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Title

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3 Short term effects of a weight loss and healthy lifestyle programme for

4 overweight and obese men delivered by German football clubs

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Abstract

Numbers of obese and overweight people continue to grow in Germany as they do worldwide. Men are affected more often but do less about it and few weight loss services attract men in particular. To evaluate the effectiveness of a men-only weight loss program, Football Fans in Training (FFIT), delivered by football clubs in the German Bundesliga, we did a non-randomized trial with a waiting list control group. Participants' data were collected between January 2017 and July 2018. FFIT is a 12-week, group-based, weight loss program and was delivered in stadia and facilities of 15 professional German Bundesliga clubs. Inclusion criteria were age 35-65 years, BMI ≥ 28 and waist circumference ≥100 cm.. Clubs recruited participants through Social Media, E-Mail and match day advertisement. 477 German male football fans were allocated to the intervention group by order of registration date at their respective clubs. 84 participants on waiting list were allocated to the control group. Primary outcome was mean difference in weight loss with treatment condition over time as independent variable. We performed a multilevel mixed-effects linear regression analysis. Results were based on Intention-to-treat (ITT) analysis with Multiple Imputation.. After 12 weeks, the mean weight loss of the intervention group adjusted for club, course and participants' age was 6.24 kg (95 % CI 5.82 to 6.66) against 0.50 kg (-0.47 to 1.49) in the comparison group ($p<0.001$). The

41 results indicate that Football Fans in Training effectively helped German men to
42 reduce their weight and waist circumference.
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Background

In 2014, more than half of the adult population in Europe was defined as overweight (BMI ≥ 25 kg/m²), and a quarter classified as obese (BMI ≥ 30 kg/m²).[1, 2] In Germany, the last nationwide survey (2008-2011) that used objective measurement showed similar numbers for obesity and that 53% of adult women and 67% of adult men were overweight.[3] While about average in Europe for women the number for overweight men is significantly larger than Europe-wide and also significantly larger than for German women.

Overweight and obesity contribute to increased risk of ill-health and premature mortality. For example, in Germany, between 2002 and 2008, the numbers were elevated by 31 % for excess weight related deaths and 37 % for years of life and quality adjusted life years lost.[4] The Global Burden of Disease (GBD) Obesity Collaborators reported four million deaths and 120 million disability adjusted life years for 2015 globally.[5] Overweight and Obesity also cause increased costs for both individuals and health systems. A study conducted in collaboration with one of Germany's biggest health insurance companies estimated the direct and indirect costs of overweight and obesity to the public health system at 63 billion € in 2015.[6]

Compared with women, overweight men face a disproportionately higher health risk. A meta-analysis published in 2016 and including 3.9 million people showed

64 a significantly higher mortality risk in men with BMI higher than 25.[7] But despite
65 this and the higher prevalence of overweight and obesity in men (67% vs 53%,
66 as mentioned above), German men of all ages are underrepresented in existing
67 health behavior change programs. Some of Germany's biggest commercial
68 weight reduction programs reported that female participants made up between
69 73.7 % and 78.0 % of all attendees.[8-10] A review of 244 weight loss trials, mostly
70 conducted in the United States, similarly showed that 27.0 % of participants
71 were male and only five percent of all trials were men only (32.0 % women
72 only)[11] Furthermore, according to the 2017 report by Germany's union of health
73 insurance companies, of 1.7 million participants attending their preventive
74 health courses, 81.0 % were female.[12] There are several possible reasons for
75 men's low attendance rates. First is the subjective misperception of their BMI. In
76 a study testing differences in weight status perception after either self-reported
77 or objective BMI measurements, proportionally more men (42.7 % self-reported,
78 54.7 % objectively measured) than women (19.3 % self-reported, 30.9 %
79 objectively measured) had the tendency to estimate their weight as "about right"
80 when statistically being considered overweight (BMI = 25-30).[13] Secondly, men
81 seem to have fewer concerns about health risks[14] and about eating, body
82 weight, and physical appearance.[15] Additionally men report barriers to seeking

