

# BMJ Open Are changes in physical fitness, body composition and weight associated with exercise attendance and dropout among fitness club members? Longitudinal prospective study

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## ABSTRACT

**Objectives** The primary aim of the present study was to investigate if changes in physical fitness, body composition and weight are associated with exercise attendance and dropout among fitness club members. Secondary, we wanted to identify motives for fitness club membership and exercise.

**Setting** New members at 25 fitness clubs in Oslo, Norway.

**Participants** In total, 125 new fitness club members were recruited. Eligible criteria were <4 weeks of membership, untrained (exercising <60 min once a week) and ≥18 years. At inclusion, and after 3 (n=87) and 12 months (n=64), participants answered a questionnaire (including motives for membership and exercise, and attendance) and performed measurements of maximum oxygen uptake ( $VO_{2max}$ ), one repetition maximum (bench press and leg press), body composition and weight. In total, 56 participants underwent measurements at all time points. Based on self-reported attendance, participants were divided into three groups: regular attendance (≥2 sessions per week), low attendance (<2 sessions per week) and exercise dropout (no sessions the last month).

**Results** At 3 months, regular attendees had significantly higher  $VO_{2max}$  than dropout (6.54 mL/min/kg, 95% CI 2.00 to 11.07, p=0.003). At 12 months, a difference in  $VO_{2max}$  of 5.32 mL/min/kg (95% CI -0.08 to 10.72, p=0.054) was found between regular attendees and dropout, and between regular and low exercise attendance (6.17 mL/min/kg, 95% CI 0.19 to 12.15, p=0.042).  $VO_{2max}$  was the only factor showing an association with attendance. No differences or associations were observed in maximal muscle strength or body composition between the three groups. Primary motive for fitness club membership and exercise was increase in physical fitness (92.8%).

**Conclusions**  $VO_{2max}$  was the only factor associated with exercise attendance at two time points. Increased physical fitness was primary motive for fitness club membership and exercise.

## INTRODUCTION

The scientific evidence linking regular physical activity to health benefits is well established.<sup>1 2</sup> In fitness clubs, members

## Strengths and limitations of this study

- The use of a longitudinal prospective study design for long-term follow-up.
- Valid and reliable measurement methods.
- The use of an electronic questionnaire based on previously validated surveys.
- The high dropout from the study.
- Self-reported attendance at the fitness club.

predominantly exercise for health benefits.<sup>3</sup> However, 40%–65% of individuals initiating exercise are predicted to drop out the first 3–6 months.<sup>4 5</sup> This rate is similar independently of supervised or non-supervised exercise, across age and gender.<sup>6</sup> Based on these numbers, it is of importance to investigate if changes in physiological factors are associated with exercise attendance, as well as exercise dropout.

Several studies have demonstrated physiological and appearance-related motives in initiation of physical activity.<sup>7–9</sup> To increase the probability of physical activity maintenance, achievement of a goal may be desired, that might produce a conscious experience of pleasure.<sup>10 11</sup> Sperandei *et al*<sup>7</sup> showed that a goal achievement in relation to exercise may be physiological factors such as weight loss, increase in muscle mass or aerobic capacity.<sup>7</sup> It is shown that goal reaching (eg, increase in physical fitness or weight loss) may motivate people to sustained participation in exercise, and that individuals are prone to dropout if their goals and expectations are not met within a reasonable time.<sup>7 10 12 13</sup> Hence, we may assume that positive changes in physical fitness, including maximal oxygen uptake ( $VO_{2max}$ ) and maximal muscle strength, body composition and weight, will contribute to the probability of exercise maintenance.

To our knowledge, this is the first prospective longitudinal study examining long-term changes in physical fitness, body composition and weight in fitness club members. In addition, the literature is scant regarding motivational factors for fitness club participation. Therefore, the primary aim of the present study was to investigate if physical fitness ( $VO_{2max}$  and maximal muscle strength), body composition and weight are associated with exercise attendance and dropout after 3 and 12 months of fitness club membership. Secondary, we wanted to identify motivational factors for fitness club participation.

## MATERIALS AND METHODS

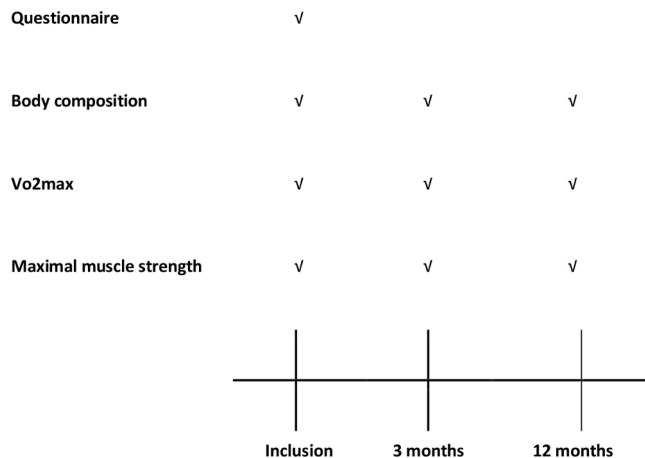
### Design

The present study was part of a longitudinal prospective study, following up a group of new members at 25 fitness clubs in Oslo, Norway, to gather repeated measures of physical activity level and health status, including a wide range of psychosocial and physiological parameters, financed by and conducted at the Norwegian School of Sports Sciences in Oslo, during the period October 2015 to November 2018. In accordance with the Declaration of Helsinki, all participants received written information about the project's purpose and procedures, and gave consent to participate. No economic compensation was given.

