A sedentary lifestyle is associated with cardiovascular and metabolic disease, several cancers, and some psychological disorders. A substantial and compelling body of evidence demonstrates the amelioration and even prevention of such conditions with increased levels of physical activity. Despite this evidence however, many public health initiatives aimed at increasing levels of physical activity have failed to demonstrate clinically relevant effects on public health. It has been hypothesised that the highly controlled environments in which much physical activity and health research is conducted limits its replicability in real-world public health / community settings. The aim of this review was to evaluate evidence for the effectiveness of community fitness-centre based interventions on inactivity-related disease in adults. Data from 13 investigations highlighted three factors: 1) an overall lack of community-based physical activity studies, 2) a lack of clinically relevant data in those studies; and 3) a further reliance on self-report and rudimentary outcome measurements such as body weight. It is concluded that the current laboratory-based evidence for physical activity and health is yet to be replicated in real world settings, and that rigorous and clinically relevant naturalistic research is required.

Introduction

Type-II diabetes, cardiovascular diseases, colon cancer, breast cancer, dementia and depression constitute a cluster of diseases described as the ‘diseasome’ of physical inactivity.[1] All of these conditions have been associated with low levels of physical activity (PA) levels, and are associated with increases in abdominal adiposity.[2] Such lifestyle-related disorders place a huge burden on the resources and finances of health agencies.[3]

Increases in PA contribute substantially and significantly to the prevention and management of many chronic conditions, including those above.[4] Schemes designed to promote PA and healthy lifestyles have been established in many countries, for example ‘Exercise is Medicine’ in the USA,[5] ‘Change4Life’ in the UK,[6] and ‘Getting Australia Active’.7 However, rates of inactivity related diseases continue to rise in the UK,[3] and globally,[8] suggesting that levels of PA are still insufficient.

Recent reports (e.g., European Health and Fitness Association, 2010), have called on fitness centres to become ‘community hubs for PA promotion and exercise’. Exercise referral schemes, whereby patients are referred by their General Practitioner (GP) to programmes within local fitness centres, have been proposed as an effective way of promoting PA and managing chronic conditions.[9] There is however uncertainty as to the effectiveness of such schemes,[10] specifically whether they are an efficient use of resources for sedentary people with or without a medical diagnosis.[10] GP referral schemes have not yet led to significant improvements in health conditions or long term behaviour changes,[11] or to increases in PA levels.[12]

Given the evidence presented in major reviews,[4 9 13] and in position stands issued by professional bodies,[14 15] there is little doubt among researchers, policy makers, and practitioners that PA leads to improvements in health and a reduction in risk factors. However, on the basis of the evidence above, there appears to be a problem in converting the findings of research into large scale interventions that make real impacts in public health.

It has been hypothesised that the controlled environments in which much research into PA and health is conducted reduces its transferability into community settings,[16] and that if more research was conducted in real world environments, the resultant data would have more relevance to, and application in, public health.
The aim of this review is to assess the evidence for the impact of community fitness centre interventions on inactivity-related diseases in adults. This is not a review of exercise referral schemes, but of peer-reviewed and published research conducted in the community setting.

Methods

PubMed searches were conducted for search terms detailed in tables 2 & 3. Articles were screened by title, then by abstract and finally by a full reading of the paper if required. Papers were only included if the PA intervention was delivered in or from a community fitness centre. Examples of articles excluded are those in which the intervention was administered from locations such as clinical research units,[17] human performance laboratories,[18] clinical centres,[19] outpatient clinics,[20] university medical centres,[21] 22] biomedical research centres,[23] university research centres,[24] or the applied physiology section of a university exercise facility.[25] Papers were also excluded if not in English,[26] 27] if the target cohort were children.[28] The inclusion of Dunn et al,[36], conducted within the Cooper Fitness Centre and linked with the Cooper Institute and Clinic, hosts of many large and widely cited studies in PA,[37] 38] was borderline. The facility is however run as a community fitness facility, in a similar way to the The Ohio State University Center for Wellness and Prevention (Graffagnino et al) – also a ‘borderline’ inclusion.