help with health needs like socialization to conceal vulnerability[16] and last, some men view existing programs as unattractive and difficult to attend to.[11] However, it is well established that men who do attend weight loss programs are often successful in losing weight.[17, 18] Research shows that even 5 to 10 percent weight loss result in substantial health benefits and lowers future risks.[19] The “Football Fans in Training” program (FFIT), originating in Scotland, has demonstrated the power of the professional football setting to attract men in the UK to a men-only group-based weight management and healthy living program.[20] The 12-week program was developed in 2010[21], and evaluated in a randomized controlled trial (in 2011-2012) which showed that FFIT was effective and cost-effective, showing benefits in weight loss and other secondary outcomes 12 months after baseline.[22] Key to FFIT’s success is the program’s alignment with the emotional attachment of fans to football and use of what has been regarded, until recently at least, as a traditionally male setting.[21, 23] Building on FFIT’s success and popularity in Scotland, other programs addressing men’s health, weight and physical inactivity have been adapted for other professional sports club environments and for other countries, including rugby and ice hockey, to attract men to lose weight, and improve other health behaviors.

After translation and very minor adaptations, FFIT was successfully launched in the German Bundesliga, the most attended football league worldwide, in 2016. Previous research showed the feasibility of recruiting clubs to deliver the program and fans to attend the program.[24] The current study aims to test the effectiveness of the adapted German Football Fans in Training program with German football fans.

Methods

Intervention and Setting

FFIT is a gender-sensitized weight loss program delivered free of charge at professional football club facilities by trained club coaches, originally developed by a team at the University of Glasgow.[21] FFIT in Germany (Fußballfans im Training) was adapted by translation into German and minor cultural amendments as described below.

After an initial health check and baseline measurements, the participants attended twelve weekly sessions of 90 minutes. All sessions included (1) a classroom based session and (2) a group-based physical activity session. Each weekly classroom-based discussion covered a topic related to weight loss or behavior change. This included: developing a healthier diet by enhancing knowledge about nutrition and alcohol, interpreting food labels and choosing

121 healthier take-out food. Participants were taught to use behavior change
122 techniques including self-monitoring, goal-setting and getting support from other
123 group members, family and friends. Goals were reviewed weekly and through
124 discussion men learnt from one another about how to make changes. A detailed
125 description of the programme and mapping of all behavior change techniques
126 can be found in Gray et al. (2013). The classroom based session also included
127 an incremental walking program designed to increase fitness over time through
128 goals setting and self-monitoring of steps[25]. The physical activity session was
129 light to moderate physical activity, of increasing duration and intensity as the
130 twelve weeks progressed. Club coaches, who had been trained to deliver FFIT,
131 were instructed to include basic workout principles like warm-up and cool-down
132 as well as endurance, muscle, flexibility and coordination training. Football
133 training exercises were also recommended.
134 Some minor adaptations to the original program materials were made to make
135 them appropriate for use in Germany. Examples of foods used in the healthy
136 diet sessions were replaced by more popular choices in Germany.
137 Measurement units were assimilated to German standards (e.g. liters instead of
138 pints). Additional content was also added to explain the link between obesity
139 and cancer, especially colon cancer, in men.[26] A more detailed description of
140 the adaptation process can be found elsewhere.[24]

Study Design and participants

We conducted a pragmatic non-randomized trial with a waiting list comparison group. Data for both intervention group and comparison group were collected between January 2017 and July 2018. During this time period men were recruited to 29 12-week deliveries of FFIT in 15 clubs. Clubs chose their own recruitment methods (e.g., social media, half-time announcements at home matches, club magazines) and all men interested in participating were invited to apply through the official homepage www.ffit.de, where they were informed of the inclusion criteria. Men were eligible to take part in the program if they were aged between 35 and 65 years with a BMI >= 28 and waist circumference >= 100 cm at objective measurements prior to course start. At the initial health check, all potential participants were asked to fill out a German version of the Physical Activity Readiness Questionnaire (PARQ)[27]. The PARQ questionnaire and blood pressure readings indicated possible contraindications to physical activity. Therefore, men who answered ‘Yes’ to any PARQ question or who had resting systolic blood pressure of 160 and higher or diastolic blood pressure of 100 and higher had to provide a letter of support from their physician or were excluded from participating in physical activity during club sessions (although they were still able to take part in the ‘classroom’ part of the session and the

pedometer-based walking program). Most clubs opened recruitment to all male supporters, but three restricted participation in FFIT to season ticket holders. By the end of July 2018, a total of 934 men had registered for 29 courses in the 15 clubs, of whom 477 were allocated to the intervention group. Allocation was mostly done on the basis of first come, first served. Two clubs allocated the participants on their own terms which are unknown to the research team. These men were measured twice, with baseline assessments conducted during the initial health check one week prior to program start. The second (follow up) measurement was conducted during the week 12 session of FFIT. Thus, baseline and follow-up measurements were 13 weeks apart.

