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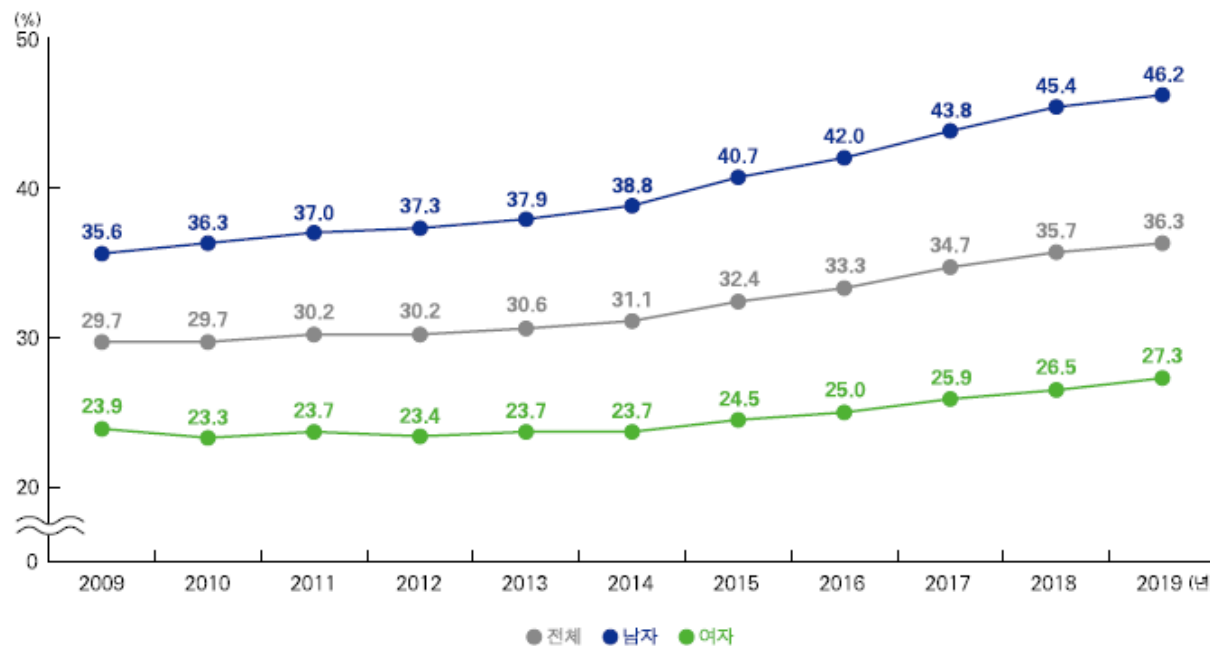
원주세브란스기독병원 가정의학과
김종구

Contents
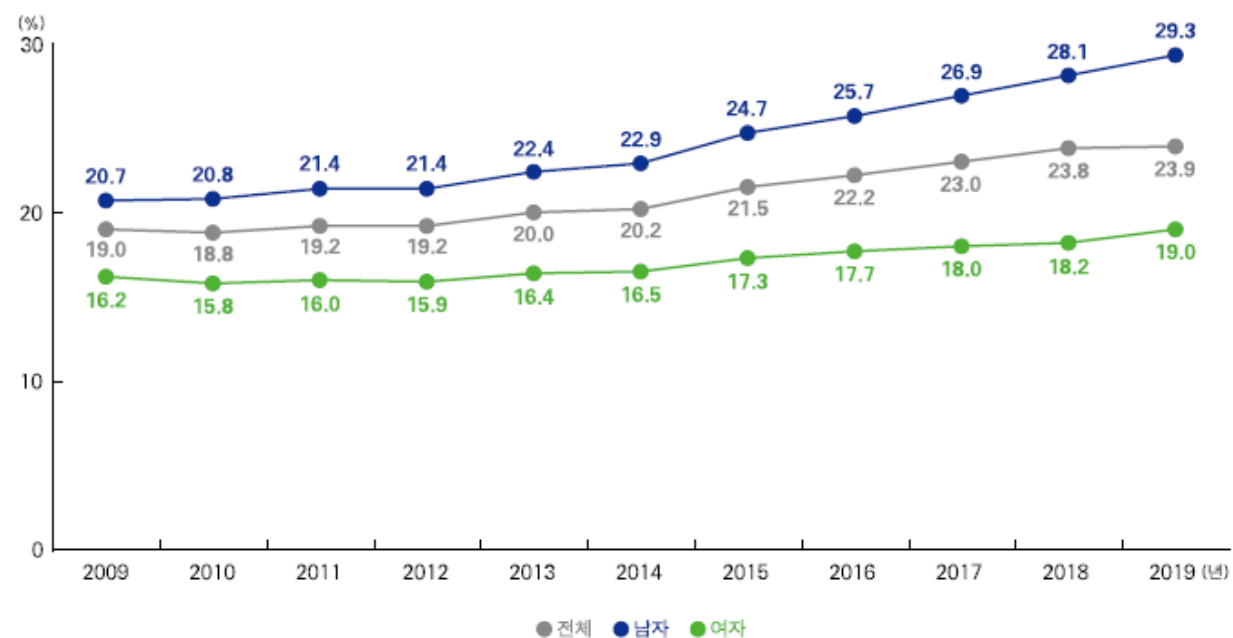
- 비만 및 신체활동 실천 현황

- 체중 감소와 운동

- 운동 치료 지침

비만 유병률 추이

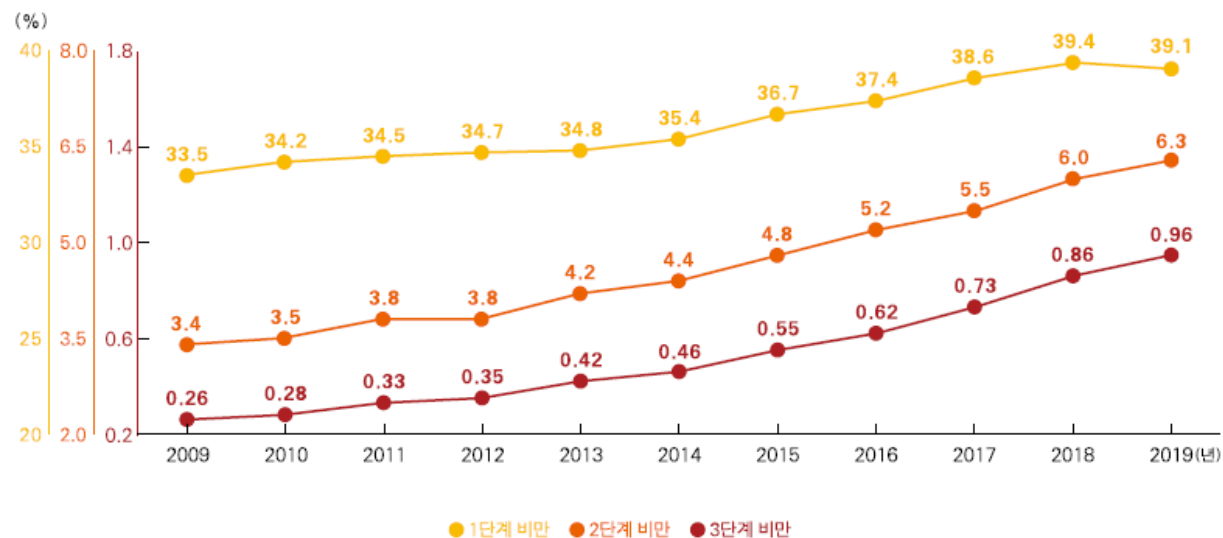비만 유병률

복부비만 유병률

Obesity Fact sheet 2021

비만 유병률 추이

남자 비만 단계별 유병률

여자 비만 단계별 유병률

Obesity Fact sheet 2021
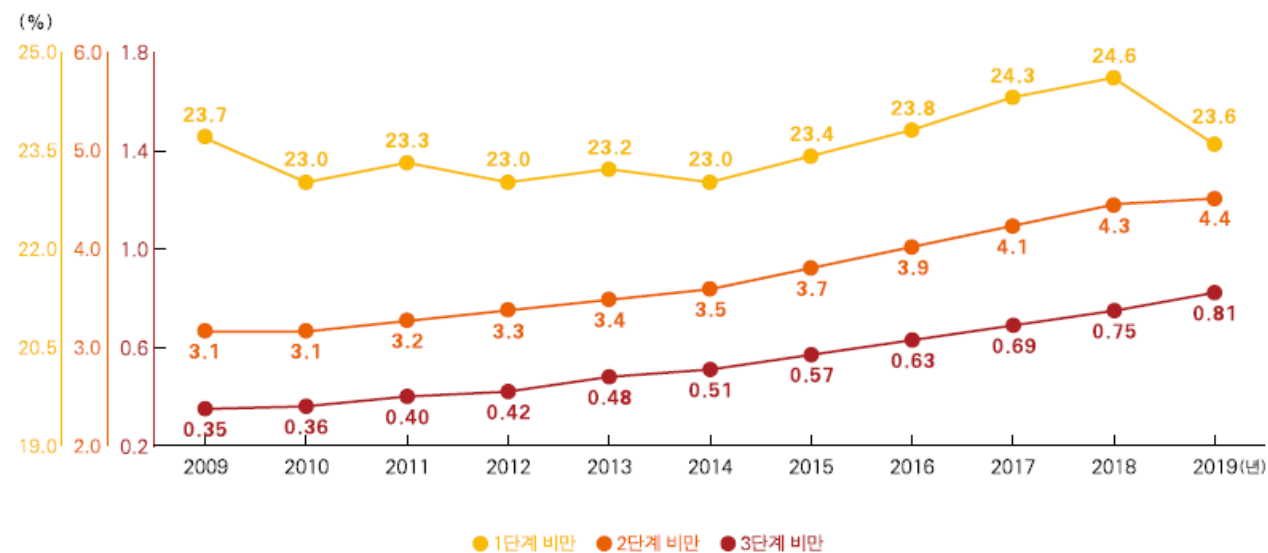
중등도 이상 신체활동 실천율

2021년 시·군·구 중앙값 19.7%로 전년 대비 0.1%p 감소.

