DOI: https://doi.org/10.4038/gmj.v30i1.8261 Case report

‘Fighting the Fat’: Novel fitness-focused approach in managing overweight and dyslipidaemia

KDCU Wijayasiri[1], **MAA Rushdhi**[2]

[1] *Faculty of Medicine, Sir John Kotelawala Defence University, Sri Lanka.*
[2] *Ministry of Health, Sri Lanka.*

Correspondence: Dr. K. D. C. Upendra Wijayasiri
e-mail: *upendra.wija@gmail.com*
https://orcid.org/0000-0003-3678-8496
Submitted on 28.02.2025 and accepted for publication on 03.03.2025 0000-0003-3678-8496

Introduction

Being overweight, a highly prevalent global health problem; usually associated with multitude comorbidities such as cardiovascular diseases, generalised deconditioning of cardiopulmonary fitness, fatty liver, type 2 diabetes and certain types of cancers (1). The body mass index (BMI) exceeding 23 is taken as overweight for Sri Lankan population (2).

Generalised deconditioning is characterised by suboptimal oxygen utility (low VO_{2max}), dominant anaerobic metabolism at cellular level hence reduced muscle strength. Generalised deconditioning due to physical inactivity and sedentary life style exacerbates liver fat accumulation and inflammation which may later advance in to non-alcoholic steatohepatitis (NASH), cirrhosis and liver cancer. The cardiopulmonary fitness; VO_{2max} for an Asian adult male ranges from <34.99 ml/kg/min (poor) through 35 - 44 ml/kg/min (average), 45 - 54 ml/kg/min (Good) to >55 ml/kg/min (excellent) (3). Generalised deconditioning with poor Vo_{2max} level is a crucial component of overall health and is strongly associated with a higher risk of cardiovascular disease, type-2 diabetes, NASH, cirrhosis, liver cancer and premature mortality (4).

This case study is focused to discuss the importance of using cardiopulmonary exercise test (CPET) assessing a patient with overweight, dyslipidaemia, fatty liver and generalised deconditioning. Further this case report discusses the importance of fine-tuned aerobic exercise training program based on CPET findings in managing overweight and fatty liver. This case study is published with informed consent of the patient.

Presentation, history and pre-intervention findings

A 42-year-old male self-referred to a sports medicine clinic, presenting with newly diagnosed fatty liver and overweight. His sedentary lifestyle, attributed to socio-economic constraints, impacted his daily activities. He was on atorvastatin 10mg daily for dyslipidaemia, with no history of angina, exertional dyspnoea, or diabetes. Family history revealed dyslipidaemia and overweight amongst first degree relatives.

He was followed up by a general physician for his dyslipidaemia before self-presenting at the sports medicine clinic. His height was 169 cm, weight 76 kg, and BMI 26.6 kg/m^2. Blood pressure was 110/60 mmHg, resting ECG and the stress ECG (assessed during CPET) were normal. The 2D echocardiogram study revealed structurally and functionally normal heart. His haemoglobin level was low at 12 g/dL (13 - 17 g/dL). Abdominal ultrasound scan revealed grade 2 fatty liver. Bio-impedance analysis - BIA (*TANITA*™, Japan) revealed total body fat level was 28.7% with 11% visceral fat and 21.5% skeletal muscle mass.

The CPET was conducted after obtaining the informed consent of the patient. The patient maintained the cycling cadence at 60 rounds per minute (RPM) during the test and 50 RPM during recovery on the cycle ergometer. Real-time gas exchange, stress ECG, heart rate, and blood pressure were monitored.

The CPET findings are summarised in Table 1. Figure 1 shows the VO_2 and O_2 pulse graphs of the CPET.

Vo_{2peak}: peak O_2 uptake at peak level of exercise; O_2 pulse: amount of O_2 used per heartbeat; MHR: maximum heart rate; $HR_{recovery}$: percentage of drop of the heart rate from maximum level achieved; AT_{VO2}: percentage of VO_2 peak at the AT; AT_{HR}: heart rate at the AT.