Selection Criteria

- Article Published between 01/01/1975 – 22/01/2013
- Physical Activity / Exercise intervention located / delivered from a community Fitness Centre
- Measurement Pre & Post intervention
- Clinically relevant measures of health

Table 1. Article selection criteria

<table>
<thead>
<tr>
<th>Search Terms</th>
<th>Papers Located</th>
<th>Relevant Papers</th>
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<tr>
<td>Fitness Centre &amp; Insulin Sensitivity</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Fitness Centre &amp; Blood Pressure</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Fitness Centre &amp; Cholesterol</td>
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</table>

Table 2. Articles located during initial searches – Title & Abstract

<table>
<thead>
<tr>
<th>Search Terms</th>
<th>Papers Located</th>
<th>Relevant Papers</th>
<th>Final Papers</th>
</tr>
</thead>
<tbody>
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<td>Fitness Centre &amp; Insulin Sensitivity</td>
<td>171</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fitness Centre &amp; Blood Pressure</td>
<td>373</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Fitness Centre &amp; Cholesterol</td>
<td>208</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Fitness Centre &amp; Obesity</td>
<td>73</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 3. Articles located during secondary searches – All Fields

Results

Article selection criteria are presented in Table 1. Searches for matches in the Title and Abstract only (Table 2.) located only three articles.[29-31] Suchánek et al.[29] focused on gene polymorphism and falls outside the public health spectrum in this case. Both Jolly et al.[30] and Boyce et al.[31] however reported relevant findings. Searches were widened to include all fields and 1225 articles were located. The number of articles implementing community based PA / exercise interventions from fitness centres was still limited – only 11 met the selection criteria (Table 3.). This evidence is presented below and detailed in Table 4 (foot of this document).
It is evident that few articles document research conducted in community fitness facilities. Of 1225 articles identified only 22 were relevant, or required reading to identify the setting of the intervention. However, the 11 articles described below provide an insight into the evidence base for community based interventions.

Jolly et al.,[30] compared several commercial and primary care weight loss programmes in the UK, each of 12 weeks duration, on a sample of 740 overweight men and women. Programmes included the commercially available products ‘Weight Watchers’, ‘Slimming World’ and ‘Rosemary Conley’ (group based diet and fitness classes), and GP- and Pharmacy-led counselling sessions. A comparison group was provided with vouchers for 12 weeks access to a local fitness facility. Primary outcome variables were weight loss at 12 weeks and at 12 month follow up. All interventions resulted in significantly reduced weight at 12 weeks, and all barring the GP and Pharmacy-led counselling maintained this reduction at 12 months. Only Weight Watchers was associated with a significant increase in PA and decrease in body mass than the comparison group.

PA levels and body mass reduction / gain were also the key focus of the investigation by Boyce et al.[31] The investigation monitored staff during the first eight months of working in a call centre. Questionnaire data relating to weight, height, PA levels/habits, and body part discomfort were collected from 393 employees. The study highlighted substantial weight gains (68% gained an average of 0.9kg/month), which in fact may have been greater than reported due to the under-reporting associated with self-report data, especially the obese.[33] Perhaps counter-intuitively it was reported that fitness centre members in the sample experienced significantly greater BMI and weight gains over the period than non members (the authors make no reference to rates of fitness centre attendance or usage).

Mathieu et al.,[34] designed and piloted a 10 week exercise programme for health and exercise professionals who want to help those at risk of, or already with, T2D. The programme involved one weekly supervised exercise session and an individual home-based training session, and was conducted with 39 participants with T2D (29 completed the study with no controls). Supervised sessions included a 15 minute lecture on health improvements tips before 60 minutes PA and finally a 15 min review of the previous week. Aerobic, resistance and flexibility training were all covered in both the supervised and home-based sessions. PA levels were self-reported by telephone. Significant increases in PA were reported at 10 weeks and maintained at 6 month follow-up. Aerobic capacity, grip strength, HDL cholesterol, body weight, waist circumference and systolic blood pressure all improved between baseline and 10 weeks (but were not measured at six months). These data highlight the benefits of one session a week with an exercise professional who is able to initiate and monitor behaviour change. Improvements in metabolic risk factors however are significant and suggest a tangible training effect.

A similar process was implemented by Kreuzfeld et al.,[35] with long-term unemployed workers (n=119). Participants were referred by a job training centre and attended a lecture on the benefits of a healthy lifestyle alongside physical training in a fitness studio. A combined endurance and strength training protocol was conducted in groups of 12 twice a week for eight weeks. Following the structured training period, participants were able to continue exercising free of charge, but on a self-guided basis. Significant improvements in physical fitness, blood pressure and body composition were reported following the initial intervention. Significant reductions in depression and chronic backache were reported by over 50% of participants (two factors that are often linked with long term unemployment). All improvements were maintained at six months, although no further improvements were made.