시군구 중앙값

	'08년	'09년	'10년	'11년	'12년	'13년	'14년	'15년	'16년	'17년	'18년	'19년	'20년	'21년
(%)		20.9	21.7	21.0	20.2	21.9	21.7	22.5	22.2	22.3		24.7	19.8	19.7

유산소 신체활동 실천율 추이
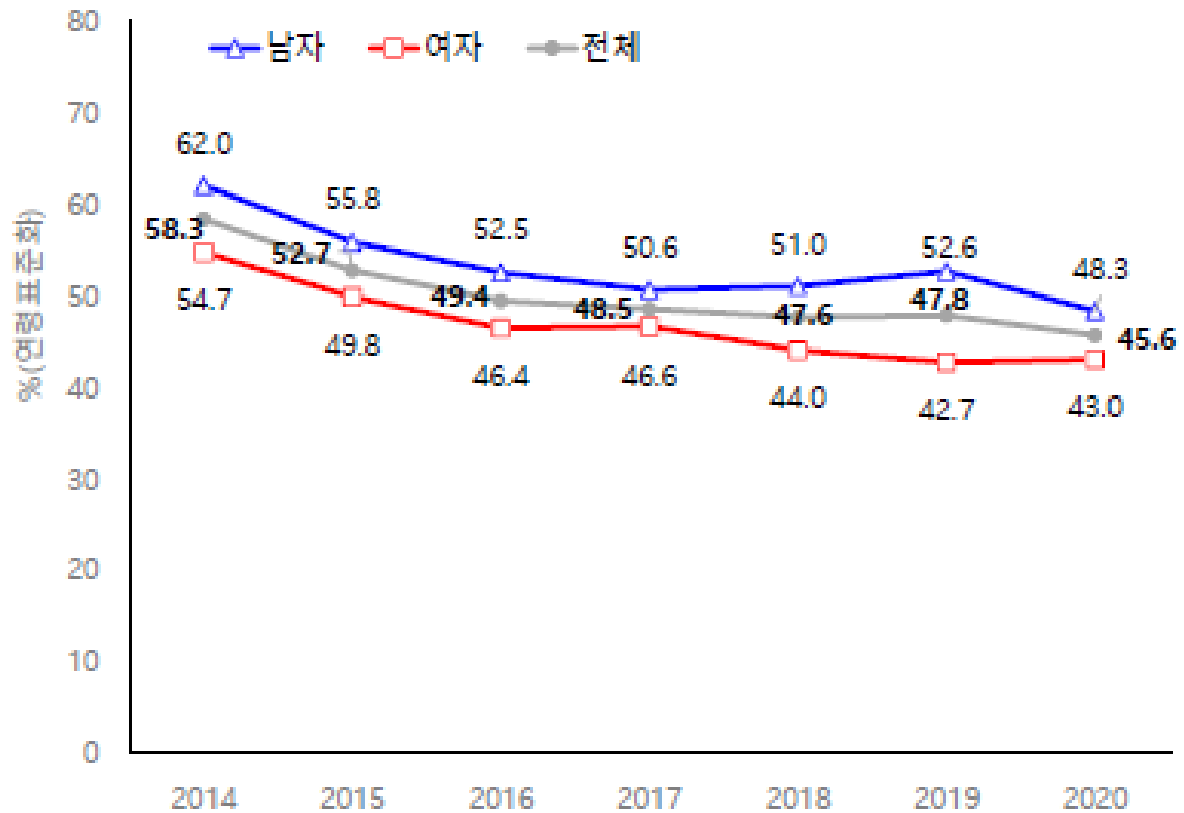
유산소 신체활동 실천율, 2020
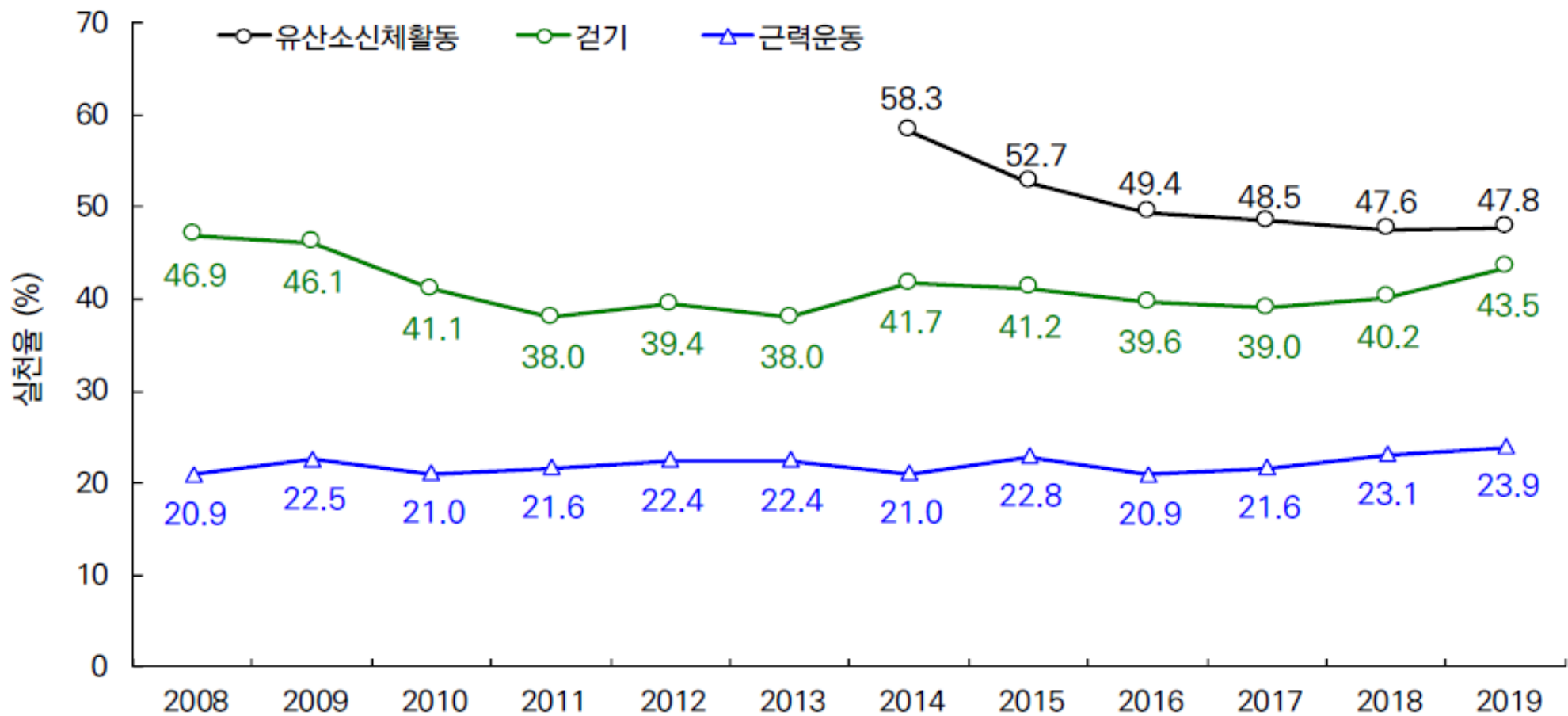
국민건강영양조사 2020

신체활동 실천율 추이

일상생활에서의 신체활동 현황　　학교에서의 신체활동 현황
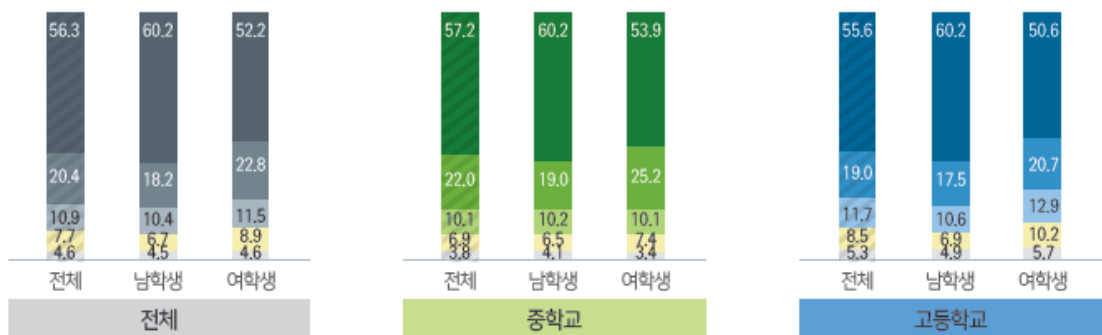
청소년건강행태조사 2019
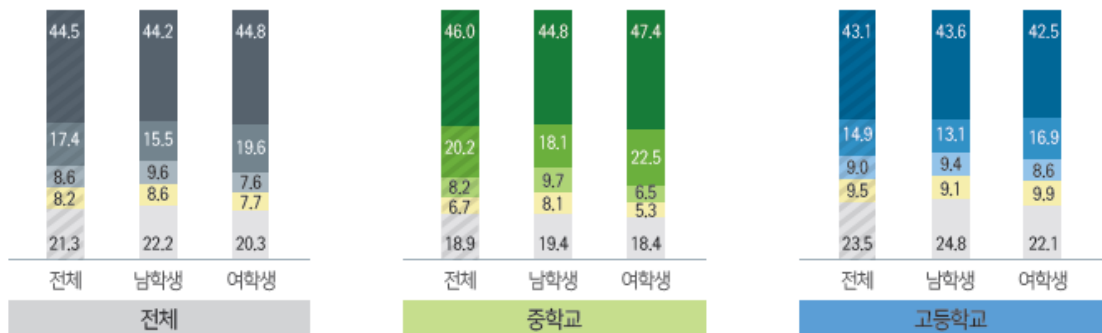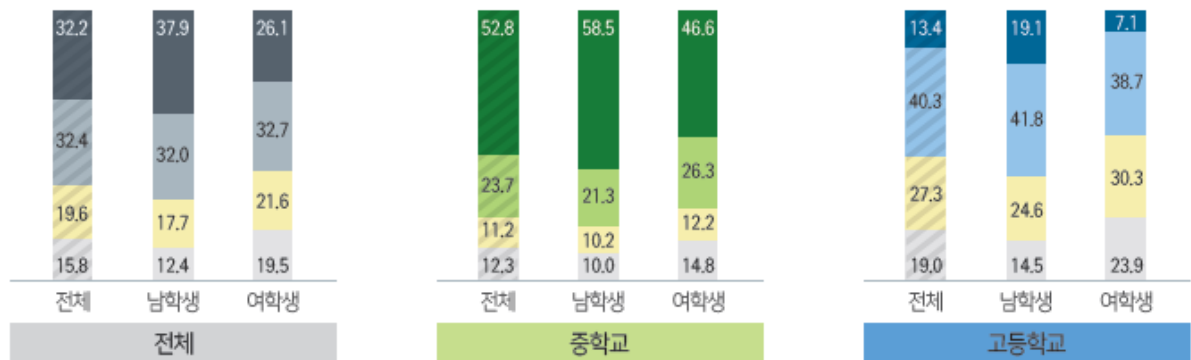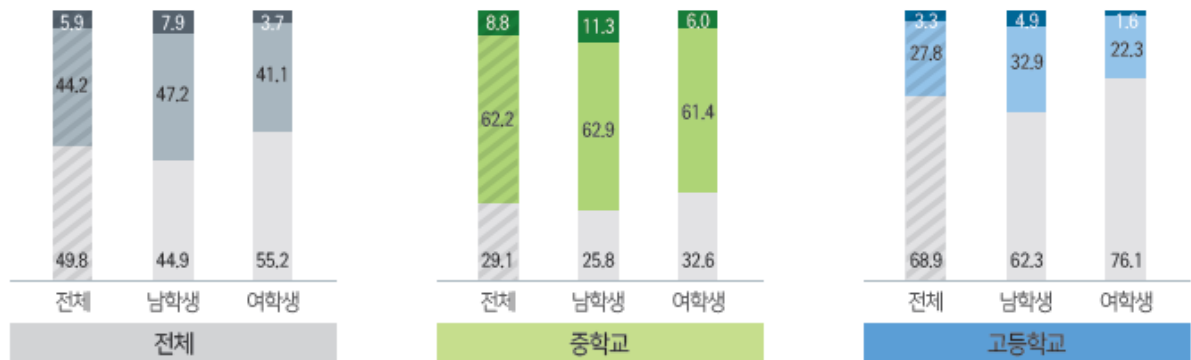
근력강화운동 실천율 추이