To strengthen the validity of the study, a comparison group (N=84) was recruited from waiting lists.[28] The lists included all men who had applied to a course at their club but had not been selected by the methods described above. These men, if any, were then invited to take part in objective comparison group measurements in the time leading up to the following course which they were considered to join. Attendance to those measurements was voluntary, without further incentives and the same through all clubs. They were measured twice, following the same protocols as the intervention group measurements, with follow up occurring 13 weeks after baseline data collection. A flow chart of participants is presented in Figure 1.

Outcome Measures

All measurements and questionnaire administration were conducted by the FFIT coaches who had been trained to a standard measurement protocol. In addition, to quality assure data collection, all measurement sessions were supervised by members of the research teams. Men who were not able to take part in the official measurement session were asked to attend at a subsequent time that was convenient to them. The primary outcomes were objectively-measured weight and waist circumference. Secondary outcomes were BMI, body fat percentage, and systolic and diastolic blood pressure. Weight and body fat percentage were recorded with an electronic scale (Omron BCM BF 511) with men wearing light clothes and having removed their shoes and anything in their pockets. Waist circumference was measured with an ordinary tape measure about 5cm above the navel. Blood pressure assessments were conducted in a separate room for a more relaxed atmosphere and nobody to talk to. Men were asked to sit down and relax for at least one minute before measurement. Height was measured without shoes. All self-reported data were obtained using a short questionnaire that participants filled out in between the objective measurements.

To assess sedentary time, men were asked to estimate the average number of hours per day they had spent sitting during the last 7 days. A modified, German

version of the DINE questionnaire[29] was used to assess fruit and vegetable intake, fatty food intake, sugary food intake and the proportion of whole grain intake among pasta, rice and bread over the last week. In the Fatty Food Score, Sugary Food Score, Vegetable and Fruit Score as well as Whole Grain Score, a higher score indicated a higher number of days during the last week on which the respective food types were consumed. Additionally, the Warwick-Edinburgh Mental Well-being Scale[30] was used to measure participants' psychological well-being.

Statistical Analysis

All statistical analyses were conducted with Stata 15 (Stata Corp, College Station, TX). To follow the Intention-to-treat principle, Multiple Imputation was used to decrease bias due to missing data following the assumption that data were missing at random (MAR).[31]Missing data were imputed using the MICE technique (multivariate imputations by chained equations) with M = 10 imputations.[32] The pooling of the regression estimates followed Rubin's rule.[33] Baseline characteristics were analyzed with linear regression to check for baseline differences between intervention and comparison group. Table 2 reports mean values and standard deviations, as well as mean differences between groups. Multilevel mixed-effects linear regression analysis was applied to evaluate effects of the intervention on primary and secondary outcomes.

Time of assessment (baseline vs follow-up), group (intervention vs comparison) and the interaction term between time and group were included as fixed effects. Additionally, participants' age was included as a fixed effect because of a significant baseline difference between groups (Table 1). To deal with the clustered structure of the data, random intercepts were included for the three levels, i.e. club, course and individual. Sensitivity analysis was performed with the same regression model using complete data sets only (per protocol) and replacing missing data with the participants' respective data from baseline measurements (LOCF). Adjusted mean scores (95% CI) for baseline and post-assessment, mean changes for both groups, intraclass correlations (ICCs) for club and course level and group-by- time interaction effects are presented

Results

On average, courses were attended by 18 (Range: 12-26) participants with one or two coaches. Ninety-one of the 477 men (19%) measured at baseline in the intervention group were lost to follow-up 13 weeks later; equivalent figures for the comparison groups were 6/84 (7%) (see Figure 1).

Place holder for Figure 1

Participants' baseline characteristics are shown in Table 1. Between-groups analysis showed no significant differences except for the men's age. Therefore age was added to all analysis as a confounding variable.

Place holder for Table 1

Mixed-model regression analysis results indicated significant differences between intervention group and comparison group effects over time for weight and most other outcomes. After undertaking the 12 weeks FFIT program, men in the intervention group had lost an adjusted mean of 6.24 kg in weight (95 % CI: 5.82 to 6.66), while men in the comparison group had lost 0.50 kg (-0.47 to 1.49). ICCs were 0.014 for club und 0.000 for course level.