Dunn et al.,[36] compared PA counselling (PAC), aimed at increasing PA levels and improving dietary and lifestyle choices, with a supervised structured exercise programme. All participants (n=235) lived within 10 miles of the Cooper Fitness Centre (Texas, USA), and were recruited via posters, newspaper adverts etc. It was reported that PAC and the structured exercise programme were equally effective at improving cardiorespiratory fitness, total cholesterol levels and blood pressure after six months.

Van Roie et al.,[39] reported that both lifestyle counselling and structured exercise interventions improved cardiovascular risk factors to similar extents in elderly participants over an 11 month period (n=186). Cardiorespiratory and muscular fitness however improved to greater levels with structured exercise. Structured exercise was not only supervised, but the fitness centre was only open to study participants, arguably decreasing its potential for replication outside of a research environment. It was hypothesised that observed improvements would subside in the 12 months following the intervention in participants who completed the exercise programme but be maintained in the lifestyle counselling group, and this was found to
be the case at 12 month follow-up.[40] After 23 months however both groups still showed improvements from baseline. These data once again demonstrate the potential of such interventions, but also suggest the difficulties associated with maintaining improvements derived from supervised and structured environments following such interventions.

Brehm et al.,[41] implemented a 12 month structured exercise intervention with a 12 month follow up in a German sports club (n=157). The structured programme involved one 90 minute class per week incorporating exercise, games, relaxation techniques and general health and fitness information. Adherence was 84% (n=117) over the first 12 months and at the 12 month follow up 80% of these were still active within the sports club. Participants had been offered a continuation of the programme or other similar activities upon completion of the first year and consequently had the opportunity to maintain their activity levels in a familiar environment. Previously exercise referral schemes have been criticised for not providing participants with a clear exit pathway, and consequently activity has ceased and behaviour change is limited.[10] There is a strong chance that the positive effects of the initial 12 months on behaviour, fitness, cardiovascular risk factors and mental health will have been maintained in those still engaged, although this was not examined.

Graffagnino et al.,[16] reported a study in which a community medical wellness facility within a hospital hosted an intervention aimed at reducing body weight and other cardiovascular risk factors. Participants were asked to pay an enrolment fee of $350 and $130 per month for the duration of the intervention (six months), and had access to exercise physiologists and dieticians for 10 minute sessions each week for counselling and dietary advice. After six months mean body mass was reduced by 7.3% in men and 4.7% in women, whilst significant reductions in fasting blood lipids and glucose levels were observed. Furthermore, significant correlations between percentage weight loss, the number of sessions attended with experts and the number of times the exercise facility was used were evident. Although this investigation was conducted in a community facility it was very expensive, and even with the availability of expert advice, the dropout rate was very high – 53% of the 418 participants – suggesting a lack of sustained behaviour modification.

Tworoger et al.,[42] reported an intervention aimed at post menopausal women (n=173) achieving five sessions of moderate intensity exercise (60-75% HRmax) per week for one year. For the first three months participants attended three supervised sessions a week and completed a further two at home. For the final nine months this was reduced to between one and three supervised sessions per week with the remainder of the five completed at home. PA levels increased throughout the intervention with those reporting at least 225 minutes of exercise per week reporting greater improvements in sleep quality (primary outcome) than those completing less than 180 minutes. PA data were collected via daily activity logs. A mean improvement in cardiorespiratory fitness of 12% suggests a large training effect. Therefore there was undoubtedly a positive impact on health, suggesting that initial high supervision and gradual handover may be an effective method for initiating behaviour change.

Nishijima et al.,[43] approached supervision slightly differently in the Sapporo Fitness Club Trial. Participants (n=561) attended eight individually supervised exercise sessions spread throughout the six month intervention period. Other than these sessions participants were asked to attend the fitness centre two to four times each week on their own. 2.6 sessions per week were averaged by participants. Supervised sessions consisted of bicycle exercise at 40% predicted VO2 peak combined with resistance training (two set of 20 repetitions). Each exercise session lasted 60-90 minutes. Reductions were demonstrated in all primary outcomes - systolic blood pressure, LDL cholesterol and glycated haemoglobin, although only systolic blood pressure was reduced to a significantly greater extent than controls. Significant between-group differences were observed in changes in body weight, waist circumference, diastolic blood pressure, and triglycerides. Dropout rate was only 11% i.e. 249 of 281 participants completed the exercise intervention, an impressive percentage considering the limited supervision.