학교급별 근력강화운동 실천율 추이

청소년건강행태조사 2021
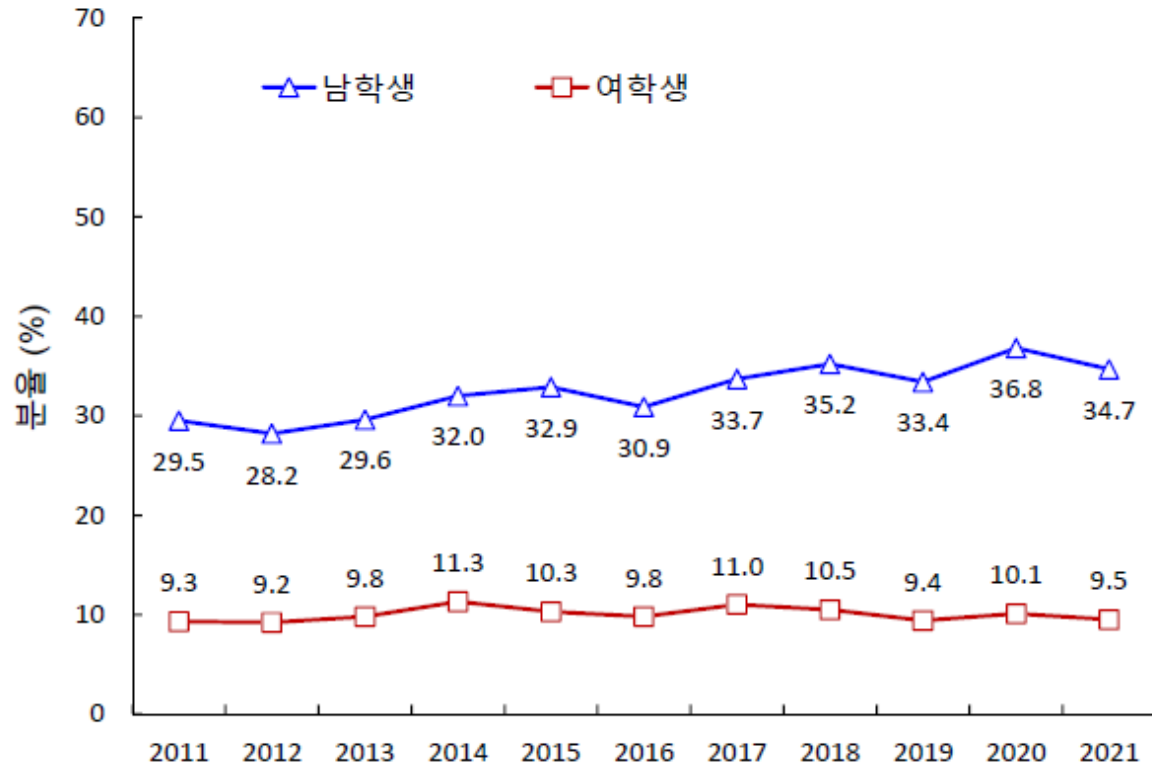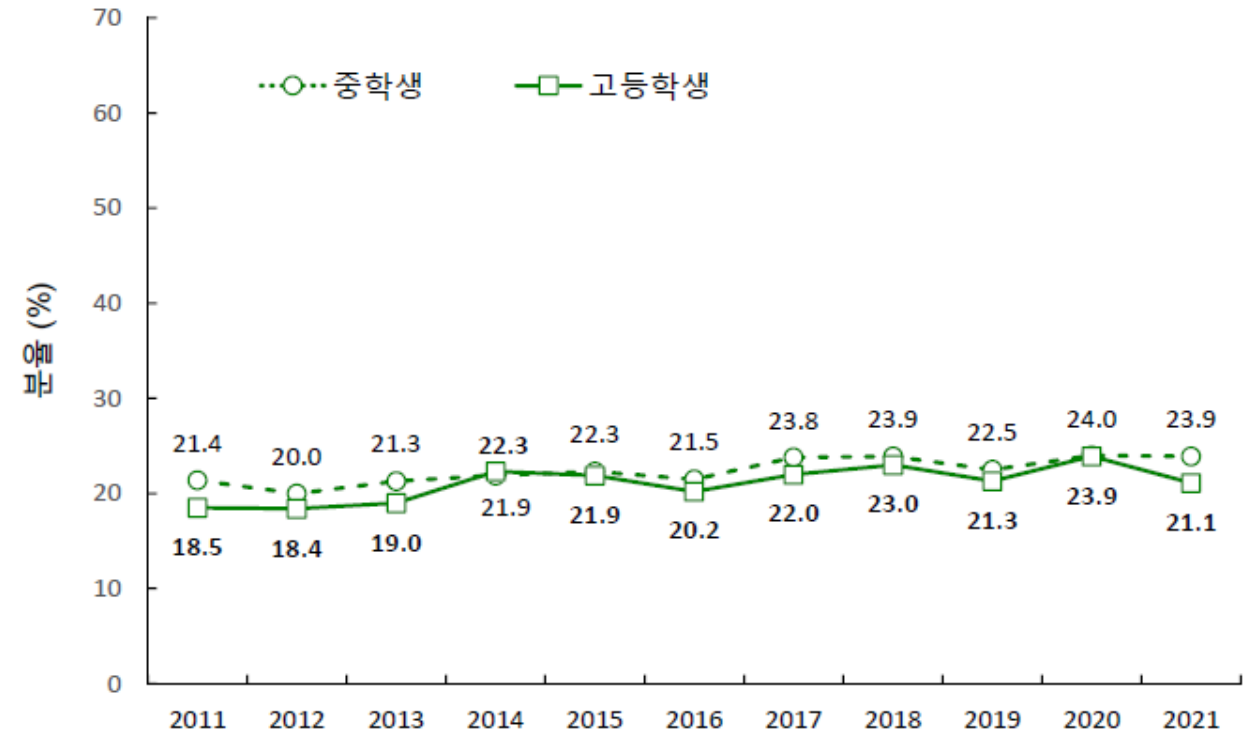
비만 진료시 흔히 듣는 얘기
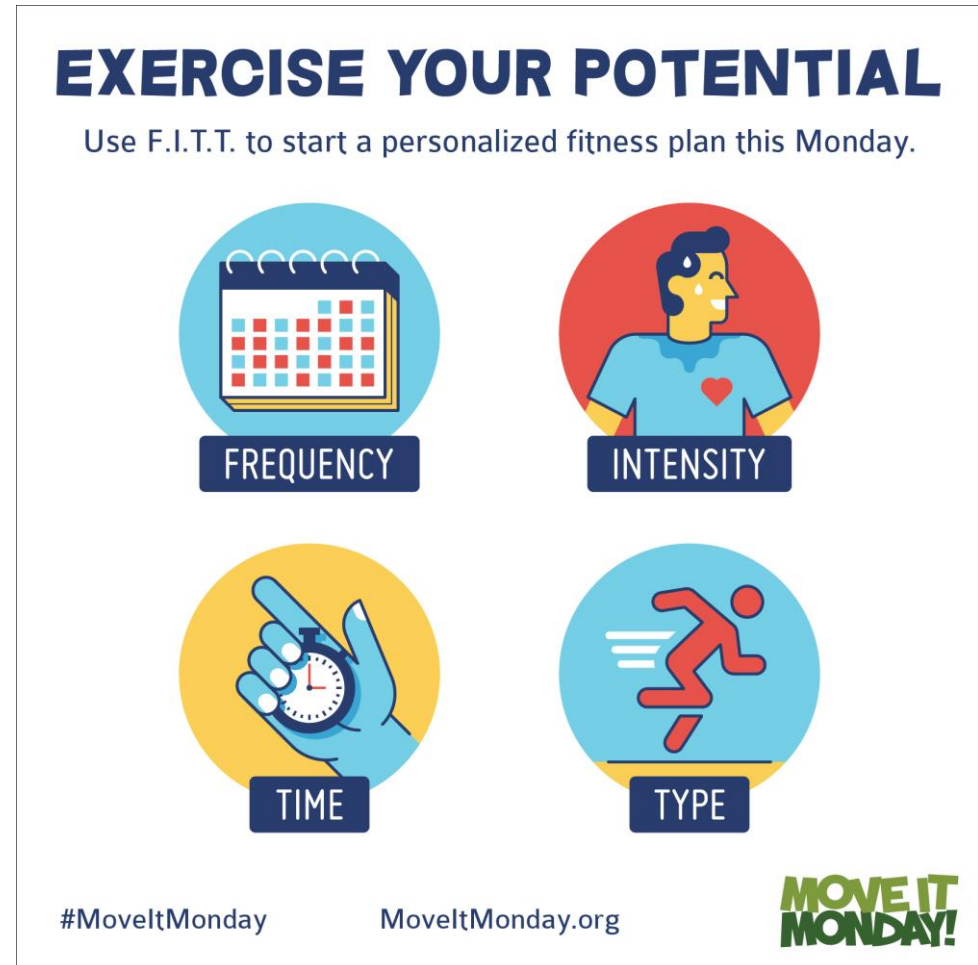
- 요즘 운동을 하지 못해서 체중이 늘었어요....

- 얼마나 운동을 해야 체중을 줄일 수 있을까?

FITT workout formula

- Frequency

- Intensity

- Time

- Type

EXERCISE YOUR POTENTIAL
Use F.I.T.T. to start a personalized fitness plan this Monday.

FREQUENCY

INTENSITY

TIME

TYPE

#MoveItMonday   MoveItMonday.org

MOVE IT MONDAY!

Classification of Physical Activity Intensity
 : Maximum Heart rate

Author	Equation	Population
Fox (19)	$HR_{max} = 220 - age.$	Small group of men and women
Astrand (9)	$HR_{max} = 216.6 - (0.84 \times age)$	Men and women ages 4–34 yr
Tanaka (48)	$HR_{max} = 208 - (0.7 \times age)$	Healthy men and women
Gellish (21)	$HR_{max} = 207 - (0.7 \times age)$	Men and women participants in an adult fitness program with broad range of age and fitness levels
Gulati (23)	$HR_{max} = 206 - (0.88 \times age)$	Asymptomatic middle-aged women referred for stress testing

Classification of Physical Activity Intensity

- Maximum Heart rate(MHR) : 220-Age

- Heart Rate Reserve(HRR)
  = MHR –resting heart rate

- Target Heart rate
  = (HHR × training %) + resting heart rate

Intensity	Relative Intensity	
	$\dot{V}O_2R(\%)$ HRR (%)	Maximal HR (%)
Very light	<20	<50
Light	20–<40	50–<64
Moderate	40–<60	64–<77
Vigorous (hard)	60–<85	77–<94
Vigorous (very hard)	85–<100	94–<100
Maximal	100	100

High intensity training in obesity: a Meta-analysis

Y. Türk[1], W. Theel[2,3], M. J. Kasteleyn[4,5], F. M. E. Franssen[6], P. S. Hiemstra[5], A. Rudolphus[1], C. Taube[5] and G. J. Braunstahl[1]

- High intensity training (HIT) is a time-effective alternative to traditional exercise programs which mostly involves a low to moderate intensity training of long duration

- HIT is defined as exercise performed at an intensity of > 65% of maximal capacity

Identification

Records identified through database searching (n = 4251)

Additional records identified through other sources (n = 2)

Screening

Records after duplicates removed (n = 1865)

Records screened (n = 339)

Records excluded (n = 258)

Eligibility

Full-text articles assessed for eligibility (n =81)

Full-text articles excluded, with reasons (n =63)

Not randomized : 18
Mean BMI <30: 26
Age >60 or <18: 3
Language: 2
Character of the intervention: 6
Same study population: 3
Outcome parameter: 5

Included

Studies included in qualitative synthesis (n =18)

Studies included in quantitative synthesis (meta-analysis) (n = 18)

Obesity Science & Practice 2017

Effect of HIT/HITT vs. lower intensity exercise on cardiopulmonary fitness (VO2max) and body composition

a	study (n)	participants (n)	MD (IV, Random, 95% CI)	p-value	I^2
VO$_{2max}$ (ml/kg/min)	15	469	1.83 [0.70, 2.96]	<0.05	31%
BMI (kg/m^2)	15	437	0.20 [-1.10, 1.50]	0.76	91%
Body weight (kg)	12	386	-1.18 [-4.16, 1.80]	0.44	0%
Body fat (%)	10	296	-1.69 [-3.10, -0.27]	0.02	30%
Waist circumference (cm)	8	253	-1.04 [-4.54, 2.45]	0.56	27%
b					
VO$_{2max}$ (ml/kg/min)	11	257	1.79 [0.21, 3.36]	0.03	38%
BMI (kg/m^2)	9	177	0.37 [-1.44, 2.18]	0.69	70%
Body weight (kg)	7	153	-0.42 [-5.30, 4.47]	0.87	7%
Body fat (%)	7	157	-2.01 [-3.73, -0.30]	0.02	0%
Waist circumference (cm)	5	111	-1.63 [-6.37, 3.10]	0.87	7%

