kaczorowska A et al., (2025) [10]	South West Poland	Ageing populations	To establish the correlations of performance on hand grip strength with QoL in individuals aged 50-90 years in South West Poland	Grip strength and QoL	Higher grip strength is equal to better QoL
Zhou YY et al., (2023) [2]	North America	Adults (mixed sex, different ages) with sarcopenic obesity	The objective of this systematic review and meta-analysis was, first, to determine the prevalence of sarcopenic obesity in diabetic patients, and second, to determine potential adverse outcomes.	The risk of sarcopenic obesity with diabetes	Sarcopenic obesity prevalence in patients with diabetes is 27%, and it is linked with possible severe adverse outcomes
Bärg M et al., (2025) [7]	Germany	Elderly patients with T2DM	The purpose of the meta-analysis was to compare the outcomes of home-based and gym-based resistance training on glycaemic control (HbA1c) in patients with T2DM	HbA1c, strength, function	Resistance training improved glycaemic control & muscle function
Jeon YK et al., (2020) [8]	South Korea	Postmenopausal women with T2DM	To assess the outcomes of an aerobic and resistance-training intervention on body composition and metabolic parameters in postmenopausal with T2DM	Lean mass, fat, HbA1c, insulin sensitivity	Improved body composition & metabolic control
Argyropoulou D et al., (2022) [3]	Greece	Sarcopenia/ T2DM in elders/ old age and elderly population	The objectives of the current review were to introduce diet and exercise interventions to manage sarcopenia and T2DM and to determine which diet intervention and exercise interventions can be applied simultaneously to address the two conditions	Muscle mass, strength, function	Finest consequences with resistance combined with nutrition
Lim ST et al., (2023) [6]	South Korea	Sarcopenic older adults with T2DM	This review aims to see difference of regular physical activities or resistance exercises to prevent sarcopenia, improve health, muscle mass and metabolic disorders	Strength, function, glycaemic control	Multicomponent exercise increased strength, reduced glycaemia

[Table/Fig-2]: Comparison of previous literature and present case report in postmenopausal women with T2DM [1-3,6-10].

HbA1c: Glycated Haemoglobin

challenges of sarcopenia and obesity in postmenopausal women with T2DM. Objective measures such as bioelectrical impedance analysis (InBody 270) and dynamometry provide valuable feedback on patient progress. Limitations in this case include the lack of biochemical measures, such as Glycated Haemoglobin (HbA1c), and the short duration of follow-up.

## CONCLUSION(S)

Scheduled exercise programs combining aerobic and resistance training improved body composition, muscle strength, and T2DM-specific health-related QoL in a postmenopausal woman. The present case supports previous findings that physiotherapy-based interventions are effective for managing musculoskeletal health in postmenopausal women with T2DM. Body composition analysis using the InBody 270, which relies on bioelectrical impedance analysis, is a safe, practical, and effective method for monitoring changes over time.

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