

Impact of low and moderate intensity exercise on quality of life in overweight or obese men and women: A pilot study

Abstract:

Objective: To compare the effects of exercise intensity on quality of life measures in an overweight or obese population.

Method: This study consisted of a five week exercise program involving a combination of aerobic and resistance training to compare the effects of low versus moderate intensity exercise on quality of life scores as determined by the Short Form-36 Health Survey V1 questionnaire in overweight and obese individuals.

Results: Quality of life scores in both exercise groups were below Australian national averages at baseline in overweight or obese individuals. The general health (GH) subscale improved in both exercise groups (Low: $p = 0.002$, Moderate: $p = 0.003$) when compared to baseline values. The Low intensity group showed significant improvements in the Physical Component (PCS) subscale and Bodily Pain (BP) subscale (PCS: $p = 0.027$, GH: $p = 0.034$). When comparing exercise intensity groups there was no statistically significant difference despite generally better results in the low intensity group.

Conclusion: Low intensity exercise would appear to improve more quality of life subscale scores in overweight and obese individuals compared to moderate intensity exercise. However there was no significant difference between groups in overall quality of life change. This trend supports the need for further study in the area before definitive conclusions can be made.

Introduction:

The rates of obesity and overweight are increasing rapidly in Australia and worldwide. Approximately 62.8% of Australian adults are overweight or obese, up from 61.2% in 2007-08 and 56.3% in 1995 [1]. Overweight and obesity increase the risk of developing chronic diseases like type 2 diabetes, cardiovascular disease, hypertension, stroke and other health conditions [2, 3]. In addition to these risks, increased weight is linked to lower health related quality of life (QOL) scores when compared to healthy weight individuals [3, 4].

Previous studies have confirmed the beneficial effects of regular physical activity in improving the severity of overweight and obesity [2]. Exercise programs for overweight or obese individuals may lead to improvements in cardiovascular disease risk factors, with or without changes in weight [2]. Some studies suggest a combination of resistance and aerobic exercise be used to maximise improvements in weight loss, fat loss and cardio-respiratory fitness [5].

An increasing number of studies involving overweight or obese participants are utilising QOL as an outcome measure as it is now considered a vital part of an individual's health status [6, 7]. Exercise and lifestyle change studies have found improvements in QOL scores in these individuals [8]. Exercise programs that achieve weight loss have also been found to improve QOL scores, with and without the inclusion of dietary change [8, 9]. Despite these findings there have been no studies to date which have investigated the optimal exercise intensity to maximise improvements in QOL in overweight or obese individuals.

Current Australian physical activity guidelines for overweight or obese individuals recommend approximately 300 minutes of moderate intensity activity, or 150 minutes of vigorous activity per week to achieve weight loss [10]. In contrast to these clear recommendations there exist no clinical guidelines regarding exercise prescription for maximising improvements in QOL in these individuals. Most previous trials targeting QOL in overweight or obese peoples or in the general population follow the physical activity guidelines for achieving weight loss and have not attempted to compare the effect of differing exercise intensities on QOL improvements [8, 11].

This research study aimed to show the impact of regular physical activity as a method of improving QOL in overweight or obese persons. It also aimed to establish whether low or moderate intensity exercise was superior for maximising improvements in QOL in these individuals.

Research Design and Methods:

The current study was a five week exercise program comparing the effects of low and moderate intensity exercise in overweight or obese adults. Overweight and obesity was defined as a body mass index (BMI) of between 25 and 40 [12].

Participants were recruited using a variety of media modalities including radio interviews, television interviews and newspaper articles. Posters were put up in the local area and pamphlets were placed in local mailboxes.

Exclusion criteria included BMI's less than 25 or greater than 40, men younger than 25 or older than 44 and women younger than 25 or older than 54, and a systolic blood pressure greater than 139 or less than 90 or a diastolic blood pressure greater than 89 or less than 60 at rest [10].

BMI limits were introduced to ensure patients were classified as overweight or obese but exclude morbidly obese individuals who are known to have additional health risks [10]. The upper age limit

was chosen for participant safety due to the increased risk of a cardiac event in overweight or obese men over the age of 44 and women over the age of 54 [13]. The lower age limit was selected to exclude children and adolescents which may have impacted on the reliability of results. Blood pressure limits were required to ensure participants were safe to perform the exercise program and also to reduce the risk of a cardiac event [13].