### Participants

Participants were recruited by an email invitation from the local fitness club. Eligibility criteria were <4 weeks membership, untrained (exercising <60 min once a week at moderate or vigorous intensity),  $\geq 18$  years, healthy (no chronic serious disease or pathology, ie, heart disease or severe hypertension) and not pregnant. In Europe, September and January are two important months for recruiting new fitness club members. Hence, the participants for the present study were mainly enrolled during those two key periods (group 1: October/November 2015:  $n=75$ , group 2: January/February 2016:  $n=50$ ).

To date, it is scientific evidence that higher levels of  $VO_{2max}$  are associated with a lower risk of mortality from cardiovascular disease, independent of age, smoking and body composition.<sup>14</sup> Hence, power calculation of sample size was conservatively based on the results of  $VO_{2max}$  in other studies,<sup>15 16</sup> as well as clinically relevant changes in physiological variables during an exercise period of 12 months. For example, in healthy adults starting a regular exercise regimen, it is estimated an increase in  $VO_{2max}$  of 3%–10% the first 10–12 weeks, depending on exercise volume, intensity and method.<sup>17</sup> Therefore, with a power of 85% at a 0.05 level, a total of 55 participants would be needed to detect a change of 4% in  $VO_{2max}$ . However, studies have shown high losses to follow-up in a group of new beginning exercisers (25%–30%).<sup>18 19</sup> In addition, among those who start to exercise regularly, about 50% dropout from their exercise programme within 6–12



**Figure 1** Outline of the measurements throughout the study.

months.<sup>5 20–22</sup> For that reason, we aimed to include 125 participants, equally men and women.

In total, 275 men and women contacted the research group. Of these, 146 were excluded due to exercising regularly, and 4 due to cardiovascular disease and hypertension. Outline of the measurements throughout the study is shown in [figure 1](#). At inclusion, 125 participants answered the questionnaire regarding motives for fitness club membership and exercise. In total, 87 participants (42 men and 45 women) and 64 participants (33 men and 31 women) answered the questionnaire and performed physiological measurements, at 3 and 12 months, respectively. For all 3 time points, 56 participants underwent all measurements. A flow diagram of the participants throughout the study is shown in [figure 2](#).