Study or Subgroup	HIT			Traditional			Weight	Mean Difference IV, Random, 95% CI	Mean Difference IV, Random, 95% CI
	Mean	SD	Total	Mean	SD	Total			
Arad 2015	44.5	4	11	44.5	8	9	5.2%	0.00 [-5.74, 5.74]	
Cheema 2015	29.5	11.1	6	35	11.3	6	1.2%	-5.50 [-18.17, 7.17]	
Cocks 2015	31.8	6.51	8	29.6	4.8	8	5.5%	2.20 [-3.40, 7.80]	
Higgins 2016	41.2	4.8	23	44.2	4.4	29	17.1%	-3.00 [-5.53, -0.47]	
Landeata-Diaz 2012	34.5	5.41	20	37.24	6.75	20	10.2%	-2.74 [-6.53, 1.05]	
Lunt 2013	39	5.6	9	39	5.3	14	7.6%	0.00 [-4.59, 4.59]	
Mezghanni 2012	37.12	4.05	11	40.87	2.9	10	14.1%	-3.75 [-6.74, -0.76]	
Nicklas 2009	42.7	3	38	42.7	3.3	40	27.7%	0.00 [-1.40, 1.40]	
Sawyer 2016	44.8	5.8	9	46.4	7.3	9	4.7%	-1.60 [-7.69, 4.49]	
Skleryk 2013	27.2	5.94	8	32.3	3.96	8	6.7%	-5.10 [-10.05, -0.15]	
Total (95% CI)			143			153	100.0%	-1.69 [-3.10, -0.27]	

Heterogeneity: Tau^2 = 1.38; Chi^2 = 12.87, df = 9 (P = 0.17); I^2 = 30%
Test for overall effect: Z = 2.33 (P = 0.02)

Favours [HIT]   Favours [Traditional]

Figure 6 Forest plot of comparison: HIT vs. traditional exercise. Outcome: %body fat

Effectiveness of high-intensity interval training for weight loss in adults with obesity: a randomised controlled non-inferiority trial

Andrea D'Amuri,[1] Juana Maria Sanz,[2] Eleonora Capatti,[3] Francesca Di Vece,[3] Filippo Vaccari,[4] Stefano Lazzer,[4] Giovanni Zuliani,[1,3] Edoardo Dalla Nora,[3] Angelina Passaro [1,3]

- High-intensity interval training(HITT) vs. moderate-intensity continuous training (MICT)

- PA for weight loss. PA < 150 min/wk promotes minimal weight loss, PA > 150 min/wk results in modest weight loss of 2–3 kg, PA > 225–420 min/wk results in 5- to 7.5-kg weight loss, and a dose–response exist

  - American College of Sports Medicine position stand (2009)

Outcome measures	BDC	PTDC	Intervention effect MD (95% CI)	P value GLM change within-subjects	Intervention type	BDC	PTDC	P value Paired samples t-test	Intervention× intervention type effects MD (95% CI)	P value GLM change between-subjects
Weight (kg)	105.3±14.4	99.4±14.4	−5.9 (−7.8 to −4.0)	**<0.001**	**MICT**	107.1±17.4	101.1±17.9	**0.001**	−6.0 (−9.0 to −3.0)	0.860
					HIIT	102.8±11.0	97.1±10.2	**<0.001**	−5.7 (−8.3 to −3.1)	
BMI (kg/m^2)	35.6±4.4	33.6±4.5	−2.0 (−2.6 to −1.3)	**<0.001**	**MICT**	36.1±5.1	33.9±4.8	**0.001**	−2.1 (−3.2 to −1.1)	0.696
					HIIT	35.0±3.7	33.1±4.2	**<0.001**	−1.9 (−2.7 to −1.0)	
Waist (cm)										
Males	116.8±13.8	112.0±15.4	−11.4 (−15.6 to −7.1)	**<0.001**	**MICT**	116.5±17.1	109.6±17.7	0.369	−1.8 (−6.1 to 2.5)	0.039
					HIIT	117.1±9.5	101.2±9.0	**<0.001**	−8.5 (−10.9 to −6.1)	
Females	109.7±7.6	106.3±7.5	−17.8 (−22.8 to −12.8)	**<0.001**	**MICT**	108.6±8.1	90.1±11.5	**0.054**	−4.4 (−8.9 to 0.1)	0.774
					HIIT	110.6±7.6	93.4±10.4	**0.043**	−2.4 (−4.7 to −0.1)	
Hip (cm)										
Males	118.6±8.9	115.7±10.6	−3.0 (−4.8 to −1.2)	**0.003**	**MICT**	120.3±10.4	118.7±12.8	0.280	−1.5 (−4.6 to 1.5)	0.102
					HIIT	116.4±6.8	111.9±5.7	**0.001**	−4.5 (−6.4 to −2.5)	
Females	125.5±8.9	119.0±9.7	−6.6 (−9.6 to −3.6)	**<0.001**	**MICT**	126.7±11.6	118.0±9.9	**0.011**	−8.7 (−14.7 to −2.8)	0.155
					HIIT	124.4±6.4	119.9±10.0	**0.020**	−4.5 (−8.1 to −1.0)	
FM (kg)	38.0±9.5	32.7±9.4	−5.4 (−7.2 to−3.6)	**0.001**	**MICT**	37.7±10.9	32.4±9.1	**<0.001**	−5.3 (−7.8 to −2.8)	0.919
					HIIT	38.4±8.2	32.9±10.1	**0.001**	−5.5 (−8.3 to −2.6)	
FM (%)	36.5±8.3	33.2±8.8	−3.2 (−4.6 to −1.9)	**0.001**	**MICT**	35.4±8.9	32.5±8.3	**0.001**	−2.9 (−4.4 to −1.4)	0.619
					HIIT	37.3±7.7	33.7±9.2	**0.006**	−3.6 (−5.9 to −1.2)	
FFM (kg)	67.3±13.7	66.6±13.8	−4.1 (−14.0 to 5.8)	0.247	**MICT**	69.4±15.5	65.1±11.7	0.127	−5.3 (−7.8 to −2.8)	0.735
					HIIT	68.6±16.3	64.7±11.0	0.641	−5.5 (−8.3 to −2.6)	
FFM (%)	63.5±8.3	66.7±8.8	3.3 (1.9 to 4.7)	**0.001**	**MICT**	64.6±8.9	67.4±8.3	**0.002**	2.8 (1.3 to 4.4)	0.554
					HIIT	62.3±7.7	66.0±9.4	**0.008**	3.7 (1.2 to 6.3)	

Outcome measures	BDC	PTDC	Intervention effect MD (95% CI)	P value GLM change within-subjects	Intervention type	BDC	PTDC	P value Paired-samples t-test	Intervention×intervention type effects MD (95% CI)	P value GLM change between-subjects
Total cholesterol (mg/dL)	220.0±37.2	202.0±37.0	−17.8 (−27.9 to 7.79)	**0.001**	**MICT**	220.9±40.5	198.2±35.9	**0.012**	−22.7 (−39.6 to −5.9)	0.332
					HIIT	219.1±34.8	206.1±38.9	**0.038**	−13.0 (−25.2 to −0.9)	
LDL cholesterol (mg/dL)	145.3±30.1	129.7±33.7	−15.6 (−24.3 to −6.8)	**0.001**	**MICT**	143.0±28.0	126.6±31.4	**0.028**	−16.4 (−30.8 to −2.0)	0.839
					HIIT	147.7±33.0	133.0±36.9	**0.012**	−14.7 (−25.6 to −3.8)	
HDL cholesterol (mg/dL)										
Males	46.7±9.2	45.8±10.6	−0.6 (−4.9 to 3.6)	0.757	**MICT**	46.0±10.2	43.1±9.2	0.116	−2.9 (−6.7 to 0.9)	0.271
					HIIT	47.6±8.4	49.3±12.0	0.695	1.7 (−8.1 to 11.4)	
Females	53.6±15.6	50.7±10.9	−3.0 (−6.9 to 0.9)	0.117	**MICT**	58.2±19.7	54.0±13.5	0.228	−4.2 (−11.9 to 3.5)	0.514
					HIIT	49.6±10.7	47.8±7.9	0.382	−1.8 (−6.4 to 28)	
Triglycerides (mg/dL)	123.6±71.4	120.9±72.6	−7.5 (−56.1 to41.1)	0.837	**MICT**	132.8±88.3	118.9±66.3	0.470	−14.0 (−54.2 to 26.2)	0.297
					HIIT	113.6±48.7	123.0±81.0	0.388	9.4 (−13.2 to 32.0)	
Fasting glucose (mg/dL)	98.7±9.3	96.9±8.8	−1.8 (−4.2 to 0.7)	0.154	**MICT**	99.0±9.7	97.0±9.2	0.084	−2.0 (−4.3 to 0.3)	0.838
					HIIT	98.3±9.2	96.7±8.7	0.502	−1.5 (−6.3 to 3.2)	
Fasting insulin (µU/mL)	10.2±5.2	9.6±10.0	−0.6 (−3.3 to 2.0)	0.645	**MICT**	10.05±5.92	10.07±13.12	0.992	0.0 (−4.5 to 4.6)	0.633
					HIIT	10.27±4.40	9.05±5.35	0.393	−1.2 (−4.2 to 1.8)	
HOMA-IR index	2.5±1.4	2.4±2.8	−0.1 (−0.9 to 0.6)	0.706	**MICT**	2.48±1.59	2.53±3.70	0.935	0.1 (−1.2 to 1.3)	0.608
					HIIT	2.54±1.23	2.22±1.51	0.420	−0.3 (−1.2 to 0.5)	
SBP (mm Hg)	127±14	126±12	−0 (−4 to 4)	0.824	**MICT**	125±16	124±13	0.823	−1 (−7 to 6)	0.892
					HIIT	129±12	129±12	0.942	- (−5 – 5)	
DBP (mm Hg)	74±10	69±10	−6 (−9 to −2)	**0.003**	**MICT**	73±10	67±10	**0.039**	−6 (−11 to 0)	0.926
					HIIT	76±11	70±11	**0.039**	−6 (−11 to 0)	
HR (bpm)	73±11	62±10	−11 (−14 to −8)	**<0.001**	**MICT**	73±12	61±11	**0.001**	−12 (−17 to −8)	0.384
					HIIT	73±9	63±9	**0.001**	−9 (−14 to −4)	

Table 4 Effect of intervention (MICT vs HIIT) and group effect on CRF, calorie prescription and calorie intake

Outcome measures	BDC	PTDC	Intervention effect MD (95% CI)	P value GLM change within-subjectsts	Intervention type	BDC	PTDC	P value Paired-samples t-tests	Intervention× intervention type effects MD (95% CI)	P value GLM change between-subjects
VO$_2$peak (mL)	2952.5±736.1	3268.6±776.9	316.1 (241.0 to 391.1)	<0.001	**MICT**	3016.3±782.7	3186.9±770.7	0.001	170.5 (86.7 to 254.4)	<0.001
					HIIT	2888.7±706.2	3350.3±799.4	<0.001	461.6 (329.3 to 593.8)	
VO$_2$ peak/weight (mL/kg)	28.0±6.0	32.9±6.7	4.9 (3.9 to 5.9)	<0.001	**MICT**	28.3±6.5	31.6±16.1	<0.001	3.3 (2.0 to 4.6)	0.003
					HIIT	27.8±5.6	34.3±7.3	<0.001	6.5 (4.9 to 8.1)	
Calorie prescription (kcal)	2597.9±417.1	1657.4±529.8	−441 (−617 to −264)	<0.001	**MICT**	2161±462	1741±587	<0.001	−12.1 (−16.5 to −7.6)	0.816
					HIIT	2035±371	1574±470	<0.001	−9.3 (−14.3 to −4.4)	
Calorie intake (kcal)	2058.9±652.1	1657.4±529.8	−402 (−604 to −199)	<0.001	**MICT**	2273±730	1741±587	0.009	−532 (−911 to −152)	0.200
					HIIT	1845±499	1574±470	0.007	−272 (−457 to −86)	

Variable	MICT		HIIT		Pvalue
	Mean±SD	*Median (min – max)*	*Mean±SD*	*Median (min – max)*	
Number of sessions (n)	34,4±3,9	34,5 (32,4 – 36,5)	34,8±4,9	36,0 (32,2 – 37,4)	0,812
Time for session (min)	44,3±7,6	46,5 (40,2 – 48,3)	33,6±3,6	35,0 (31,7 –35,6)	**>0,001**
Energy expenditure for training session (kcal)	389,8±96,8	394,4 (338,3– 441,4)	350±68,6	332,0 (313,4 – 386,5)	0,189

MICT, Moderate Intensity Continuous Training. HIIT, High Intensity Interval Training.