Other exclusion criteria included the presence of diabetes, heart disease, previous myocardial infarction, peripheral vascular disease, severe illness or infection and any medications that interfere with or alter heart rhythm [14]. Each exclusion criteria was introduced for the safety of the patient. Informed consent was obtained from all individual participants included in the study.

Study Design:

The study was approved by the Charles Sturt University Human Research Ethics Committee protocol number 2014/200. Participants were provided with an information sheet and medical history questionnaire as well as having the details of the program explained to them verbally. Written informed consent was obtained prior to acceptance into the trial. Participants were randomly allocated to either the low or moderate intensity exercise group using the flip of a coin.

The primary outcome measure of the study is QOL (evaluated using the SF-36). Secondary outcome measures include weight, BMI, waist circumference, systolic and diastolic blood pressure.

Participants completed a physical activity readiness questionnaire to identify whether they would require a review with their general practitioner prior to their acceptance into the exercise program. The medical history questionnaire was provided to ensure no health conditions or safety risks had been missed in the previous forms or physical assessments which would prevent participants from safely participating in the study.

The primary outcome measure of QOL was chosen due to the gap in the literature regarding exercise intensity and QOL in overweight or obese individuals. Secondary outcome measures were selected as they are commonly used to measure the effectiveness of exercise programs. They were also selected to assess whether any change in QOL is linked to change in these secondary outcome measures.

Exercise Intervention:

The exercise program consisted of twice weekly, one hour classes involving a combination of aerobic and resistance training in a supervised environment [5]. Time restraints and availability of the gym facilities prevented additional classes from being provided and longer class durations.

Aerobic and resistance training exercise was performed to coincide with current exercise guidelines [10]. The aerobic component involved 15 minutes of treadmill walking or jogging and 15 minutes on an exercise bike. Resistance exercise included calf raises, lunges, squats and shoulder press [5]. Resistance exercises were chosen to target the major muscle groups of the upper and lower limbs whilst remaining within the time restrictions. Participants performed three sets of 10 repetition of each of these resistance exercises and used a variety of free weights depending on their level of fitness and corresponding heart rate. Participants were encouraged to perform a five minute warm up on one of the exercise machines before each class and time was allocated for stretching at the completion of each session. Stretches performed post exercise were up to the individual, with no strict structure for 30 second holds for each muscle group stretched.

The exercise program for both groups was identical in terms of volume and type with the only difference being exercise intensity. The intensity of the exercise was established by using percentage of maximal heart rate (MHR) with low intensity exercise being defined as 40-55% MHR and moderate intensity as 55-70% MHR [15]. Each participants MHR was estimated by subtracting their age in years away from 220 [16]. Individual MHR were used to calculate their target heart rate zone in correlation with their allocated exercise group. Each participant was required to wear a heart rate chest strap and watch which allowed them to constantly monitor their heart rate. Participants were informed of their target heart rate zone and were instructed to stay between these values whilst exercising. The personal trainer would regularly monitor participant's heart rates to ensure they were remaining within their target heart rate zone.

Quality of Life:

QOL was measured using the RAND Short Form Health Survey version 1 (SF-36). The SF-36 is a QOL questionnaire that provides information on QOL with regard to health and contains eight subscales and two summary scores [17]. The eight subscales include vitality, physical functioning, bodily pain, general health perceptions, physical role functioning, emotional role functioning, vitality, social role functioning and mental health. Subscale scores range from 0 to 100, with higher scores indicating better health status. The summary scores are divided into a physical and mental component and provide an overview of the subscale scores in their particular category [18].

Statistical Analysis:

All data was analysed using IBM SPSS V20. Only participants who achieved an attendance rate of greater than 80% and who completed a pre and post exercise assessment of outcome measures were included in the data analysis (n = 12). An 80% attendance rate was decided on to ensure the reliability of results. Lower participation rates may have provided inaccurate results and falsely skewed data.

A Mixed-Design (Split-Plot) ANOVA for repeated measures over time was used to compare the effects of the interventions on QOL and secondary outcome measures. Independent samples t-tests were performed to examine differences between exercise groups. Statistical significance was set at $p < 0.05$ throughout the analysis.