Table 1: CPET findings of the patient

CVS response	• VO_2 peak: 32.9 ml/Kg/min. • O_2 pulse: 13.7 ml/beat • MHR: 173 bpm (98% of MHR_{AP}) • $HR_{recovery}$: 28% (174 bpm to 124 bpm)
Anaerobic threshold (AT)	• AT_{VO2}: 18.4 ml/Kg/min (53 % of VO_2 peak) • AT_{HR}: 120 - 130 bpm

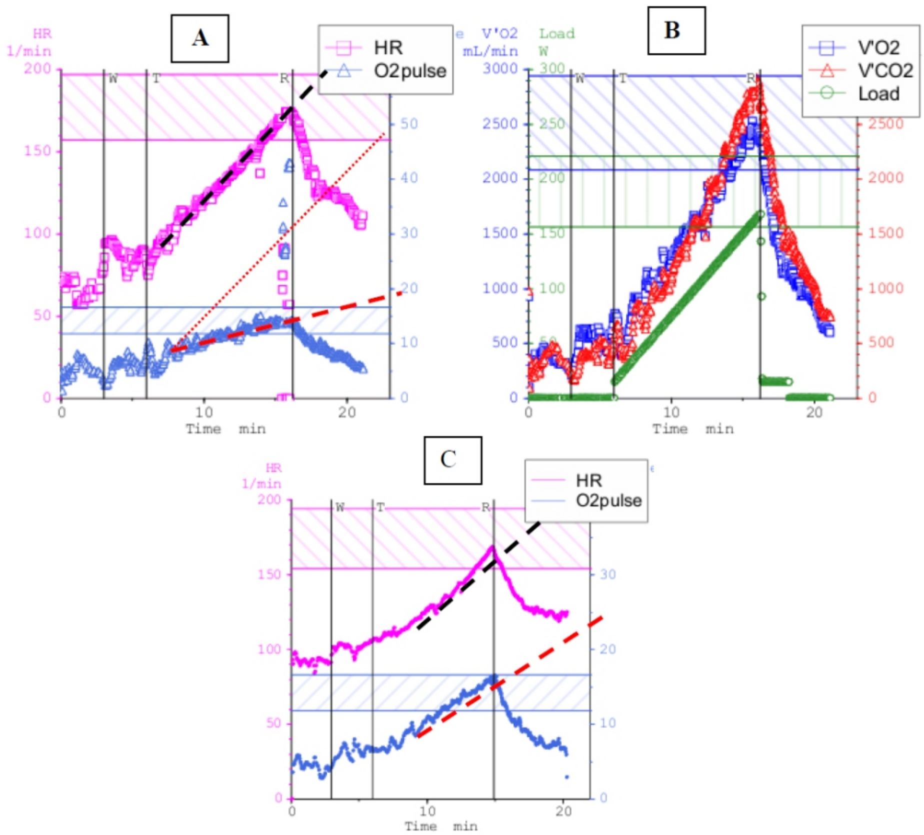

Figure 1: Graphs of O_2 pulse and VO_2 kinetics against the heart rate of the patient. A: O_2 pulse (blue line) against the heart rate (pink line). The O_2 pulse is in plateauing/ flattening pattern over the heart rate. B: VO_2 and VCO_2 kinetics against the load of the resistance. C: Normal O_2 pulse and heart rate kinetics of a healthy active person.

Intervention, outcomes and discussion

CPET is grounded in the principle that airway gas exchange reflects cardiac output, pulmonary blood flow, and peripheral oxygen extraction, coupled with ventilation. Oxygen pulse, myocardial oxygen utilisation per heartbeat, reflects stroke volume and left ventricular systolic function. A reduced or plateauing oxygen pulse near peak exercise suggests left ventricular dysfunction.