Figure 2 shows the proportion of participants in the intervention and comparison group who lost more than five and ten percent of their baseline weight, respectively.

Place holder for figure 2

Weight loss data translated into a drop of BMI by 1.97 kg/m^2 (1.81 to 2.13) against 0.15 (-0.18 to 0.48) and of body fat by 2.86 % (2.50 to 3.22) against 0.67 (-0.63 to 1.41), both in favor of the intervention group.

Further significant group-by-time effects were found for all DINE-based outcomes related to food intake. Fatty food intake and sugary food intake scores both showed a significantly larger drop in the intervention group. The inverse was seen for the intake of vegetables and fruit: intervention group participants increased their vegetable intake score by 0.98 (0.76 to 1.19) compared to 0.31 (-0.07 to 0.69) in the comparison group; fruit intake score increased by 1.52 (1.29 to 1.75) in the intervention group and decreased by 0.06 (-0.52 to 0.41) in comparison group. The measured increase in proportion of whole grain products among pasta, rice and bread was 23.40 % (18.69 to 28.12) compared to 6.63 % (2.07 to 15.33). Sedentary time in the intervention group decreased by 1.37 hours a day (0.89 to 1.85) on average, which was

significantly more than the decrease by 0.30 hours a day (-0.42 to 1.02) in the comparison group. For the Warwick-Edinburgh Mental Well-Being Scale no group-by-time interaction effect was found. The increase by 0.19 (0.14 to 0.24) in the intervention group was slightly higher than the 0.14 (0.05 to 0.24) in the comparison group. All adjusted results of the linear regression analysis on basis of ITT and after Multiple Imputation for each outcome are shown in Table 2. Sensitivity analyses showed similar results with a loss of 6.50 kg (6.08 to 6.92) for the intervention group and 0.58 kg (-0.36 to 1.51) in the comparison group when data were per-protocol, and 5.28 kg (4.89 to 5.68) weight loss for the intervention group and 0.50 kg (-0.46 to 1.47) weight loss for the comparison group when missing data at follow-up was conservatively replaced with baseline weight (LOCF imputation). Also, we drew three random samples of 84 participants from the intervention group to match the number of comparison group participants. Weight loss results were:

1. Intervention: 5.66 kg (4.88 to 6.45), Comparison: 0.50 (-0.31 to 1.31)
2. Intervention: 5.54 kg (4.75 to 6.33), Comparison: 0.50 (-0.32 to 1.32)
3. Intervention: 6.50 kg (5.60 to 7.40), Comparison: 0.50 (-0.40 to 1.40)

Place holder for Table 2

Discussion

Summary and perspective

In this research report we described the evaluation of a weight loss program delivered to male football fans in close collaboration with 15 professional football clubs in the German Bundesliga. The program is an adapted version of the Scottish “Football Fans in Training”, which has been successfully implemented in the Scottish Profession Football League since 2010.[20-22, 34] Earlier research shows the translation and adaptation process as well as the success at recruiting clubs and fans from Germany for the program[24]
Over an 18 month study period, 477 participants were recruited into the intervention arm, and 84 into a comparison arm. Statistically significant differences between the intervention and comparison groups were found for changes in weight, BMI, girth, blood pressure, body fat percentage, fruit and vegetable intake, whole grain percentage, fatty food and sugary food intake and sedentary time. More than fifty percent of men in the intervention group lost at least 5% of their baseline body weight.
Previous research has reported that men successfully lose weight once enrolled in either men-only or mixed weight loss programs.[11, 17, 18] Participation in FFIT in Germany resulted in an average weight loss similar to the original trial

conducted in Scotland. In their randomized controlled trial, Hunt et al. reported a weight loss of 5.80 kg after 12 weeks compared to 0.42 kg in the control group. [22] Positive changes could be confirmed for German football fans in terms of a healthier diet. The slight weight loss and small trend to positive outcomes among comparison group participants' data also confirmed the findings of Hunt et al. The original research discussed this extensively and was followed by further research into this.