### Patient and public involvement

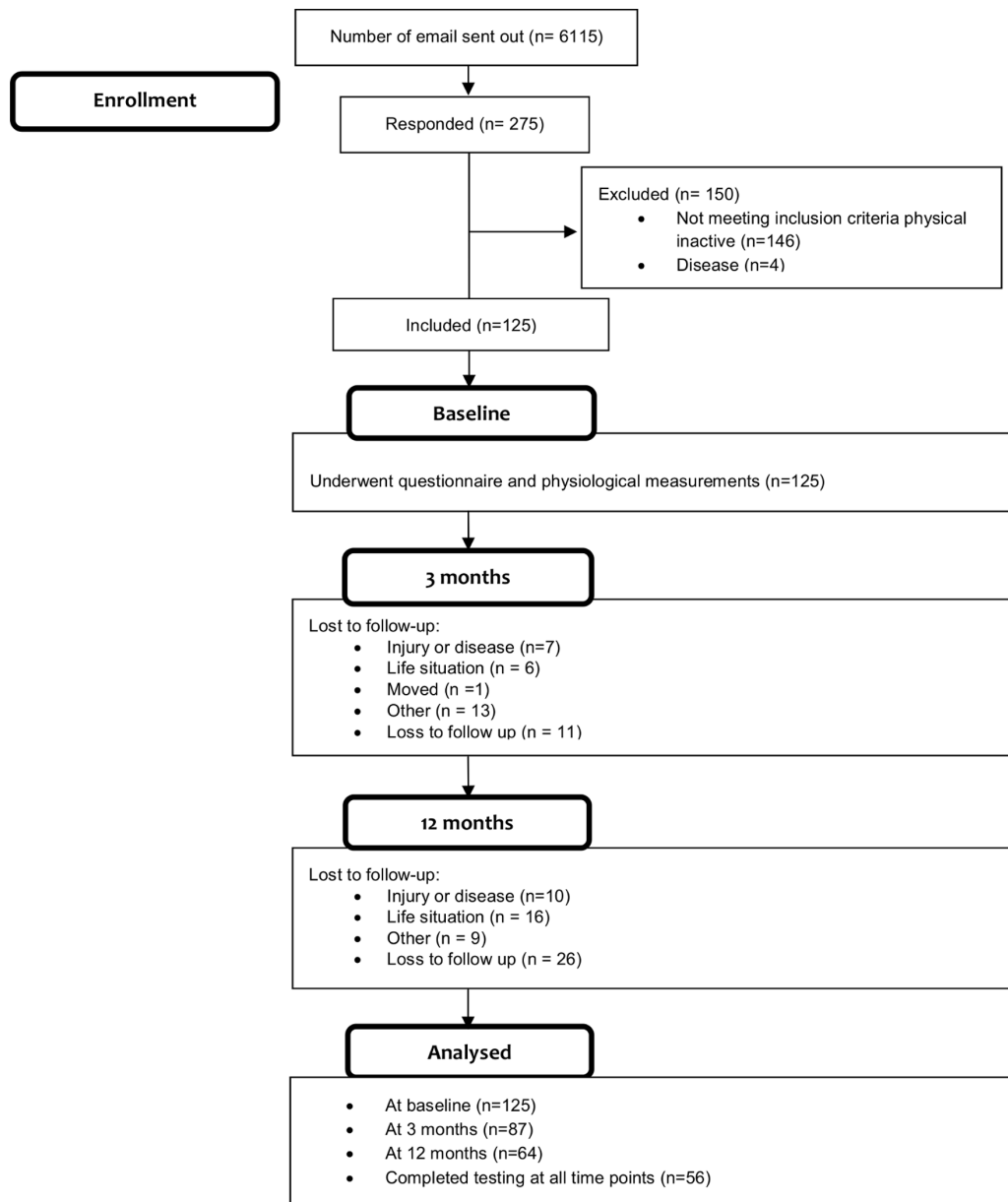
Participants and public were not involved in the development of research questions, study design or recruitment.

### Measurements

To investigate if changes in physical fitness, body composition and weight were associated with exercise attendance and dropout among fitness club members, data were collected at inclusion and after 3 and 12 months, by answering a standardised electronic questionnaire, before physiological measurements. All measurements were performed by qualified personnel following standardised measurement procedures and lasted approximately 60 min for each participant.

### Body composition

Body composition was measured with Inbody 720 (Biospace, USA). This method appears to adequately assess lean body mass compared with dual-energy X-ray absorptiometry, when adhering to strict pretest guidelines.<sup>23</sup> The measurement was done in light clothing without shoes and after 2 hours fasting. Before each measurement, the device was set to subtract 0.5 kg for the participant's clothes. Height was measured with a fixed stadiometer (Seca scale, Mod: 8777021094, S/N: 5877248124885) to the nearest 0.5 cm and body weight



**Figure 2** Flow diagram of the participants throughout the study.

was measured with Inbody 720 to the nearest 0.1 kg, respectively.

### Maximal oxygen uptake

Cardiorespiratory fitness was measured as  $\text{VO}_{2\text{max}}$  with a cardiopulmonary exercise test (CPET).<sup>24</sup> CPET was conducted on a treadmill using an incremental modified Balke protocol until exhaustion.<sup>25 26</sup>  $\text{VO}_{2\text{max}}$  was measured with indirect calorimetry (Oxycon Pro, Jaeger, Hoechberg, Germany) with the ‘breath-by-breath’ method. The participants breathed through a Hans Rudolph two-way breathing mask (2700 series; Hans Rudolph, Kansas City, Kansas, USA), connected to the gas analyser. Prior to each test day, all analysers were calibrated after the manufacturer’s guidelines and all exercise tests were supervised by the same research fellow. The Borg scale (range 6–20) was used for rating of perceived exertion.<sup>27</sup> The exercise

test was stopped when the participants reached maximal exhaustion ( $\geq 19$  on the Borg scale), and an additional criterion was a respiratory exchange ratio (RER) between 1.10 and 1.30 according to age.<sup>26</sup> The highest  $\text{VO}_{2\text{max}}$  and the highest RER corresponding to the highest minute ventilation were reported.

### Maximal muscle strength

Maximal muscle strength was measured as one repetition maximum (1RM), the most common method to assess maximal muscle strength in non-laboratory situations.<sup>28 29</sup> In the current study, 1RM was measured in bench press (Smith machine) and leg press. Participants received verbal instructions and a practical demonstration of the exercises, before test procedures were initiated. The test protocol in both exercises started with three warm-up series with decreasing repetitions (ie, 7-5-3), while the

load was gradually increased (on an individual basis). Thereafter, the load for each participant was increased by 2%–5% until failure. Resting periods between attempts were 1 to 2 min with a maximum of four attempts. The highest load with an appropriate technique was registered as 1RM.