The effects of exercise session timing on weight loss and components of energy balance: midwest exercise trial 2

Erik A. Willis[1,2] · Seth A. Creasy[3] · Jeffery J. Honas[4] · Edward L. Melanson[3,5,6] · Joseph E. Donnelly[4]

- Participants were physically inactive, overweight/obese (BMI 25–40 kg/m2) young adults (age 18–39 years)

- an early exerciser (Early-Ex; n=21) if they completed ≥50% of their total sessions between the hours of 7:00–11:59 am

- a sporadic exerciser (Sporadic-Ex; n=24) if they did not complete ≥50% of their total sessions in any time category

- A late exerciser (Late- Ex; n=25) if completing ≥50% of their total sessions between the hours 3:00–7:00 pm

- non-exercise control group

Table 1 Sample characteristics

	Early-EX (n = 21)		Late-EX (n = 25)		Sporadic-EX (n = 24)		Controls (n = 18)		p value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Age (yrs.)[a,b]	23.7	3.5	24.2	3.1	21.2	2.3	22.6	3.0	0.003
Weight (kg)	88.1	16.5	96.9	19.7	87.8	17.5	87.4	14.6	0.173
BMI (kg/m^2)	29.7	3.6	32.0	5.5	30.6	4.9	29.5	3.6	0.246
Body composition (kg)									
Fat mass	33.5	8.4	36.6	9.5	34.3	11.2	34.1	7.7	0.658
Fat-free mass	51.1	10.1	55.9	13	48.9	9.6	49.2	9.7	0.086
Time of exercise sessions (%)									
Early sessions (7:00 am–11:59 am)[c,d,e]	69.6	14.1	19.9	11.7	40.2	7.5	-	-	<0.0001
Mid-day sessions (12:00 pm–2:59 pm)[d,e]	11.4	10.5	12.8	9.8	27.0	10.6	-	-	<0.0001
Late sessions (3:00 pm or later)[c,d,e]	17.6	13.0	65.9	11.9	31.3	11.2	-	-	<0.0001
	N	%	N	%	N	%	N	%	
Female (n %)	10	47.6	11	44.0	15	62.5	50	9.0	0.601
Randomized group (n %)									0.424
400 kcal/session	8	38.1	14	56.0	13	54.2	-	-	
600 kcal/session	13	61.9	11	44.0	11	45.8	-	-	

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Weight change (%) at months 0, 3.5, 7, and 10 by group
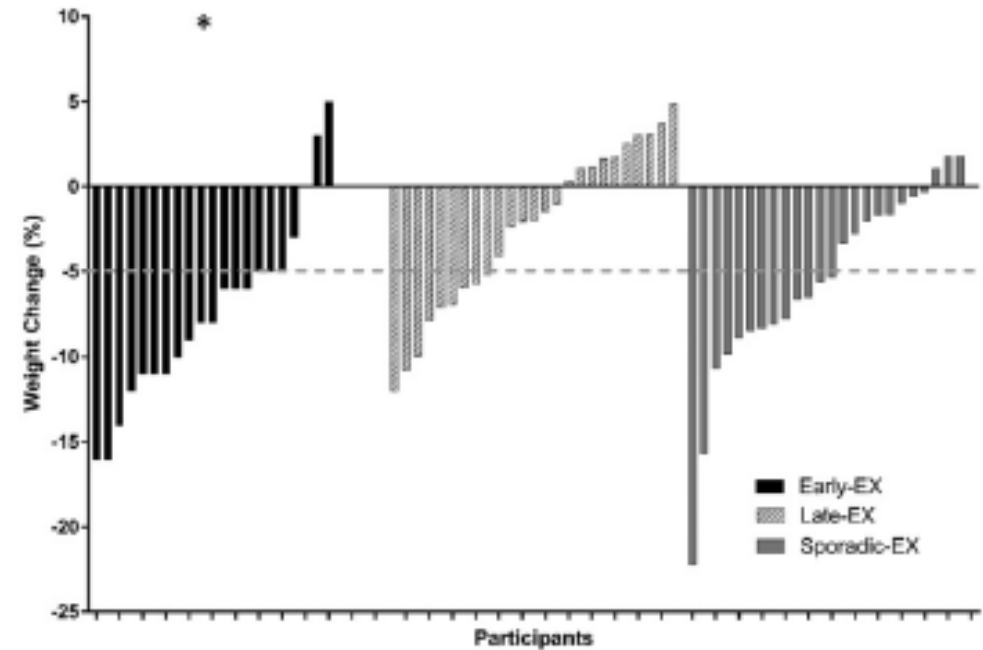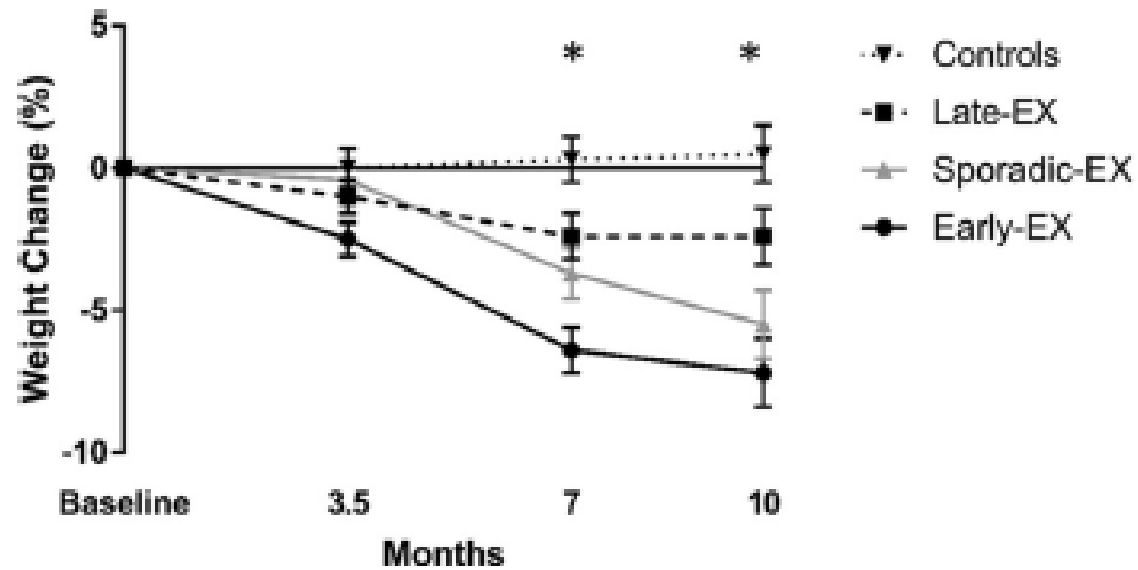
Table 2 A summary of the ANCOVA results for unadjusted and adjusted NExEE, TDEE, and RMR presented by group

	Baseline				10 Months				Change				p value
	N	Mean	95% CI		N	Mean	95% CI		N	Mean	95% CI		
Fat-free mass (kg)													0.140
Controls	18	49.2	44.3	54.0	18	50.4	44.8	55.9	18	1.8	0.6	3.0	
Early-EX	21	51.1	46.5	55.7	21	51.6	46.9	56.3	21	0.1	−0.7	0.9	
Late-EX	25	55.9	50.6	61.3	25	56.6	51.6	61.6	25	0.5	−0.3	1.2	
Sporadic-EX	24	48.9	44.8	52.9	24	48.7	44.9	52.6	24	0.0	−0.7	0.7	
Fat mass (kg)[a]													0.008
Controls	18	34.1	30.3	37.9	18	34.3	29.7	38.8	18	−1.5	−4.7	1.8	
Early-EX	21	33.5	29.6	37.3	21	26.6	23.2	30.0	21	−6.2	−8.3	−4.1	
Late-EX	25	36.6	32.7	40.5	25	34.4	30.0	38.8	25	−1.6	−3.5	0.2	
Sporadic-EX	24	34.3	29.5	39.0	24	30.4	25.3	35.4	24	−3.9	−5.8	−1.9	
TDEE (kcal/d)													0.462
Controls	18	2725	2296	3154	17	2736	2356	3117	17	−12	−385	362	
Early-EX	21	2637	2367	2907	16	2830	2551	3109	16	297	97	498	
Late-EX	25	3207	2903	3511	24	3466	3217	3714	24	226	−16	468	
Late-EX	25	1825	1658	1992	24	1875	1715	2036	24	45	−35	125	
Sporadic-EX	23	1681	1530	1832	23	1607	1494	1720	22	−79	−184	25	
RMR Adj. for FM and FFM (kcal/day)													0.673
Controls	18	1706	1626	1786	17	1680	1568	1792	17	−11	−140	118	
Early-EX	21	1794	1711	1876	16	1745	1635	1856	16	−41	−173	91	
Late-EX	25	1714	1646	1781	24	1749	1678	1819	24	45	−28	118	
Sporadic-EX	23	1758	1684	1832	23	1707	1637	1777	22	−62	−150	27	
NExEE (kcal/d)													0.470
Controls	18	818	516	1120	17	811	534	1088	17	−34	−404	335	
Early-EX	21	614	454	775	16	576	390	762	16	28	−210	266	
Late-EX	25	1061	844	1279	24	980	767	1192	24	−105	−321	110	
Sporadic-EX	23	761	612	910	23	742	533	951	22	12	−230	254	
NExEE Adj. for FM and FFM (kcal/day)													0.568
Controls	18	860	598	1122	17	809	564	1054	17	−75	−439	289	
Early-EX	21	630	491	770	16	623	435	811	16	46	−188	279	
Late-EX	25	999	772	1225	24	921	691	1150	24	−91	−299	116	
Sporadic-EX	23	807	666	947	23	786	583	988	22	10	−228	248	

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Resistance exercise, alone and in combination with aerobic exercise, and obesity in Dallas, Texas, US: A prospective cohort study