The only non-significant group-by-time effect was observed for the Warwick-Edinburgh Mental Well Being Scale. Considering the items and questions asked it is very unclear if this construct measures what was supposed to be an estimation of a rise in overall psychological well-being due to lost weight and improved physical fitness. Other instruments more suited to capturing the positive feelings about a more active and healthy life might lead to different results Hunt et al. reported significantly positive changes and between-group differences for self-reported psychological health and quality of life after using the Rosenberg self-esteem scale and the Short Form of the positive and negative affect scale (PANAS).

FFIT in Germany compares well to other research about weight loss programs in professional football or other professional sports. The EuroFIT trial[35] which also used and slightly adapted the FFIT formula to football clubs throughout

Europe reported 2.60 kg weight loss and 3.3 cm loss of waist circumference post-program. Positive effects on sedentary time and behavioral components were also reported. The Scottish FFIT has also branched into rugby and hockey. In rugby a pilot trial delivered through professional rugby clubs in New Zealand was held in which the difference in weight loss favored the intervention group by 2.5 kg and loss of waist circumference favored the intervention group by 3.5 cm[36]. In Canada, in a pilot trial of Hockey Fans in Training participants lost 3.6 kg more than the comparison group and reported positive effects on nutrition and other components aswell.[37]

Limitations

The FFIT study in Germany was not a fully powered randomized controlled trial to replicate the original FFIT study.[22]. Several considerations led to this decision. Observational studies have found that without a specific intervention the weight of German men who met the inclusion criteria for this study is very unlikely to decrease and likely to increase slightly.[38, 39] It is therefore very unlikely that decreases in weight could be attributed to “spontaneous remission”. The focus of our study was easy and practicable implementation of an evidence-based, successful weight loss programme for clubs under routine “field-conditions” and thus we prioritized high external validity. We made these decisions based on the knowledge that clubs did not want to exclude their fans

from a programme which existing evidence suggests the participants are very likely to benefit from. Further, our main aim was to evaluate the transfer of FFIT into the German Bundesliga and whether German fans would also experience similarly positive outcomes. We found that the programme could be transferred and German fans could benefit.

Although an effort was made to recruit participants to a comparison group we were not wholly successful and there are many fewer participants in that group compared to in the intervention group. It was difficult to recruit to the comparison group for several reasons. First, there were only limited numbers of men on waiting lists. Second, clubs would often decide not host comparison group measurements particularly if they had not yet made a decision to continue delivering the FFIT programme. Third, participation in the measurements was not required for those wanting to participate in the next upcoming course. Limiting the size of the intervention group was out of the question as the program funding required that as many participants as possible should benefit and it would also have sharply reduced the overall sample size. Because of this large equality between group numbers we simulated an even number as part of our sensitivity analysis described in the results. The numbers indicated that the effects are strong enough to maintain in this much smaller sample.

In spite of the lack of randomization, baseline data were very similar between intervention and comparison group, with the exception of participants age, which was significantly different between groups. Thus, age was included in the regression models as a fixed effect, alongside club, course and time. We were not able to follow up any fans that did not participate in the end of course measurements. Thus, all results were analyzed following the Intention-to-treat principle with Multiple Imputation to deal with drop-outs and missing data. There were no drop-outs on course level. Although every FFIT coach was trained to standard measurement protocols, facility circumstances during measurements differed between clubs and sometimes courses. As blood pressure is strongly affected by the environment or discomfort during the measurement procedure this might have resulted in confounding effects for the BP outcomes. Such systematic influences on club or course level have been considered in our statistical model with the addition of club and course as a random effect.. To assure high quality, all data collection sessions at clubs were monitored by the scientific project staff. Outcomes like sedentary time and diet-related information were self-reported and limited to the last week. This week could have been influenced by confounding events like illness, injuries or holidays.

Conclusion

The study suggests that “Football Fans in Training” is a very promising program to help fill a gap in Germany’s health care landscape as far fewer men than women are attracted to take part in existing preventive courses and offers of health systems, including weight reduction programs. To date,there have been very few programs that are specifically designed to try and attract men in Germany. The FFIT has previously been shown to be very effective in Scotland in attracting overweight, middle-aged men and supporting them in weight loss and lifestyle changes, building on its concept of using the socio-cultural environment of the professional football clubs as a ‘draw’. We have shown that the idea and concept was transferrable to professional football in Germany before[24] and successful in promoting positive health and lifestyle changes in men here. Long-term results have still to confirm that FFIT in Germany enables participants to sustain weight loss. Future research will evaluate weight loss results one year after initiation of courses.