### Questionnaire

An electronic questionnaire was used to identify motives for fitness club membership and exercise, exercise attendance, dropout and membership dropout. A pilot testing was done among four volunteers and four research group members. At all time points (inclusion, 3 and 12 months), the questionnaire took approximately 30 min to complete.

At 3-month and 12-month follow-up, the participants reported on exercise attendance, dropout or membership dropout the last 4 weeks. The questions and response options were: (1) 'Have you been a member at the fitness club during the last 4 weeks?': 'yes' or 'no', (2) 'Have you exercised at the fitness club the last 4 weeks?': 'yes' or 'no', (3) 'How many times have you exercised per week at the fitness club on average during the past 4 weeks?': 'one per week', 'two per week', 'three per week', 'four per week', 'five per week', 'six per week' or 'seven or more per week'. Exercise was defined as physical activity that was planned, repetitive and with the purpose to improve or maintain physical fitness, health or performance.<sup>30</sup>

Motives for fitness club membership and exercise were based on the validated questionnaire 'Reasons for Exercise Inventory' (Exercise Motivations Inventory—2 [EMI-2]).<sup>11</sup> Due to a comprehensive questionnaire in the current research project, 36 out of 51 statements were chosen prior to inclusion. The chosen statements were taken into account as appropriate for physically inactive new fitness club members. Further, two statements were added to the questionnaire section: (1) 'Increase in physical fitness' and (2) 'To prevent pain in my body'. The participants read each statement and indicated to what degree (0 [not true for me] to 5 [very true for me]) the statement was a motive for new fitness club membership and exercise. In the statistical analysis, a score of 5 was defined as an important motive for fitness club membership and exercise. Based on the structure of EMI-2, main motives (>40%) were divided into six subscales: strength and endurance, positive health, revitalisation, health avoidance, appearance and weight management.

### Statistical analysis

Data were analysed using SPSS Statistical Software V.24.0 and STATA V.15.0 for Windows. Analyses were based on participants who completed the questionnaire and physiological measurements at inclusion (n=125), 3 months (n=87) and 12 months (n=64). Level of significance was set as  $p \leq 0.05$ . Physiological measurements and main motives for fitness club membership and exercise are presented as means with SD, or frequencies (n) and percentages. To compare gender, age and group differences (study

participants versus study dropouts), in selected variables, including physical fitness, a one-way between-group analysis of variance, independent t-tests or  $\chi^2$  were used as appropriate. A linear random effects regression model was conducted to investigate if physical fitness ( $VO_{2max}$  and maximal muscle strength), body composition and weight were associated with exercise attendance and dropout at two time points (3 and 12 months). In the analysis, time from inclusion was set as the repeated factor and attendance was set as the second factor, where baseline values were set as neutral by a separate code. Standard errors were computed by a robust estimator taking the within-person dependency into account.

According to self-reported exercise sessions at the fitness club the last 4 weeks, the participants were divided into three groups: *regular exercise attendance*: visiting the fitness club  $\geq$  two times a week, *low exercise attendance*: visiting the fitness club  $\leq$  once a week and *exercise dropout*: no exercise the last month. Few had membership dropout at 3 and 12 months; hence, no analyses were done for this specific outcome. For any baseline differences in physical fitness, body composition and weight, self-reported exercise attendance at 3 months was used for group comparisons.

### RESULTS

Fitness club members (n=125) from a European city with a population of approximately 673 500 were predominantly Caucasian (96.8%), with 7.2% aged 18–24, 59.2% aged 25–39, 30.4% aged 40–64 and 3.2% aged 65 plus. Background variables and health factors are described elsewhere.<sup>31</sup> Physical fitness, body composition and weight at inclusion are given in table 1.

At 3 (104 responders) and 12 months (91 responders), 2 participants (two men) and 13 participants (5 men and

**Table 1** Physical fitness ( $VO_{2max}$  and maximal muscle strength), body composition and weight for all participants, and between men and women at inclusion (n=125)

Variable	All participants (n=125)	Men (n=62)	Women (n=63)
Body weight (kg)	77.0 $\pm$ 14.8	85.5 ( $\pm$ 12.0)	68.8 ( $\pm$ 12.5)
BMI (kg/m <sup>2</sup> )	25.0 $\pm$ 3.9	25.6 ( $\pm$ 3.2)	24.6 ( $\pm$ 4.5)
FM (%)	25.4 $\pm$ 8.6	20.0 ( $\pm$ 5.4)	30.5 ( $\pm$ 7.9)
MM (kg)	32.0 $\pm$ 7.8	38.6 ( $\pm$ 4.4)	25.6 ( $\pm$ 4.0)
FFM (kg)	57.3 $\pm$ 12.2	67.9 ( $\pm$ 7.4)	47.0 ( $\pm$ 4.9)
WHR	0.89 $\pm$ 0.04	0.90 ( $\pm$ 0.03)	0.87 ( $\pm$ 0.05)
$VO_{2max}$ (mL/min/kg)	37.7 $\pm$ 7.1	40.5 $\pm$ 7.2	35.0 $\pm$ 6
$VO_{2max}$ (L/min)	2.8 $\pm$ 0.7	3.41 ( $\pm$ 0.6)	2.37 ( $\pm$ 0.4)
1RM in leg press	178.1 $\pm$ 92.1	211.3 ( $\pm$ 47.0)	145.6 ( $\pm$ 112.5)
1RM in bench press	46.9 $\pm$ 23.7	64.6 ( $\pm$ 18.5)	28.9 ( $\pm$ 11.9)