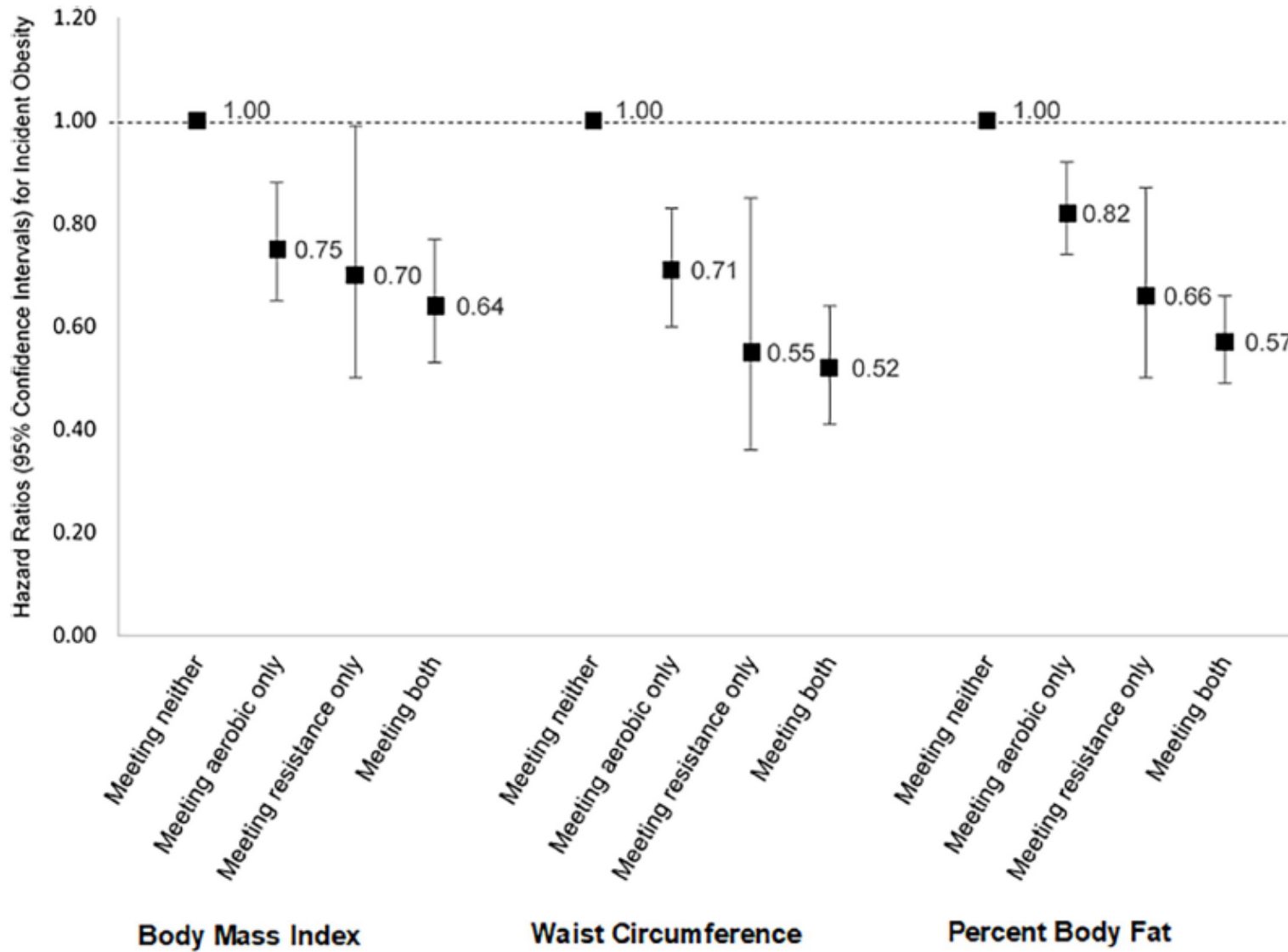Angelique G. Brellenthin[1]*, Duck-chul Lee[1], Jason A. Bennie[2], Xuemei Sui[3], Steven N. Blair[3]

- Participants were 11,938 healthy adults ages 18–89 years with a BMI < 30 kg/m2 at baseline

- Incident obesity was defined as a BMI 30 kg/m^2 , waist circumference (WC) > 102/88 cm for men/women, and percent body fat (PBF) ≥ 25%/30% for men/women at follow up

Table 2. Hazard ratios for incident obesity as defined by body mass index, waist circumference, or percent body fat by weekly minutes of resistance exercise.

Obesity outcome	Resistance exercise amount	Number (%) of participants	Number of cases	Hazard ratio (95% CI) or p-value for linear trend			
				Unadjusted model	Model 1*	Model 2†	Model 3‡
Body mass index ≥ 30 kg/m²§ (n = 11,938)	**Minutes per week**						
	0	8,504 (71)	666	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	1–59	824 (7)	56	0.89 (0.68–1.17)	0.76 (0.58–1.00)	0.78 (0.59–1.03)	0.86 (0.65–1.13)
	60–119	1,297 (11)	65	**0.75 (0.58–0.97)**	**0.61 (0.47–0.79)**	**0.64 (0.49–0.83)**	**0.70 (0.54–0.92)**
	120–179	622 (5)	44	1.18 (0.87–1.60)	0.88 (0.65–1.20)	0.90 (0.66–1.23)	0.99 (0.73–1.36)
	≥180	691 (6)	43	0.91 (0.67–1.24)	**0.72 (0.53–0.98)**	**0.73 (0.54–0.996)**	0.81 (0.59–1.10)
				p = 0.35	**p < 0.001**	**p = 0.002**	**p = 0.05**
	Any resistance exercise						
	No (0 min/wk)	8,504 (71)	666	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	Yes (≥1 min/wk)	3,434 (29)	208	0.89 (0.76–1.04)	**0.72 (0.61–0.84)**	**0.74 (0.63–0.87)**	**0.81 (0.69–0.96)**
Waist circumference: >102 cm for men, >88 for women‖ (n = 9,490)	**Minutes per week**						
	0	6,618 (70)	582	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	1–59	694 (7)	44	**0.73 (0.54–0.99)**	**0.69 (0.51–0.94)**	**0.71 (0.52–0.96)**	0.78 (0.57–1.06)
	60–119	1,076 (11)	45	**0.55 (0.41–0.74)**	**0.52 (0.38–0.70)**	**0.54 (0.39–0.73)**	**0.59 (0.44–0.81)**
	120–179	517 (6)	28	0.79 (0.53–1.14)	0.70 (0.48–1.03)	0.72 (0.49–1.06)	0.80 (0.54–1.18)
	≥180	585 (6)	27	**0.59 (0.40–0.87)**	**0.57 (0.38–0.83)**	**0.57 (0.39–0.84)**	**0.64 (0.43–0.94)**
				p < 0.001	**p < 0.001**	**p < 0.001**	**p < 0.001**
	Any resistance exercise						
	No (0 min/wk)	6,618 (70)	582	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	Yes (≥1 min/wk)	2,872 (30)	144	**0.64 (0.54–0.77)**	**0.61 (0.50–0.73)**	**0.62 (0.51–0.75)**	**0.69 (0.57–0.83)**
Percent body fat: ≥25% for men, ≥30% for women¶ (n = 8,733)	**Minutes per week**						
	0	5,980 (68)	1,323	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	1–59	650 (7)	105	**0.73 (0.60–0.89)**	**0.71 (0.58–0.86)**	**0.72 (0.59–0.88)**	**0.76 (0.62–0.93)**
	60–119	1,020 (12)	131	**0.64 (0.54–0.77)**	**0.63 (0.52–0.75)**	**0.64 (0.54–0.77)**	**0.69 (0.57–0.83)**
	120–179	499 (6)	65	**0.71 (0.56–0.91)**	**0.67 (0.52–0.86)**	**0.68 (0.53–0.88)**	**0.73 (0.56–0.94)**
	≥180	584 (7)	59	**0.49 (0.37–0.63)**	**0.49 (0.38–0.64)**	**0.50 (0.39–0.65)**	**0.53 (0.41–0.70)**
				p < 0.001	**p < 0.001**	**p < 0.001**	**p < 0.001**
	Any resistance exercise						
	No (0 min/wk)	5,980 (68)	1,323	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	Yes (≥1 min/wk)	2,753 (32)	360	**0.64 (0.57–0.72)**	**0.63 (0.56–0.71)**	**0.64 (0.57–0.72)**	**0.68 (0.60–0.77)**

Table 3. Hazard ratios for incident obesity as defined by body mass index, waist circumference, or percent body fat by weekly frequency of resistance exercise.

Obesity outcome	Resistance exercise frequency	Number (%) of participants	Number of cases	Hazard ratio (95% CI) or p-value for linear trend			
				Unadjusted model	Model 1*	Model 2†	Model 3‡
Body mass index ≥ 30 kg/m²§ ($n = 11,938$)	**Days per week**						
	0	8,504 (71)	666	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	1	253 (2)	14	1.02 (0.60–1.73)	0.72 (0.42–1.23)	0.74 (0.73–1.25)	0.80 (0.47–1.35)
	2	927 (8)	52	0.88 (0.66–1.16)	**0.69 (0.52–0.92)**	**0.72 (0.54–0.95)**	0.79 (0.59–1.05)
	3	1,509 (13)	107	1.00 (0.81–1.22)	0.83 (0.67–1.01)	0.85 (0.69–1.04)	0.94 (0.76–1.16)
	4	413 (3)	18	**0.58 (0.37–0.93)**	**0.48 (0.30–0.76)**	**0.49 (0.31–0.79)**	**0.55 (0.34–0.88)**
	≥ 5	332 (3)	17	0.73 (0.45–1.18)	**0.61 (0.38–0.99)**	0.62 (0.38–1.01)	0.69 (0.42–1.11)
				$p = 0.06$	**$p < 0.001$**	**$p < 0.001$**	**$p = 0.01$**
	Meeting resistance exercise guidelines						
	No (<2 d/wk)	8,757 (73)	680	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	Yes (≥ 2 d/wk)	3,181 (27)	194	0.88 (0.75–1.03)	**0.72 (0.62–0.85)**	**0.75 (0.63–0.88)**	**0.82 (0.69–0.97)**
Waist circumference: >102 cm for men, >88 for women‖ ($n = 9,490$)	**Days per week**						
	0	6,618 (70)	582	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	1	218 (2)	9	0.67 (0.35–1.30)	0.61 (0.31–1.17)	0.62 (0.32–1.20)	0.67 (0.35–1.30)
	2	773 (8)	31	**0.55 (0.38–0.79)**	**0.52 (0.36–0.75)**	**0.54 (0.37–0.78)**	**0.60 (0.41–0.87)**
	3	1,260 (13)	79	**0.77 (0.61–0.98)**	**0.73 (0.58–0.93)**	**0.75 (0.59–0.95)**	0.83 (0.65–1.06)
	4	352 (4)	13	**0.43 (0.25–0.74)**	**0.40 (0.23–0.70)**	**0.41 (0.24–0.72)**	**0.46 (0.27–0.80)**
	≥ 5	269 (3)	12	**0.55 (0.31–0.98)**	**0.51 (0.29–0.90)**	**0.50 (0.28–0.90)**	**0.56 (0.31–0.99)**
				$p < 0.001$	**$p < 0.001$**	**$p < 0.001$**	**$p < 0.001$**
	Meeting resistance exercise guidelines						
	No (<2 d/wk)	6,836 (72)	591	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	Yes (≥ 2 d/wk)	2,654 (28)	135	**0.65 (0.54–0.78)**	**0.61 (0.51–0.74)**	**0.63 (0.52–0.76)**	**0.70 (0.57–0.85)**
Percent body fat: $\geq 25\%$ for men, $\geq 30\%$ for women¶ ($n = 8,733$)	**Days per week**						
	0	5,980 (68)	1,323	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	1	198 (2)	21	**0.61 (0.40–0.94)**	**0.58 (0.38–0.90)**	**0.59 (0.38–0.91)**	**0.62 (0.40–0.95)**
	2	745 (9)	89	**0.62 (0.50–0.77)**	**0.62 (0.50–0.77)**	**0.63 (0.51–0.79)**	**0.68 (0.54–0.84)**
	3	1,203 (14)	181	**0.73 (0.62–0.85)**	**0.71 (0.61–0.83)**	**0.73 (0.62–0.85)**	**0.78 (0.66–0.91)**
	4	337 (4)	37	**0.48 (0.34–0.66)**	**0.47 (0.34–0.65)**	**0.48 (0.34–0.66)**	**0.51 (0.37–0.71)**
	≥ 5	270 (3)	32	**0.57 (0.40–0.81)**	**0.53 (0.37–0.75)**	**0.54 (0.38–0.77)**	**0.58 (0.41–0.83)**
				$p < 0.001$	**$p < 0.001$**	**$p < 0.001$**	**$p < 0.001$**
	Meeting resistance exercise guidelines						
	No (<2 d/wk)	6,178 (71)	1,344	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
	Yes (≥ 2 d/wk)	2,555 (29)	339	**0.65 (0.58–0.73)**	**0.64 (0.57–0.72)**	**0.65 (0.58–0.74)**	**0.70 (0.62–0.79)**