Although the psychological mechanisms behind the attraction of FFIT for men in the UK, Germany or elsewhere have not been fully evaluated yet the supposed appeal consisting of a mixture of a “male” environment and methodical approach aswell as an emotional connection for the participants should be applicable to various fields in German health promotion. Health care providers

of all institutions have to make the effort of developing programs men are more likely to attend. The FFIT might also show promise to be disseminated to a broader field, including smaller professional clubs and clubs on an amateur level. This should be one aim of future research. FFIT in Germany also extends the evidence that the FFIT works in various different countries and sports when emotionally engaged men are targeted.

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Conflicts of Interest

The authors declare that there are no conflicts of interest. “Fußballfans im Training“ is funded by the “Stiftung Deutsche Krebshilfe” (German Cancer Aid) The German Cancer Aid had no influence on the article or authors.

Tables

Table 1: Participant characteristics at baseline

	Intervention Group (n=477) Mean (SD)	Comparison Group (n=84) Mean (SD)	p-value
Age	48.82 (7,82)	52.62 (7,63)	0.001
Height (cm)	179.71 (6,60)	179.73 (5,91)	0.981
Weight (kg)	113.52 (17,19)	111.89 (16,02)	0.419
BMI (mmHg)	35.14 (4,71)	34.70 (4,76)	0.430
Waist Circumference (cm)	119.62 (11,37)	119.63 (11,64)	0.997
Body Fat (%)	34.37 (5,01)	33.78 (5,40)	0.327
Systolic BP (mmHg)	152.35 (19,12)	154.49 (17,63)	0.355
Diastolic BP (mmHg)	95.59 (11,35)	96.06 (11,31)	0.730
Fruit Score	3.04 (1,96)	3.34 (1,96)	0.198
Vegetable Score	3.37 (1,64)	3.27 (1,66)	0.614
Fatty Food Score	23.94 (6,99)	24.52 (5,75)	0.479
Sugary Food Score	11.05 (4,06)	11.52 (4,59)	0.350
Whole Grain (%)	27.70 (31,20)	22.09 (26,40)	0.124
Sedentary time (h/day)	8.29 (3,42)	9.05 (3,41)	0.063
WEMWEBS	3.79 (0,52)	3.78 (0,46)	0.887

n, sample size; SD, standard deviation; BP, Blood Pressure; WEM, Warwick-Edinborough Mental Well-Being Scale; Whole Grain, whole grain proportion of total starchy food Intake

437 **Table 2: Adjusted mean scores and changes in outcomes from baseline to post-intervention as well as group-by-time interaction effects**