Table I – Baseline characteristics of participants

Variables	All Participants (N=12)	Low Intensity (N=7)	Mod Intensity (N=5)
Age (years)	41.17 (10.66)	38 (11.50)	45.2 (8.93)
Women n (%)	10 (83.33)	6 (85.71)	4 (80.00)
Height (cm)	168.25 (10.50)	168.57 (9.96)	167.80 (12.40)
Weight (Kg)	91.72 (14.92)	88.50 (11.66)	96.22 (19.10)
Body Mass Index (Kg/m ²)	32.48 (5.06)	31.27 (4.42)	34.16 (5.91)
Waist Circumference (cm)	105.83 (12.89)	103.43 (13.39)	109.20 (12.79)
Systolic Blood Pressure (mmHg)	128.75 (8.40)	128.57 (7.72)	129.00 (10.22)
Diastolic Blood Pressure (mmHg)	85.08 (5.501)	86.14 (3.98)	83.60 (7.40)

<i>Quality of Life</i>			
Physical Component Score	48.53 (5.75)	47.43 (4.83)	50.08 (7.12)
Mental Component Score	47.08 (9.33)	46.97 (6.66)	47.22 (13.14)
Physical Functioning	83.75 (15.69)	83.57 (14.35)	84.00 (19.17)
Physical Role Limitations	83.33 (24.62)	85.71 (19.66)	80.00 (32.60)
Bodily Pain	71.08 (19.64)	64.00 (13.33)	81.00 (24.15)
General Health	59.58 (18.67)	57.86 (20.14)	62.00 (18.37)
Vitality	52.50 (17.25)	50.00 (13.23)	56.00 (23.02)
Social Role Functioning	78.13 (21.40)	75.00 (17.68)	82.50 (27.39)
Emotional Role Functioning	77.78 (35.78)	85.71 (26.23)	66.66 (47.15)
Mental Role Limitations	70.67 (15.66)	68.00 (14.24)	74.40 (18.46)

Data presented as mean (SD) unless otherwise stated. BMI was calculated as weight in kilograms divided by height in meters squared.

Results:

Participants:

The initial cohort of participants accepted into the exercise program consisted of 17 individuals who each met the inclusion and exclusion criteria. Of these participants five did not meet the 80% attendance rate required due to personal reasons and musculoskeletal injuries unrelated to the exercise program. Data was therefore collected and analysed on the remaining 12 participants who completed the full program.

The mean age of participants was 41.17 (SD 10.66). The sample group was predominantly female (83.33%) with only two males completing the program (16.67%). At baseline the mean weight was 91.72 kg (SD 10.50) with an average BMI of 32.48 (SD 5.06) and waist circumference of 105.83cm (SD 12.89). Baseline characteristics of participants are presented in table I. Changes in outcome measures from baseline following exercise intervention are presented in table II.

Table II – Changes in outcome measures from baseline following exercise intervention

Variables	All Participants (N=12)	Low Intensity (N=7)	Mod Intensity (N=5)
Weight (Kg)	-0.167 (p = 0.662)	-0.443 (p = 0.490)	+0.220 (p = 0.465)
Body Mass Index (Kg/m ²)	-0.075 (P = 0.611)	-0.200 (p = 0.424)	+0.100 (p = 0.326)
Waist Circumference (cm)	-2.870 (p = 0.000)	-3.220 (p = 0.003)	-2.400 (p = 0.061)
Systolic Blood Pressure (mmHg)	-0.170 (p = 0.932)	-0.140 (p = 0.966)	-0.200 (p = 0.374)
Diastolic Blood Pressure (mmHg)	-2.000 (p = 0.942)	-2.710 (p = 0.502)	-1.000 (p = 0.458)
<i>Quality of Life</i>			
Physical Component Score	+3.417 (p = 0.059)	+5.628 (p = 0.027)	+0.320 (p = 0.898)
Mental Component Score	+2.133 (p = 0.266)	+2.715 (p = 0.397)	+1.320 (p = 0.487)
Physical Functioning	+3.575 (p = 0.527)	+4.700 (p = 0.634)	+2.000 (p = 0.587)
Physical Role Limitations	+2.017 (p = 0.731)	+7.029 (p = 0.181)	-5.000 (p = 0.704)
Bodily Pain	+4.709 (p = 0.382)	+10.500 (p = 0.034)	-3.400 (p = 0.769)
General Health	+11.075 (p = 0.000)	+11.843 (p = 0.002)	+10.000 (p = 0.003)
Vitality	+10.558 (p = 0.052)	+15.243 (p = 0.089)	+4.000 (p = 0.405)
Social Role Functioning	+3.858 (p = 0.415)	+6.614 (p = 0.290)	+0.000 (p = 1.000)

Emotional Role Functioning	-0.800 (p = 0.920)	-1.371 (p = 0.924)	+0.000 (p = 1.000)
Mental Role Limitations	+4.925 (p = 0.215)	+6.157 (p = 0.311)	+3.200 (p = 0.566)

Data presented as total increase or decrease in outcome measures (P value) when compared to baseline values.