PLOS Medicine 2021

Effects of supervised and unsupervised physical activity programmes for weight loss

S. A. Creasy[1,2,], R. J. Rogers[1], K. K. Davis[1], B. B. Gibbs[1], E. E. Kershaw[3] and J. M. Jakicic[1]

Objectives

Physical activity is important for weight management. However, it remains unclear what type of physical activity prescription/programme is optimal for increasing physical activity during a standard behavioural weight loss intervention. This study examined changes in physical activity after a 12-week supervised programme prescribed in minutes per week (SUP-PA), an unsupervised programme prescribed in minutes per week (UNSUP-PA) and an unsupervised programme prescribed in steps per day (STEP).

Methods

Fifty-two adults who were overweight or obese (age: 43.5 ± 10.1 years, BMI: 31.5 ± 3.5 kg$\cdot$m^{-2}) were randomized to STEP ($n = 18$), UNSUP-PA ($n = 17$) and SUP-PA ($n = 17$). Subjects attended weekly in-person group intervention sessions and were prescribed a calorie-restricted diet (1,200–1,800 kcals$\cdot$day^{-1}) combined with increased physical activity (150 min$\cdot$week^{-1} or 10,000 steps$\cdot$day^{-1} with 2,500 brisk steps$\cdot$day^{-1}).

Results

All three groups significantly increased moderate-to-vigorous physical activity (STEP: 80.6 ± 218.5 min$\cdot$week^{-1}, UNSUP-PA: 112.9 ± 180.4 min$\cdot$week^{-1} and SUP-PA: 151.1 ± 174.0 min$\cdot$week^{-1}, $p < 0.001$) with no differences between groups ($p = 0.94$) or group by time interaction ($p = 0.81$). In addition, there were no significant differences in weight loss between the groups ($p = 0.81$).

Conclusions

In this short-term study, all three physical activity programmes increased physical activity and elicited modest weight loss when combined with a standard behavioural weight loss intervention.
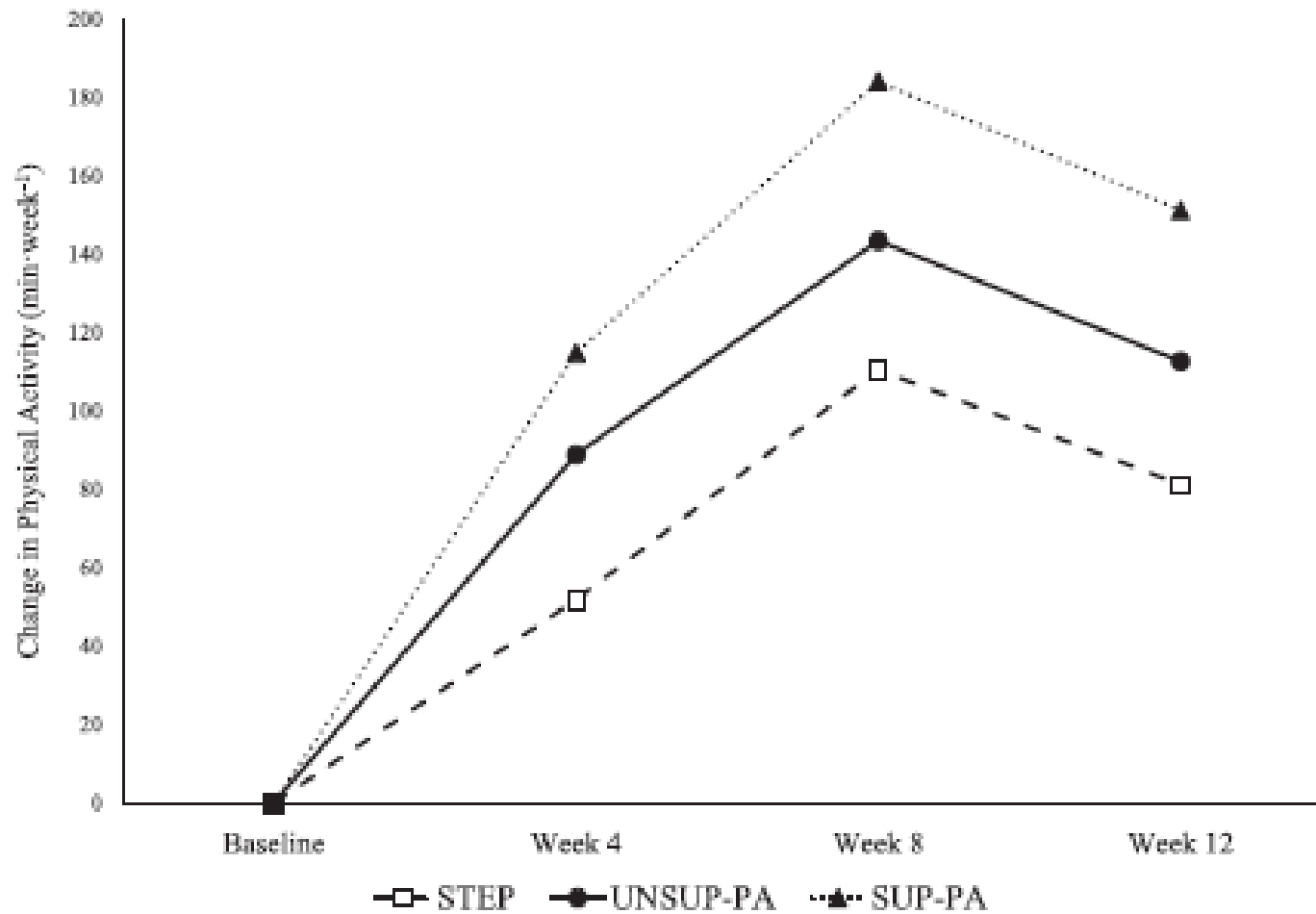
Figure 2 Change in objectively measured moderate-to-vigorous physical activity completed in bouts of ≥10 min.

Table 3 Change in weight, body composition, anthropometrics and fitness

Outcome	Group	Baseline	12 weeks	Change	P-values Group	P-values Time	P-values Group × Time
Weight (kg)	STEP (n = 17)	87.7 ± 14.7	82.3 ± 14.1	−5.3 ± 3.6	0.81	<0.001	0.36
	UNSUP-PA (n = 16)	86.8 ± 13.1	81.6 ± 11.8	−5.1 ± 3.3			
	SUP-PA (n = 16)	84.0 ± 13.7	80.1 ± 13.2	−3.8 ± 3.0			
Percent weight change (%)	STEP (n = 17)			−6.0 ± 4.0	0.43		
	UNSUP-PA (n = 16)			−5.8 ± 3.6			
	SUP-PA (n = 16)			−4.5 ± 3.5			
Fat mass (kg)	STEP (n = 17)	33.7 ± 6.3	29.6 ± 6.2	−4.1 ± 2.4			
	UNSUP-PA (n = 16)	35.4 ± 7.6	31.3 ± 8.2	−4.0 ± 2.8	0.77	<0.001	0.95
	SUP-PA (n = 15)	34.6 ± 6.7	30.8 ± 6.4	−3.8 ± 2.8			
Fat free mass (kg)	STEP (n = 17)	50.9 ± 10.5	49.7 ± 10.5	−1.2 ± 1.7	0.69	<0.001	0.06
	UNSUP-PA (n = 16)	48.2 ± 9.9	47.2 ± 9.3	−1.0 ± 1.1			
	SUP-PA (n = 15)	47.3 ± 11.1	47.3 ± 11.2	−0.1 ± 1.4			
Total body fat (%)	STEP (n = 17)	38.7 ± 4.6	36.2 ± 5.6	−2.5 ± 2.1	0.49	<0.001	0.96
	UNSUP-PA (n = 16)	41.1 ± 6.9	38.5 ± 8.4	−2.6 ± 2.3			
	SUP-PA (n = 15)	41.2 ± 6.8	38.5 ± 7.2	−2.7 ± 2.2			
Waist circumference (cm)	STEP (n = 17)	100.1 ± 9.6	94.6 ± 8.4	−5.5 ± 5.8	0.68	<0.001	0.32
	UNSUP-PA (n = 16)	101.8 ± 6.8	97.9 ± 8.3	−3.9 ± 5.6			
	SUP-PA (n = 15)	101.8 ± 9.2	94.7 ± 9.3	−7.0 ± 5.9			
Hip circumference (cm)	STEP (n = 17)	109.5 ± 8.8	105.3 ± 7.1	−4.2 ± 3.9	0.67	<0.001	0.65
	UNSUP-PA (n = 16)	109.8 ± 6.5	105.7 ± 7.3	−4.0 ± 2.7			
	SUP-PA (n = 15)	111.3 ± 9.2	108.1 ± 8.1	−3.2 ± 3.2			
Peak VO$_2$ (mL kg·min^{-1})	STEP (n = 17)	27.9 ± 5.5	29.2 ± 6.0	1.3 ± 2.4	0.26	<0.001	0.01
	UNSUP-PA (n = 16)	23.9 ± 4.5	27.7 ± 5.7	3.8 ± 3.2			
	SUP-PA (n = 16)	24.4 ± 4.2	28.2 ± 4.9	3.8 ± 1.6			
Peak VO$_2$ (L·min^{-1})	STEP (n = 17)	2.43 ± 0.56	2.39 ± 0.60	−0.04 ± 0.19	0.44	<0.001	<0.01
	UNSUP-PA (n = 16)	2.08 ± 0.52	2.25 ± 0.54	0.17 ± 0.24			
	SUP-PA (n = 16)	2.09 ± 0.59	2.31 ± 0.71	0.22 ± 0.23			

Effect of different doses of supervised exercise on food intake, metabolism, and non-exercise physical activity: The E-MECHANIC randomized controlled trial

Corby K Martin,[1] William D Johnson,[1] Candice A Myers,[1] John W Apolzan,[1] Conrad P Earnest,[2] Diana M Thomas,[3] Jennifer C Rood,[1] Neil M Johannsen,[1,4] Catrine Tudor-Locke,[1,5] Melissa Harris,[1] Daniel S Hsia,[1] and Timothy S Church[1]

- Exercise is commonly recommended for weight management, yet in long-term (≥6 mo) but not short-term studies, actual weight loss consistently is only ~30–40% of expected based on measured energy expenditure

- overweight or obesity were randomized for 24 wk to a no-exercise control group or 1 of 2 supervised exercise groups: 8 kcal/kg of body weight/wk (KKW) or 20 KKW

TABLE 2 Predicted weight loss, compensation, change from week 0 to week 24 by group on outcome variables, and mean energy expenditure during exercise training for the 2 exercise groups[1]