Data are presented as mean (SD).

BMI, body mass index; FFM, fat free mass; FM, fat mass; MM, muscle mass; WHR, waist hip ratio;  $VO_{2max}$ , maximal oxygen uptake; 1RM, 1 repetition maximum.



**Table 2** Physical fitness ( $VO_{2max}$  and maximal muscle strength), body composition and weight at 3 and 12 months of fitness centre membership for regular attendance ( $\geq 2$  sessions per week), low attendance ( $< 2$  sessions per week) and exercise dropout (no exercise sessions the last month)

Variable	3 months			P value	12 months			P value
	Regular attendance (n=45)	Low attendance (n=23)	Exercise dropout (n=18)		Regular attendance (n=27)	Low attendance (n=15)	Exercise dropout (n=21)	
	Mean (SD)	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	Mean (SD)	
$VO_{2max}$ (mL/min/kg)	40.6 (6.9)*	37.2 (7.1)	34.0 (6.7)*	0.003	42.9 (6.4)*	36.7 (9.8)*	37.6 (7.6)*	0.019
$VO_{2max}$ (L/min)	3.1 (0.8)*	2.9 (0.7)	2.6 (0.6)*	0.061	3.6 (0.8)*	2.8 (0.9)*	2.8 (0.7)*	0.044
1RM in leg press (kg)	187.6 (68.9)	174.4 (54.6)	168.4 (53.7)	0.477	197.2 (67.6)	179.1 (57.1)	180.0 (57.4)	0.552
1RM in bench press (kg)	56.5 (28.4)	48.9 (18.6)	47.8 (18.7)	0.314	55.9 (25.6)	45.9 (21.0)	50.9 (22.7)	0.432
Body weight (kg)	76.5 (13.3)	77.9 (15.3)	78.0 (18.3)	0.891	77.9 (11.5)	76.1 (17.8)	75.5 (14.1)	0.833
BMI (kg/m <sup>2</sup> )	24.8 (2.7)	25.7 (4.0)	26.7 (5.6)	0.189	24.6 (2.7)	25.5 (5.6)	24.7 (3.8)	0.803
FM (%)	23.5 (8.6)	26.1 (9.6)	29.6 (10.4)	0.064	20.8 (9.7)	25.3 (11.0)	24.9 (7.9)	0.237
MM (kg)	33.0 (8.0)	32.8 (7.5)	30.2 (6.8)	0.395	34.9 (8.1)	31.7 (8.6)	31.5 (6.1)	0.246
FFM (kg)	58.7 (13.2)	58.6 (12.5)	54.2 (11.1)	0.403	61.9 (13.3)	56.4 (13.9)	56.2 (10.2)	0.226
WHR	0.88 (0.04)	0.89 (0.04)	0.90 (0.05)	0.479	0.87 (0.04)	0.89 (0.06)	0.88 (0.05)	0.465

Data are presented as mean (SD). The p value shows group differences.

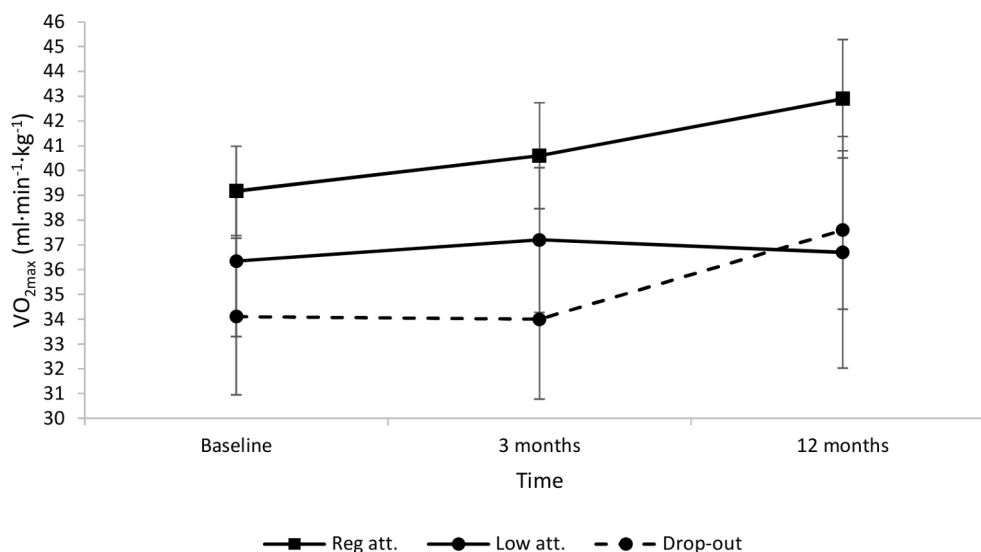
\*Groups who significantly differ.