A commercial fitness programme (Bally Total Fitness) was compared with unstructured fitness centre use (controls), in a study by Kaats et al.,[44]. Body composition was the primary outcome variable. Small between-group differences were reported in body mass, however there was a significant difference between fat mass reductions – the fitness programme resulting in a 6.1 pound fat loss compared to 0.9 pounds in the control condition – while fat-free mass increased significantly in those following the fitness programme.
Discussion

The articles above provide insights into the effectiveness of community PA interventions. Interventions are generally reported as successful, and several common themes emerge. For example, it is evident that supervised PA is associated with desirable outcomes. However, whilst many of the studies report interventions that begin with supervision, moving to a less supervised and more client-autonomous model, the data of Nishijima et al.,[43], suggests that spreading the supervision throughout the process may maintain engagement. Additionally the presence of post-programme follow up sessions may increase retention and maintain PA levels. Lifestyle and home based interventions such as those by Van Roie et al and Tworoger et al increased PA over extended periods, reduced cardiovascular risk and increased cardiorespiratory fitness.

There are however issues with the reliability of several of the studies. PA data collected via questionnaire or telephone calls has the potential to be influenced by a number of sources of bias/error, for example, participants’ perceptions of what the researchers want to hear. This can often be controlled for, however the lack of control groups in many studies is notable and renders it problematic to attribute effects exclusively to intervention. The unreliable nature of self-report PA was emphasised in the British Heart Foundation 2012 report,[45] suggesting that whilst 39% of males reported meeting recommended levels of PA, only 6% actually did so (in females the figures were 29% and 4% respectively). Related to this, the false reporting of other data, for example body weight, is common.[33]

Participants who volunteer for PA interventions are often motivated to change, arguably aiding in the success of interventions (noted by Dunn et al,[36]). Whilst this could positively impact upon engagement with any intervention, it may limit the degree of generalisability to less motivated cohorts, for example GP referral patients. Likewise, the reliability of questionnaire-based analysis is a function of the sample that respond, a sample often characterised by certain psychosocial traits (for example, people motivated to exercise might also be more motivated to respond to the survey). An example of typical response rates was provided by Boyce et al.,[31] who distributed over 1100 surveys but were met with a response rate of only 33%.

Body mass is a measurement reported widely in the studies above. It is however a crude measure that may mask clinically significant changes in lean/fat mass associated with, for example, strength training.[32] Body composition analysis might have provided more clinically relevant information. Additionally and related to this, there are example of questionable logic/ad-hoc hypotheses regarding body mass gains, for example Boyce et al.,[31] suggested that observed weight gain in their study might have resulted from resistance training, despite the fact that the level of muscle gain in question – almost 1kg per month - would be challenging to achieve and require high levels of resistance training.

Conclusion

The studies above highlight several factors, the paucity of published research in this area, the lack of clinically relevant data, and a reliance upon self report that provides little categorical insights into the effectiveness of public health interventions.

Kaats et al noted in 1998 that although almost every fitness / athletic club offers weight loss and fitness programmes, very few provide information relating to their effectiveness, which is arguably still the case today. Such information might exist but remain unpublished as the result of commercial factors or publication bias. However, it is likely that in the majority of cases the tools of measurement and the controls required for rigorous programme evaluation are simply not common place in fitness centres. Worst still, such rigorous evaluation is often not seen as worthwhile. From a public health perspective however this type of information could be crucial. The programmes described above are often the first port of call for many individuals wishing to begin exercising. It is essential therefore that what is being delivered demonstrates tangible and clinically relevant benefits to consumers. This is perhaps especially true given both the marketing of such products, which often suggest that the product is effective despite the lack of empirical evidence to support this claim.

Little research has examined the delivery of public health interventions from community centres. This might hamper the administration of public health and exercise referral interventions aimed at increasing PA and managing / preventing the onset of inactivity related disorders. It is not feasible to expect the same results found within highly controlled laboratory environments in programmes delivered by community centres; in fact data above suggest that attempts to replicate such controlled environments in the community might limit...
the effectiveness of interventions. It is imperative that there is an improvement in the measurement and evaluation of real world PA initiatives. Such measurement/evaluation must be clinically relevant, evaluated rigorously and peer-reviewed.