Variable	Control	8 KKW	20 KKW	Group P value
Predicted weight loss[2] (kg)	0.0 (−0.1, 0.1)	−1.9 (−2.1, −1.7)	−4.3 (−4.5, −4.1)	
Actual weight change (kg)	−0.2[a] (−1.0, 0.6)	−0.4[a,b] (−1.2, 0.4)	−1.6[b] (−2.4, −0.8)	0.02*
Compensation (kg)	0.0[a] (−0.5, 0.5)	1.5[b] (0.9, 2.2)	2.7[c] (2.0, 3.5)	0.01*
Energy intake, adjusted DLW (kcal/d)	−2.3[a] (−58.0, 53.5)	90.7[b] (35.1, 146.4)	123.6[b] (64.5, 182.7)	<0.01*
Energy intake, DLW (kcal/d)	−24.7[a] (−82.2, 32.9)	71.1[b] (13.6, 128.6)	90.5[b] (29.5, 151.6)	<0.01*
Change in energy intake, adjusted DLW (%)	0.0[a] (−2.2, 2.3)	3.9[b] (1.7, 6.2)	5.5[b] (3.1, 7.9)	<0.01*
Change in energy intake, DLW (%)	−0.8[a] (−3.1, 1.5)	3.2[b] (0.9, 5.6)	4.2[b] (1.8, 6.7)	<0.01*
Energy intake—buffet (kcal at lunch and dinner combined)	−88.1 (−197.4, 21.2)	−106.2 (−216.0, 3.6)	−72.0 (−183.9, 40.0)	0.90
Percentage body fat	0.1[a] (−0.4, 0.6)	−0.05[a,b] (−0.6, 0.5)	−0.8[b] (−1.4, −0.3)	0.04*
Body fat (kg)	0.1[a] (−0.6, 0.8)	−0.2[a,b] (−0.9, 0.5)	−1.4[b,†] (−2.1, −0.6)	<0.01*
Lean body mass (kg)	−0.4 (−0.8, −0.1)	−0.3 (−0.6, 0.1)	−0.1 (−0.5, 0.2)	0.51
VO_2 (L/min)	−0.11[a] (−0.16, −0.05)	0.11[b] (−0.05, 0.16)	0.28[c] (0.21, 0.34)	<0.01
VO_2 (mL·kg^{-1}·min^{-1})	−1.5[a] (−2.4, −0.6)	0.6[b] (−0.3, 1.5)	3.1[c] (2.2, 4.1)	<0.01
Systolic blood pressure (mm Hg)	−1.9 (−4.0, 0.2)	−1.1 (−3.2, 1.1)	−0.3 (−2.5, 2.0)	0.56
Diastolic blood pressure (mm Hg)	−0.8 (−2.3, 0.8)	−0.2 (−1.8, 1.4)	1.4 (−0.3, 3.1)	0.14
Total activity (min/d)	−7.2 (−16.0, 1.7)	−8.5 (−17.3, 0.3)	2.7 (−6.5, 11.8)	0.16
Moderate (min/d)	−5.7 (−14.1, 2.6)	−8.2 (−16.5, 0.0)	2.1 (−6.6, 10.7)	0.19
Vigorous (min/d)	0.2 (−0.2, 0.5)	0.0 (−0.3, 0.4)	0.4 (0.1, 0.8)	0.21
Very vigorous[3] (min/d)	−0.5 (−1.1, 0.1)	0.0 (−0.5, 0.6)	−0.0 (−0.6, 0.5)	0.39
RMR-adjusted (kcal/d)	16.4 (−44.9, 77.8)	57.0 (−5.7, 119.6)	17.6 (−48.7, 83.9)	0.57
RMR-Galgani (kcal/d)	14.3 (−46.8, 75.5)	56.7 (−5.9, 119.4)	19.3 (−46.9, 85.5)	0.56
RQ	0.000 (−0.015, 0.015)	−0.000 (−0.016, 0.015)	−0.017 (−0.033, −0.001)	0.20
FPQ, high fat/high carb	−0.14[a,b] (−0.53, 0.26)	0.20[a] (−0.21, 0.61)	−0.53[b] (−0.97, −0.10)	0.04*
VAS, after dinner, desire[3]	4.47[a] (0.58, 8.37)	3.41[a,b] (−0.56, 7.37)	−2.75[b] (−6.99, 1.48)	0.02*
SF-36, social functioning[3]	−4.99[a,b] (−9.83, −0.15)	−1.75[a] (−6.73, 3.24)	−5.80[b] (−11.06, −0.53)	0.046*
Exercise EE prescribed (kcal)	—	16,973 (15,606, 18,340)	39,690 (38,220, 41,161)	<0.01*
Exercise EE achieved (kcal)	—	17,114 (15,708, 18,520)	38,956 (37,444, 40,468)	<0.01*

TABLE 3 Change on the outcome variables for compensators and noncompensators[1]

Variable	Noncompensators	Compensators	P value
Weight (kg)	−2.69 (−3.23, −2.16)	0.78 (−0.25, 1.30)	<0.01*
BMI (kg/m^2)	−0.73 (−0.98, −0.47)	0.46 (0.20, 0.72)	<0.01*
Percentage body fat	−0.99 (−1.47, −0.52)	0.20 (−0.27, 0.67)	<0.01*
Fat mass (kg)	−1.90 (−2.50, −1.30)	0.49 (−0.10, 1.07)	<0.01*
Lean mass (kg)	−0.59 (−0.93, −0.24)	0.17 (−0.17, 0.51)	<0.01*
VO_2 (mL·kg^{-1}·min^{-1})	2.73 (1.65, 3.81)	1.27 (0.22, 2.33)	0.046*
Glucose (mg/dL)	0.21 (−1.60, 2.03)	−2.33 (−4.10, −0.56)	0.04*
Very vigorous[2] (min/d)	−0.01 (−0.11, 0.09)	−0.10 (−0.20, 0.01)	0.03*
RMR-adjusted (kcal/d)	−0.3 (−63.5, 63.0)	85.4 (23.7, 147.1)	0.05*
RMR-Galgani (kcal/d)	0.5 (−60.7, 61.7)	84.8 (24.6, 144.9)	0.04*
Energy intake, adjusted DLW (kcal/d)	60.4 (0.8, 120.1)	149.3 (91.1, 207.6)	0.03*
Energy intake, DLW (kcal/day)	14.26 (−44.94, 73.47)	144.36 (86.56, 202.16)	<0.01*
Compensatory health beliefs	−2.14 (−4.13, −0.15)	1.25 (−0.68, 3.17)	0.01*
Eating Inventory, disinhibition	−1.27 (−1.93, −0.61)	−0.28 (−0.92, 0.36)	0.02*
FCI, sweets	−0.17 (−0.44, 0.11)	0.31 (0.05, 0.57)	0.01*
FPQ, high carbs	0.26 (−0.18, 0.70)	−0.37 (−0.79, 0.06)	0.03*
FPQ, low fat	0.25 (−0.16, 0.66)	−0.40 (−0.79, 0.00)	0.02*
FPQ, low fat/high carb	0.40 (−0.05, 0.85)	−0.39 (−0.83, 0.05)	0.01*
PSQI, sleep disturbance[2]	−0.13 (−0.28, 0.03)	0.12 (−0.03, 0.27)	0.02*
SF-36, bodily pain	1.30 (−3.72, 6.31)	−6.61 (−11.46, −1.76)	0.02*
SF-36, role emotional[2]	−5.18 (−10.97, 0.61)	2.36 (−3.23, 7.96)	0.03*
SF-36, physical component summary	1.88 (0.16, 3.59)	−1.20 (−2.86, 0.46)	0.01*
SF-36, mental component summary	−2.50 (−4.34, −0.67)	0.84 (−0.93, 2.62)	0.01*
VAS, retrospective, hunger	−2.31 (−7.42, 2.81)	5.11 (0.13, 10.09)	0.03*
VAS, retrospective, PCF	−3.82 (−8.15, 0.52)	2.34 (−1.88, 6.56)	0.03*

Effect of exercise on energy balance

- the process of energy balance is dynamic and complicated, with physical activity influencing a variety of factors in addition to energy expenditure

- signaling pathways that influence energy intake, with some signals stimulating an increase in energy intake and others stimulating a decrease in energy intake

- physical activity can stimulate responses in both adipose tissue and muscle tissue

ACSM guideline

- **Frequency:** 5 d/wk to maximize caloric expenditure

- **Intensity:** Moderate to vigorous intensity aerobic activity (40%–60% VO2R or HRR)

- **Time:** A minimum of 30 min/d (*i.e.*, 150 min/wk) progressing to 60 min/d (*i.e.*, 300 min/wk) of moderate intensity, aerobic activity. Accumulation of intermittent exercise of at least 10 min is an effective

- **Type:** The primary mode of exercise should be aerobic physical activities that involve the large muscle groups

비만 진료지침

- 운동치료 전 건강상태 평가를 시행, 심혈관, 대사성, 신장질환이 있는 경우는 의사 상담 후 운동을 권고하고 그 외에는 저-중강도 운동부터 시작을 권고 (A, Class I)

- 체중감량을 위해서는 주당 150분 이상 또는 주3-5회 유산소 운동의 실시를 권고 (A, Class I)

- 근력운동은 대근육군을 이용하여 주 2-4회 실시를 권고 (A, Class I)

- 유산소운동과 근력운동이 혼합된 운동을 고려 (A, Class I)

FITT에 따른 권장 운동량

운동 종류	운동 강도	운동 빈도	운동 시간
유산소 운동	중강도(VO₂R과 HRR의 40-59%)에서 고강도(VO₂R과 HRR의 60%)로 진행	주당 5일 이상	1일 30분(주당 150분)부터 60분(주당 250-300분)으로 증가
저항 운동	1RM의 60-70%에서 점차적 강도 증가	주당 2-3일	대근육군을 이용하여 2-4세트, 8-12회 반복
유연성 운동	긴장이나 경미한 불편감이 느껴질 때까지 신장	주당 2-3일	10-30초간 정적 스트레칭 유지, 각 동작을 2-4회 반복

비만 진료지침 2020

	강도	체중 50kg		체중 65kg		체중 80kg	
	Mets	1시간	지방 1kg	1시간	지방 1kg	1시간	지방 1kg
걷기 (천천히)	2.0	105kcal	73시간	137kcal	56시간	168kcal	46시간
걷기 (시속 4km)	3.0	158kcal	49시간	205kcal	38시간	252kcal	31시간
걷기 (속보 6km)	5.0	263kcal	29시간	341kcal	23시간	420kcal	18시간
달리기 (시속 8km)	8.0	420kcal	18시간	546kcal	14시간	672kcal	11시간
고정식 자전거 (저강도)	3.0	158kcal	49시간	205kcal	38시간	252kcal	31시간
고정식 자전거 (중강도)	5.5	289kcal	27시간	375kcal	21시간	462kcal	17시간
자전거 (도로)	8.0	420kcal	18시간	546kcal	14시간	672kcal	11시간
수영 (자유형)	6.0	315kcal	24시간	410kcal	19시간	504kcal	15시간
테니스, 배드민턴	7.0	368kcal	21시간	478kcal	16시간	588kcal	13시간
등산	8.0	420kcal	18시간	546kcal	14시간	672kcal	11시간

비만 진료지침 2020

Summary

- 체중 증가 예방, 체중 감소, 체중 유지에 도움이 된다.

- 체중 감량 후 체중 유지를 위한 운동은 "more is better"

- 유산소 운동 저항성 운동 모두 체중 감소, 체지방 감량에 효과적이며, 병행하여 진행하는 경우 더 효과적일 수 있다.

- 어떻게 Compliance를 높일 것인가?

Thank you for attention