		Mean (95%CI)	Mean (95%CI)	Mean (95%CI)	ICCs	p-value
Objectively measured outcomes						
Weight (kg)	Intervention	113.08 (111.19 to 114.97)	106.84(104.94 to 108.74)	-6.24 (-6.66 to -5.82)	0.014 (Club)	< 0.001
	Control	113.17 (109.20 to 117.15)	112.68 (108.69 to 116.67)	-0.50 (-1.47 to 0.47)	0.000 (Course)	
BMI (kg/m²)	Intervention	35.07 (34.61 to 35.53)	33.10 (32.63 to 33.57)	-1.97 (-2.13 to -1.81)	0.004(Club)	< 0.001
	Control	34.90 (33.85 to 35.95)	34.75 (33.69 to 35.81)	-0.15 (-0.48 to 0.18)	0.000(Course)	
Girth (cm)	Intervention	119.42 (117.96 to 120.90)	111.59 (110.06 to 113.12)	-7.83 (-8.44 to -7.23)	0.024(Club)	< 0.001
	Control	119.84 (116.94 to 122.74)	118.69 (115.76 to 121.62)	-1.15 (-2.27 to -0.37)	0.000 (Course)	
Systolic blood pressure (mmHg)	Intervention	152.50 (150.36 to 154.65)	141.39 (138.92 to 143.86)	-11.11 (-13.14 to -9.08)	0.013(Club)	0.003
	Control	154.15 (149.48 to 158.82)	149.37 (144.81 to 153.93)	-4.78 (-8.75 to -0.81)	0.001(Course)	
Diastolic blood pressure (mmHg)	Intervention	95.52 (94.11 to 96.92)	87.05 (85.56 to 88.55)	-8.46 (-9.50 to -7.42)	0.025 (Club)	< 0.001
	Control	96.45 (93.69 to 99.22)	94.62 (91.80 to 97.46)	-1.83 (-4.03 to 0.38)	0.000 (Course)	
Body Fat (%)	Intervention	34.29 (33.76 to 34.82)	31.43 (30.89 to 31.98)	-2.86 (-3.22 to -2.50)	0.002(Club)	< 0.001
	Control	34.17 (33.00 to 35.36)	33.50 (32.33 to 34.68)	-0.67 (-1.41 to 0.63)	0.000(Course)	
Self-reported outcomes						
WEM	Intervention	3.80 (3.75 to 3.84)	3.99 (3.93 to 4.04)	0.19 (0.14 to 0.24)	0.000(Club)	0.367
	Control	3.75 (3.64 to 3.86)	3.89 (3.78 to 4.00)	0.14 (0.05 to 0.24)	0.000(Course)	
Sedentary time (h/day)	Intervention	8.19 (7.81 to 8.57)	6.82 (6.30 to 7.33)	-1.37 (-1.85 to -0.89)	0.013(Club)	0.013
	Control	8.94 (8.12 to 9.75)	8.64 (7.77 to 9.50)	-0.30 (-1.02 to 0.42)	0.000(Course)	
DINE-based measures						
Fatty food score	Intervention	23.97 (23.31 to 24.64)	19.38 (18.37 to 20.39)	-4.60 (-5.58 to -3.61)	0.004(Club)	< 0.001
	Control	24.42 (22.94 to 25.91)	22.81 (21.29 to 24.32)	-1.61 (-3.04 to -0.19)	0.000(Course)	
Sugary food score	Intervention	11.00 (10.62 to 11.38)	7.66 (7.20 to 8.13)	-3.34 (-3.80 to -2.87)	0.000(Club)	0.009
	Control	11.59 (10.76 to 12.43)	9.47 (8.61 to 10.33)	-2.12 (-2.97 to -1.28)	0.016(Course)	
Fruit score	Intervention	3.06 (2.88 to 3.42)	4.57 (4.35 to 4.81)	1.52 (1.29 to 1.75)	0.000 (Club)	< 0.001
	Control	3.31 (2.90 to 3.72)	3.25 (2.81 to 3.70)	-0.06 (-0.52 to 0.41)	0.000 (Course)	
Vegetable score	Intervention	3.35 (3.19 to 3.51)	4.33 (4.11 to 4.55)	0.98 (0.76 to 1.19)	0.000(Club)	0.003
	Control	3.35 (2.98 to 3.62)	3.56 (3.20 to 3.93)	0.31 (-0.07 to 0.69)	0.000(Course)	
Whole-grain proportion (%)	Intervention	28.11 (24.50 to 31.72)	51.51 (47.22 to 55.81)	23.40 (18.69 to 28.12)	0.000(Club)	0.001
	Control	22.16 (14.33 to 30.00)	28.79 (20.70 to 36.88)	6.63 (2.07 to 15.33)	0.000(Course)	