BMI, body mass index; FFM, fat free mass; FM, fat mass; MM, muscle mass; WHR, waist hip ratio;  $VO_{2max}$ , maximal oxygen uptake; 1RM, 1 repetition maximum.

8 women) reported membership dropout, respectively. In addition, 25.0% (11 men and 15 women) at 3 months and 36.3% (16 men and 17 women) at 12 months reported exercise dropout, although still being a member. No gender or age differences were seen between groups at any measurements points (data not shown). Self-reported weekly exercise sessions at 3 and 12 months were in mean 2.0 ( $\pm 1.0$ ) and 2.2 ( $\pm 1.4$ ), with no differences between men and women ( $p=0.391$ ,  $p=0.152$ ). At 3 and 12 months, 51.7% and 42.2% reported regular exercise attendance, with no gender differences ( $p=0.775$ ,  $p=0.371$ ).

At 3 months, regular attendees had a significantly higher  $VO_{2max}$  than exercise dropout (6.54 mL/min/kg,

95% CI 2.00 to 11.07,  $p=0.003$ ). At 12 months, a difference in  $VO_{2max}$  of 5.32 mL/min/kg (95% CI -0.08 to 10.72,  $p=0.054$ ) was found between regular exercise attendance and exercise dropout, as well as between regular and low exercise attendance (6.17 mL/min/kg, 95% CI 0.19 to 12.15,  $p=0.042$ ). The linear random effects regression model showed an association between  $VO_{2max}$  (mL/min/kg and L/min) and exercise attendance ( $z=-2.37$  and  $-2.16$ ). Otherwise, no differences or associations were observed in longitudinal data of maximal muscle strength or body composition between regular and low attendance and exercise dropout (table 2). The nature of the association is shown in figure 3.



**Figure 3** The nature of association between  $VO_{2max}$  (mL/min/kg) and attendance ( $z=-2.37$ ).

**Table 3** Main motives for fitness club membership and exercise at inclusion (n=125). Data are presented as n (%). The main motives (>40%) are categorised based on Exercise Motivations Inventory—2: strength and endurance, positive health, revitalisation, health avoidance, appearance and weight management

Strength and endurance	n (%)	Positive health	n (%)
Increase in physical fitness	116 (92.8)	To have a healthy body	83 (66.4)
To increase my endurance	63 (50.4)	To feel more healthy	80 (64.0)
To develop my muscles	54 (43.2)		
Revitalisation		Health avoidance	
Because after exercising I feel refreshed	81 (64.8)	To avoid ill health	74 (59.2)
Because it makes me feel good	67 (53.6)	To prevent health problems	69 (55.2)
Appearance		Weight management	
To look more attractive	73 (58.4)	To stay slim	59 (47.2)
To improve my appearance	52 (41.6)	To lose weight	57 (45.6)

Table 3 shows main motives (>40%) for fitness club membership and exercise. The majority of participants reported physical fitness as a main motive, followed by health factors. Few reported psychosocial motives for fitness club membership and exercise (such as social recognition and affiliation, data not shown).

Based on self-reported exercise attendance at 3 months, no baseline differences in physical fitness, body composition and weight were observed between regular attendance, low attendance and exercise dropout. Analysing completers only (participants who underwent testing at all time points, n=56) did not change the present findings. In addition, independent t-tests and  $\chi^2$  revealed no baseline differences in physical fitness, body composition and weight, or motives for fitness club membership and exercise between completers and study dropouts at 3 and 12 months (data not shown).

## DISCUSSION

In the present study, an association was shown between  $VO_{2max}$  (both in absolute values and relative to bodyweight) and attendance. On the other side, we cannot conclude that the participants were motivated to continue exercising because of improved  $VO_{2max}$ , or whether this was an effect of exercising regularly. However, from a public health perspective, a significantly higher  $VO_{2max}$  in those who exercised  $\geq 2$  sessions per week is of clinical relevance with respect to cardiovascular health. No differences were seen in maximal muscle strength or body composition between groups. Identified main motives for fitness club membership and exercise were mostly related to physiological factors, with increase in physical fitness (92.8%) most frequently cited, followed by health related motives.