Conflict of Interest Statement

The authors declare there to be no conflicts of interest relating to the preparation of this review

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33. Williams LT, Young AF, Brown WJ. Weight gained in two years by a population of mid-aged women: how much is too much? Int J Obes (Lond) 2006;30(8):1229-33
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<tr>
<th>Lead Author (year)</th>
<th>Sample Size</th>
<th>Sample Characteristics</th>
<th>Study Type</th>
<th>Delivery Location</th>
<th>Intervention</th>
<th>Outcome Measure</th>
<th>Effect</th>
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<tr>
<td>Jolly (2011)</td>
<td>740</td>
<td>Overweight men &amp; women</td>
<td>RCT</td>
<td>Primary care / community groups inc. Fitness Centre, Birmingham, United Kingdom</td>
<td>Commercially available weight loss programmes, fitness centre access &amp; primary care</td>
<td>Body Weight</td>
<td>Commercial = 2.3kg greater loss than primary care (p=0.004). All groups stat sig* decrease ranging from – Weight Watchers (4.4kg) – general practice (1.4kg). FC use = 2.01kg.</td>
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<td>Boyce (2007)</td>
<td>393</td>
<td>Call centre employees</td>
<td>Pre - Post</td>
<td>Call centre – South Eastern USA</td>
<td>Questionnaires repeated after 8 months – no direct intervention</td>
<td>Body Weight, PA levels, fitness centre membership &amp; injuries</td>
<td>Weight gain over 8 months – 5.1kg*. PA associated with non-weight gain. Fitness centre members (6.3kg) increased weight more than non-members (4.3kg)*</td>
</tr>
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<td>Mathieu (2008)</td>
<td>39</td>
<td>Type 2 diabetic / insulin resistant / family history of type 2 diabetes</td>
<td>Pre - Post</td>
<td>Sports Centre – Montreal, Canada</td>
<td>10 week individualised home based programme including 1 supervised PA session per week that included a lecture.</td>
<td>PA levels, aerobic capacity, strength, dynamic balance, anthropometry &amp; CV risk factors</td>
<td>Increase in; PA (effect size – 0.55), strength (0.31), aerobic capacity (0.28), dynamic balance (0.28). Reduction in; body fat (0.58) &amp; resting heart rate (0.48).</td>
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<tr>
<td>Kreuzfeld (2013)</td>
<td>119</td>
<td>Unemployed workers</td>
<td>Pre - Post</td>
<td>Lectures – Training Centre PA – Fitness Centre Rostock, Germany</td>
<td>3 month intervention. Lectures to enhance individual health competence. 2 weekly group exercise sessions combining endurance and resistance training.</td>
<td>Physical fitness, blood pressure, body composition, depression &amp; back pain</td>
<td>Reduction in; blood pressure (systolic p=0.016, diastolic p&lt;0.01), body fat % (p=0.017), depression (p=0.028). Increase VO2max (p=0.002). Back ache reduced 50%*.</td>
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<td>Dunn (1997)</td>
<td>235</td>
<td>Sedentary adults</td>
<td>Quasi - Experimental</td>
<td>Cooper fitness centre, Texas, USA</td>
<td>6 month - Structured gymnasium based exercise programme in comparison with lifestyle physical activity counselling.</td>
<td>Lipid profile, blood pressure, body composition &amp; maximal METs</td>
<td>Mean change – (STRUC) vs (LIFE). Total Cholesterol (mmol/L) - -0.3* vs -0.2*. LDL Cholesterol (mmol/L) - -0.2* vs -0.1*. SBP (mm/Hg) - -1.8* vs -3.2*. DBP (mm/Hg) - -2.2* vs -2.2*. BF% - -1.7* vs 1.4*. max METs (kcal/kg/hr) - 1.1* vs 0.4*.</td>
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<tr>
<td>Van Roie</td>
<td>186</td>
<td>Sedentary older</td>
<td>RCT</td>
<td>Specific location not</td>
<td>11 month – Structured</td>
<td>Functional</td>
<td>Mean change – (STRUC) vs (LIFE).</td>
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<tr>
<td>(2010)</td>
<td>adults</td>
<td>reported – Leuven, Belgium</td>