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Figures

443 Figure 1

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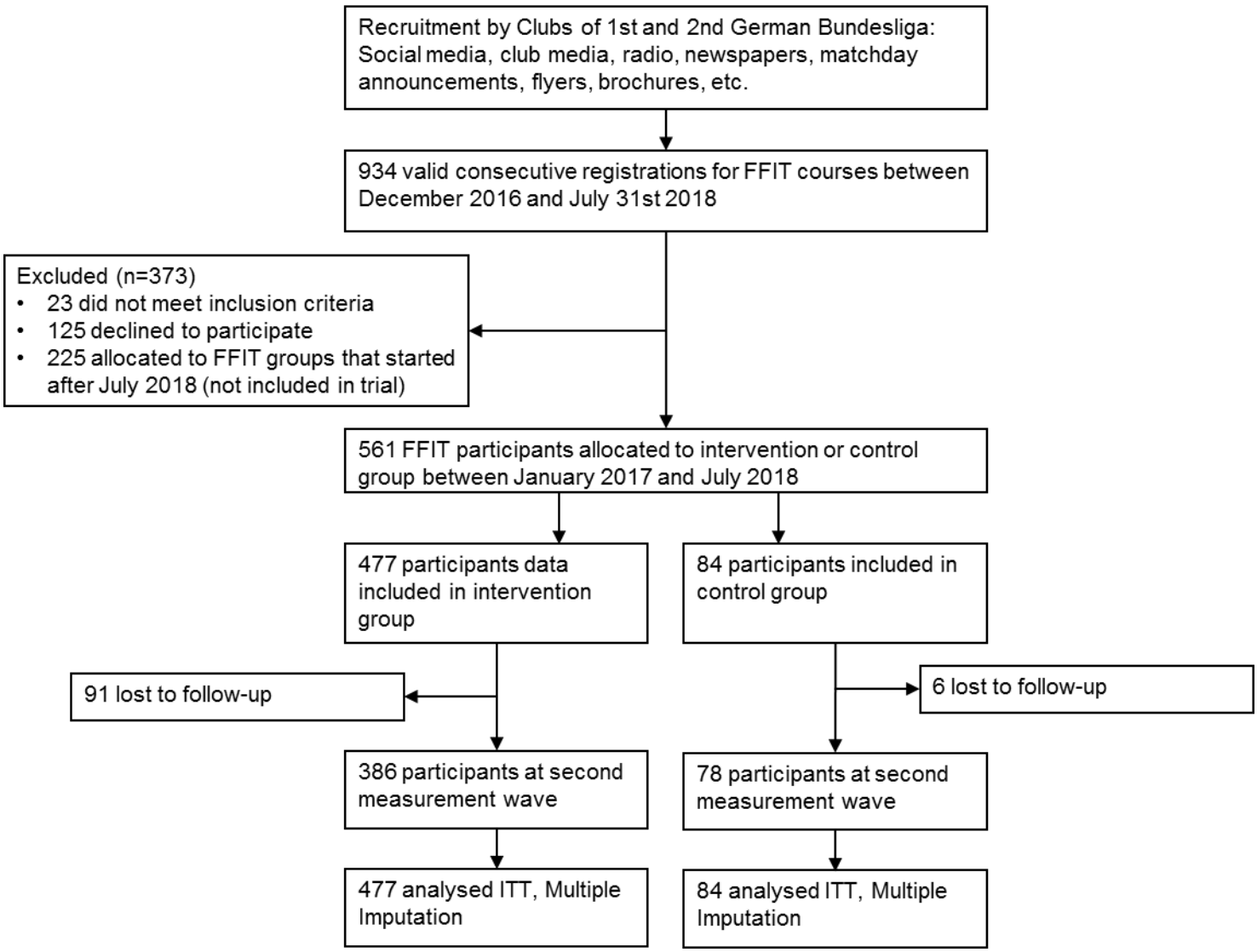

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447 Figure 2

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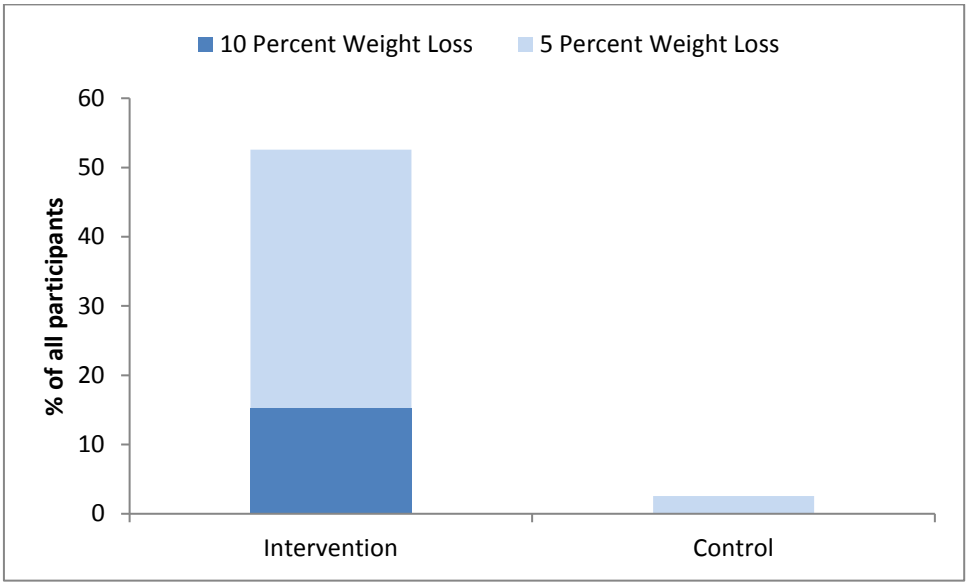

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