The present study showed no differences between regular attendance, low attendance and exercise dropout in maximal muscle strength and body composition after 3 and 12 months of fitness club membership. At a fitness club, most members are left to exercise on their own if they do not participate in group exercise classes or pay for additional services such as hire personal trainers.

Studies have shown that few manage to exercise with a recommended dosage.<sup>7 12 32-34</sup> In addition, it is shown that individuals who exercise for a very short period, especially resistance exercise, may not even reach the desired physiological changes (ie, increase in muscle mass and strength).<sup>35</sup> Moreover, the metabolism may be higher after exercise, and increased appetite may limit weight-loss goals.<sup>36</sup> Lack of improvement may also affect the individual's motivation for continuation of regular exercise and may have contributed to exercise dropout and total dropout from the current study. We found no differences between groups in maximal muscle strength. This may be due to that participants, who regularly performed resistance exercise in our study, did not perform the exercises used for testing of 1RM. Hence, it might be that no differences were found due to the exercise principle of specificity.<sup>37</sup> For example, if an individual wants to improve leg press, he or she must practice leg press, even though other exercises employ the same muscles. In addition, it may be due to a small number of exercise sessions per week (mean of 2.0 and 2.1 at 3 and 12 months, respectively) and/or insufficient workload during resistance exercise.<sup>38-42</sup> Studies have shown that it may be challenging for an individual to choose a sufficient workload during resistance exercise,<sup>43 44</sup> especially in a non-supervised setting or in group exercise sessions.<sup>19</sup> On the other hand, it may be easier to exercise at an appropriate intensity during endurance performance, due to that perceived exertion compares well with heart rate.<sup>45 46</sup> In the present study, the participants were given instructions on intensity during the CPET test. Hence, they were somewhat familiar with heart rate responses during uphill walking, comparable to other endurance activities. Unfortunately, intensity score and workload were not included in the questionnaire and we did not register heart rate during exercise sessions. However, total exercise time per week at the fitness club seems appropriate (mean of 139.2 and 155.8 min at 3 and 12 months, respectively) and is according to the current recommendations for physical activity.<sup>47</sup> Yet, total exercise time was based on self-report; therefore, social desirability

may have potentially affected the risk of over-reporting.<sup>48</sup> It is also likely that members reported time spent at the fitness club, rather than time spent exercising, although we emphasised that the participants should report exercise time only. Our initial hypothesis was that access to exercise equipment and group exercise classes could contribute to regular exercise attendance and increase in physical fitness (such as maximal muscle strength). Yet, we did not find that fitness club membership contributed to changes in maximal muscle strength and body composition. Hence, from a public health perspective, it may be important that the staff help and support fitness club members to exercise with a recommended dosage, which in turn may lead to positive changes in physical fitness and body composition.

The present study showed an association between  $VO_{2max}$  and attendance, with the highest increase in regular attendees. Among exercise dropouts, from 3 to 12 months of fitness club membership, an increase in  $VO_{2max}$  was also shown. This may present the phenomenon of exercise relapse, an individual maintaining exercise for a period, dropout for a short-term, and then relapse into previous exercise behaviour.<sup>49</sup> Therefore, we may assume that some of these participants exercised between 3 and 11 months and achieved a long-term increase in  $VO_{2max}$ , despite reporting no exercise the last month.

The participants were defined as untrained at study enrolment and may be considered representative for new members at a fitness club, as well as comparable to the general population.<sup>32–34 50</sup> Measurements of  $VO_{2max}$  at inclusion (38.8 and 34.8 mL/min/kg for men and women, respectively) were similar to Norwegian adults in the same age groups (39.5 for men and 32.3 mL/min/kg for women).<sup>15</sup>

Despite the known benefits of regular exercise,<sup>51–58</sup> overall participation rates are low and those who initiate an exercise programme have trouble maintaining it.<sup>5 20 21</sup> In the current study, a limitation was that attendance was measured by self-report only, with no information about the actual individual attendance at the fitness club. It is well known that individuals have a tendency to overestimate the number of exercise sessions because of social desirability, and therefore the measure may be imprecise.<sup>59 60</sup> Studies have shown that about 50% of those who start exercising regularly dropout from their exercise programme within the first 6–12 months.<sup>5 20–22</sup> In addition, Sperandei *et al*<sup>7</sup> suggested that 63% of new members at a fitness club will dropout before the third month and less than 4% will remain for more than 12 months of regular exercise.<sup>7</sup> In our study, the exercise dropout rate was lower (21.0% and 30.5% at 3 and 12 months, respectively), but the numbers are most likely more similar to the literature, due to high dropout from the study itself (30.4% at 3 months and 50.4% at 12 months). Others have reported that primary reasons for exercise dropout are failure, lack of improvement and changes in motivation.<sup>21 35</sup> This is in accordance with the findings of the current study. In total, 44.2% dropped out from

the previous fitness club due to lack of motivation, which may be explained by little or no change in physiological factors.