<td>gymnasium based exercise in comparison with home based PA programme and control.</td>
<td>performance, cardio respiratory and muscular fitness &amp; CV risk.</td>
<td>VO2 (ml/kg/min) – 4.5* vs 3. Time to exhaustion (sec) – 68.7* vs 33.8. Static Strength (Nm) – 17.1* vs 7.1. Dynamic Strength (Nm) – 6.2* vs 1.6. SBP (mmHg) - -4.9 vs -9.3*. DBP (mmHg) – -5.5* vs -6.4*. TOT (mg/dL) - -15.6 vs -4.1. LDL (mg/dL) - -2.8 vs -12.</td>
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<td>Intervention: High Risk: Mean Reductions; SBP: -19.83* (mmHg), DBP: -19.50* (mmHg), GLU: -17.25* (mgdL$^{-1}$), Total Cholesterol: -37.88* (mgdL$^{-1}$), LDL: -26.12* (mgdL$^{-1}$), TRI: -114* (mgdL$^{-1}$), BMI: -0.45*(kg/m$^2$).</td>
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<td>Graffagnino (2006)</td>
<td>418</td>
<td>Overweight / obese adults</td>
<td>Pre - Post</td>
<td>Medical wellness facility, Columbus, Ohio, USA</td>
<td>6 months – access to exercise physiologists and dieticians – ability to exercise at home or at centre.</td>
<td>Body weight, cholesterol, blood glucose.</td>
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<td>Mean change: Total Cholesterol: -12.1mg/dL*, LDL: -9.6mg/dL*, HDL: -1.7mg/dL*, TRI: -21.7mg/dL*, GLU: -3.6mg/dL*.</td>
<td></td>
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<td>Twooger (2003)</td>
<td>173</td>
<td>Post menopausal overweight / obese women, not receiving hormone replacement therapy</td>
<td>Quasi - Experimental</td>
<td>Exercise training facility, Seattle, Washington, USA</td>
<td>1 year – moderate intensity (60-75% HRmax). Aim 5 times per week. 1st 3 months – 3 supervised exercise sessions and 2 at home. 2nd 9 months – 1-3 sessions in facility the remainder at home.</td>
<td>Sleep quality / amount, VO2max &amp; BMI.</td>
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<td></td>
<td>225 minutes exercise per week associated with less trouble sleeping when compared with less than 180 minutes. 12% increase in VO2max*. BMI reduced by 0.3kg/m$^2$.</td>
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<tr>
<td>Kaats (1998)</td>
<td>200</td>
<td>Healthy (no underlying chronic conditions). Male &amp; female</td>
<td>RCT</td>
<td>Bally’s Total Fitness – Huntington Beach / Long Beach, California, USA</td>
<td>EX: Micro and Macro dietary supplements provided. Exercise 3 times per week: 5 minute warm up, 30 minutes AE &amp; 2 sets of</td>
<td>Body composition and lipid profile.</td>
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<td>Mean change – EX vs CON. Body weight (lbs) - -1.7 vs 0.1. Body Fat (lbs) – -6.1 vs 0.9. Fat Free Mass (lbs) 4.5 vs 0.8. Percentage decrease – EX vs CON. TOT – -6.5 vs no change. LDL – -11.1</td>
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</table>
Nishijma (2007) | 561 | 40-89 years. 2 of 3 conditions – Hypertension, Hyperlipidemia, Glucose Intolerance | RCT | Sapporo Fitness Centre, Sapporo, Japan | EX: 6 months – 8 individualised training sessions with an exercise professional. 2-4 fitness centre sessions unsupervised (mean = 2.6). | Primary Outcomes – LDL, SBP & HbA1c. Secondary included hsCRP and VO2peak. | Mean change – EX vs CON. SBP (mmHg) -8.3 vs 6.17. LDL (mg/dL) -3.99 vs -1.65. HbA1c (%) -0.023 vs -0.035. hsCRP (log transformed) -0.111 vs -0.039. VO2peak (ml/kg/min) – 2.42 vs 0.35. (no pre/post p value reported). | RT – supervised. vs 0.7. |

Table 4. Details of interventions reviewed. RCT = Randomised controlled trial, STRUC = Structured exercise intervention, LIFE = Lifestyle intervention, SBP = Systolic blood pressure, DBP = Diastolic blood pressure, MET = Metabolic equivalent of task, Ex = Exercise condition, CON = Control condition, TOT = Total cholesterol, LDL = Low density lipoprotein, HDL = High density lipoprotein, TRI = Triglycerides, BMI = Body mass index. * = P<0.05 - all comparisons pre-post intervention.