This patient had poor cardiopulmonary fitness level as indicated by markedly reduced Vo_{2peak} level; 32.9 ml/kg/min at the peak exercise reaching to 98% of the age predicted maximum heart rate. In analysing the patient's CPET report, serious concern was given to the flattening pattern of the O_2 pulse kinetics against the heart rate (Figure 1, A). The plateauing was evitable from very beginning of the exercise and flattening was continued throughout the exercise ramp. A normal response of the O_2 pulse kinetics should be more parallel movement with the increasing heart rate over the time (Figure 1, C). The other parameters of the CPET report were normal. Though the patient was asymptomatic; other than overweight and fatty liver grade 2, poor cardiopulmonary fitness level with flattened O_2 pulse alarmed an impending left ventricular systolic dysfunction at exertion and urgent intervention was indicated.

The objectives of the exercise training programme were based on the FITT (frequency, intensity, time and type) principal (5). The patient's clinical history was reviewed in accordance with the AACVPR (American Association of Cardiovascular and Pulmonary Rehabilitation) guidelines, and contraindications to exercise rehabilitation were ruled out (6). The 16-week programme aimed to improve fitness and health. Objectives include: increasing VO_{2max} to >40 ml/kg/min, achieving BMI ≤ 23 and reducing body fat to <20%. Phase 1 (weeks 1-6) focuses on aerobic exercise: brisk walking/jogging at target heart rate (THR) 120 - 130 bpm, two 30-minute sessions daily, five days weekly. Phase 2 (weeks 7-16) increased intensity: slow running/cycling at THR 140-150 bpm, up to three 30-minute sessions, plus strength training (weight training, squats and Crunches). The THRs were determined based on the heart rate data obtained during CPET. The patient was instructed to avoid soft drinks with high sugar levels, fast food, and biscuits between main meals. Additionally, the portion of rice was reduced and replaced with vegetables and protein sources, such as red fish and red meat. As the literature demonstrates a clear association between lower hemoglobin levels and reduced cardiopulmonary fitness (7), iron supplementation and anti-warm treatment were incorporated into the management plan, with referrals made to hematology and nutrition specialists for further evaluation. The dose of atorvastatin (10 mg, daily) was continued during the intervention period.

After 16 weeks, the patient's weight dropped from 76 kg to 67 kg, BMI from 26.6 to 23.4, and body fat from 28.7% to 24.2%. Visceral fat decreased from 11% to 8.5%, and muscle mass increased from 21.5% to 30.9%. Haemoglobin level was improved up to 14.3 g/dl. The patient reported his perception of increased fitness and tolerance in daily activities. He was advised to continue medications (atorvastatin and iron treatment), training, and diet for 8 more weeks, with follow-up tests planned. Unfortunately, he discontinued from follow-up due to relocation.

Conclusions

CPET is a valuable investigation tool for comprehensive assessment of cardiovascular complications of individuals with metabolic disorders like overweight, obesity, dyslipidaemia, and generalised deconditioning.

The high cost of CPET and patient reluctance due to a lack of understanding are significant barriers to its adoption.

References

1. World Health Organization. (2023). Obesity. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

2. WHO Expert Consultation, "Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies," *The Lancet.* 2004; 363(9403): 157-163.

3. O'Donovan G, Bakrania K, Ghouri N, *et al.* Non-exercise equations to estimate fitness in white European and South Asian men. *Medicine and Science in Sports and Exercise.* 2016; **48**(5): 854-859.

4. Navarro-Ledesma S, Hamed-Hamed D, González-Muñoz A, Pruimboom L. Physical activity, insulin resistance and cancer: a systematic review. *Cancers (Basel).* 2024; **16**(3): 656.

5. Roony D, Gilmartin E, Heron N, Prescribing exercise and physical activity to treat and manage health conditions. *The Ulster Medical Journal.* 2023; **92**(1): 9.

6. AACVPR, 2020. *Guidelines for cardiac rehabilitation programmes*. Human Kinetics.

7. Christou GA, Pagourelias ED, Deligiannis AP, Kouidi EJ. Exploring the anthropometric, cardiorespiratory, and haematological determinants of marathon performance. *Frontiers in Physiology.* 2021; **12**: 693733.