Consistent with our findings, Mullen and Whaley<sup>8</sup> also reported physical and aesthetic goals as important motives for exercise at a fitness club.<sup>8</sup> A challenge with such goals is that the focus is mainly on the outcome itself and not on activities that are fun and maximise exercise enjoyment. It is possible that physical and aesthetic goals may contribute to lower attendance, especially if positive changes in physical fitness, body composition and weight are lacking. Further, in our study, 59.2% also reported intrinsic motives (such as ‘exercise makes me feel good’) for participation at the fitness club. Two cross-sectional studies have reported that fitness club members with intrinsic motives are more likely to maintain exercise attendance than those with extrinsic motives (such as aesthetic goals).<sup>61 62</sup> However, findings from the present study showed that few managed to maintain long-term exercise attendance. A healthy level of physical fitness, body composition and weight is not a sprint to a finish line, it is a lifetime commitment. Hence, it is important to motivate individuals to enjoy exercise in the present, and not focus on ‘future goals’ (ie, weight loss).<sup>63–65</sup> Lastly, the literature regarding exercise maintenance is scarce.<sup>66 67</sup> Hence, more research is needed for an increased understanding of factors that contribute to long-term exercise behaviour.

## Measurements

Accurate measurement of body composition and reliability is dependent on the instrument itself and standardised procedures prior to the test (ie, fasting, abstain from exercise, toilet visit prior to test).<sup>68 69</sup> To ensure this, the participants in our study were informed about the standardised procedures prior to each test day. A limitation in bioelectrical impedance analysis is an underestimation of fat mass and an overestimation of lean body mass.<sup>70 71</sup> However, the study of Völggi *et al* showed that the underestimation of fat mass was lower in individuals with overweight and obesity (body mass index >25 and >30), especially in men.<sup>70</sup> About half of the participants (46.7% men and 47.6% women) in the present study had a fat percentage above recommended values, and were classified as overweight. Hence, the underestimation of fat mass may not be an important limitation. Despite the potential underestimation of fat mass, bioelectrical impedance analysis is cheap, easy to use and thus an alternative to more expensive methods.<sup>69</sup>

CPET is considered the ‘gold standard’ for measuring  $VO_{2max}$ . In addition, a major strength in the present study is that the same personnel conducted all CPETs. However, the method may not be suitable for individuals who have different fitness challenges related to pain or fatigue, and the method requires exercise to volitional exhaustion, as well as being expensive and time consuming.<sup>24</sup> Several participants reported that the CPET was painful due to

exercise to volitional exhaustion. This feedback may be one of the explanation of our high dropout rate.

Testing of IRM is the most reliable test for evaluating maximal muscle strength and considered the 'gold standard'.<sup>28 29</sup> In the present study, all participants were untrained at inclusion and had no experience with the test exercises. Unfortunately, we had no familiarisation sessions prior to baseline testing in our study, and we used different test leaders for practical reasons. Familiarisation sessions are recommended to achieve reliable IRM measurements.<sup>72</sup> However, all test leaders were qualified and followed standardised measurement procedures.

### Strengths and limitations

In this study, the use of a longitudinal prospective design, a sample size with a wide range in age (18–71 years), equal number of men and women, and valid and reliable measurement methods may be considered major strengths. Another strength was the use of an electronic questionnaire based on previously validated surveys.<sup>11 73–81</sup> An electronic questionnaire is able to gather responses quickly, and eliminate the costs associated with printing and distributing paper-based questionnaires. The high dropout from the study itself may be considered a limitation. Still, we had a sufficient number of participants with respect to a priori power calculation for all physiological measurements at 3 and 12 months. Self-reported attendance at the fitness club may also be considered a limitation, since individuals have a tendency to overestimate due to social desirability.<sup>59 60</sup> In addition, despite increasing Internet use in the general adult population, the use of an electronic questionnaire in this study may have contributed to study dropout of older participants, due to limited technical skills.

### CONCLUSION

Our results showed that  $VO_{2max}$  was associated with regular attendance at the fitness club at 3 and 12 months. No differences were found in body composition, weight and maximal muscle strength between study groups (regular and low attendance, exercise dropout). Lastly, physiological factors, with increase in physical fitness was the main motive for fitness club membership and exercise, followed by health and appearance-related motives.

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**Contributors** CG plotted all data, developed the questionnaire together with LAHH, and outlined the manuscript. TS developed the tread mill protocol together with CG and LAHH and supervised the testing. CG and LAHH were responsible for data collection and recruited the participants. LAHH originated the idea for the present study and supervised the project. All authors participated in discussing the design of the study, read and corrected draft versions of the manuscript and approved the final manuscript.

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**Data sharing statement** All data are fully available without restriction. Data are from the 'Physical activity at fitness clubs. -A venue for public health'-study whose authors may be contacted at the Norwegian School of Sports Sciences. christina.gjestvang@nih.no.

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