Quality of life change:

In total all SF-36 subscale and summary scores showed improvements when compared to baseline means in the low intensity exercise group with the exception of the emotional role functioning subscale. Of these improvements only three scores were found to be statistically significant. Bodily pain (p = 0.034) and general health (p = 0.002) subscale scores improved significantly along with the physical component score (p = 0.027).

Conversely, the moderate intensity group showed improvements in four of the eight subscale scores, these being physical functioning, general health, vitality and mental health. Both the physical component and mental component scores improved to a small extent. Of all the changes only the general health subscale score improved to a statistically significant degree (p = 0.003).

Testing for differences between groups found there was no statistically significant result when comparing the findings of the low intensity exercise group to the moderate intensity exercise group.

Other findings:

Measures of non-statistically significant change included weight, BMI, SBP and DBP. Waist circumference improved significantly by 3.21 cm (p = 0.003) in the low intensity group but did not change in the moderate intensity group.

Discussion:

This study examined the effects of differing exercise intensities and the impact on QOL in overweight or obese individuals. The study found that improvements in QOL can be achieved in overweight or obese individuals following a regular physical activity program of either low or moderate intensity exercise.

Previous studies involving overweight or obese participants have not examined the effect of exercise intensity as a factor in QOL change. The results in our study support some of the existing literature which suggests that physical activity can lead to improvements in a range of subscales and components of QOL in overweight or obese individuals [19]. Importantly this study found that QOL improvements are achievable without dietary change and without significant weight loss. This may suggest that physical activity levels play a larger role in personal wellbeing and quality of life than previously thought.

In contrast to the literature this study found that low intensity exercise is elicits improvements in more QOL subscales than moderate intensity exercise; however these improvements are not significant when comparing between groups. This finding is of interest considering current Australian physical activity guidelines for overweight or obese individuals recommend moderate or vigorous intensity exercise be performed [10]. The current findings suggest that lower intensity exercise is just as effective as moderate for achieving QOL change.

The low intensity group also resulted in significant reduction in waist circumference in the sample group. This reduction was not achieved in the moderate intensity group. This is in contrast to a recent study by Ross, Hudson, Stotz and Lam [14] which found that improvements in waist circumference following a structured exercise program are not related to exercise intensity in obese adults.

Strengths of the current study include its randomised design and consistency of exercise program. The volume, duration and type of exercise performed were kept constant, with the only differing variable between groups being exercise intensity.

The current study also has limitations. Firstly, the study has a small sample size and lacks a control group due to limited time and resources. The omission of a control group means that the results of the study should be interpreted with care as there is a possibility that exercise intensity was not the sole factor affecting changes in outcome measures. Other possible factors include differences between groups at baseline and difference in numbers of participants in each exercise group.

Other limitations include the lack of participant or researcher blinding and the use of the SF-36 V1 compared to the newer SF-36 V2 [20]. However, the SF-36 V1 remains a valid descriptor of QOL [21].

Conclusion:

This pilot study aimed to determine if exercise intensity affects changes in QOL in overweight or obese individuals. From the results of this study it appears that exercise involving aerobic and resistance training of either low or moderate intensity is effective for achieving improvements in QOL scores in this population. The study also found that there was no statistical significance when comparing between groups despite low intensity exercise achieving improvements in more QOL subscales than moderate intensity exercise.

The current study supports the existing literature recommending physical activity as an effective method of improving QOL in overweight or obese individuals [8]. The study provides the first insight into the effects of exercise intensity on QOL scores in overweight or obese persons in the Australian population. Future studies of high quality involving larger sample sizes are required to confirm this study's findings. Additional research should involve studies of higher exercise intensities to establish the optimal exercise intensity for improvements in QOL in these individuals. Further studies are also required to determine if there is a link between levels of fatigue following exercise intervention and improvements in QOL.

Compliance with ethical standards:

Funding: This study did not receive any funding. Equipment and usage of gym facilities were provided by Charles Sturt University Albury.

Conflict of Interest: Mr Wade McGrath declares that he has no conflict of interest. A/Prof Paul Tinley declares that he has no conflict of interest. Dr Hayder Al-Aubaidy declares that he has no conflict of interest. Mr Luke Donnan declares that he has no conflict of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Ethics approval was obtained from the Charles Sturt University Human Research Ethics Committee by meeting the requirement of the National Statement on Ethical Conduct in Research Involving Humans on December the 3rd, 2014. Protocol number 2014/200.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

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