


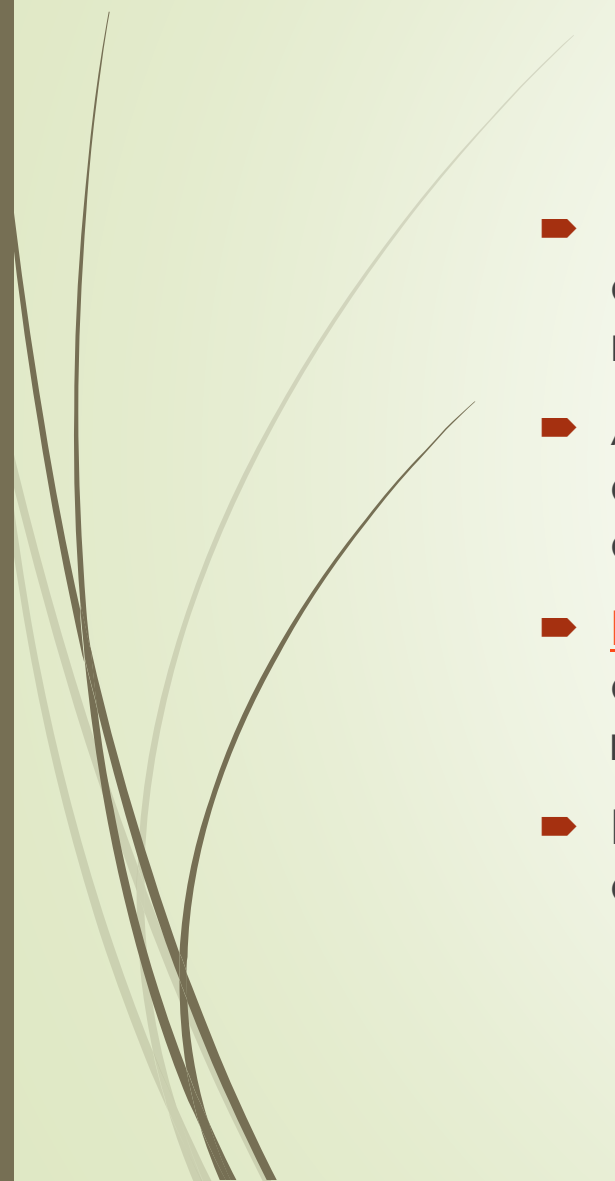
Effect of different types of regular in obesity



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- there is strong evidence that regular exercise contributes to body weight and fat loss, maintenance of body weight and fat reduction, and metabolic fitness in obesity.
 - Appropriate exercise programs should ideally combine large negative energy balance, long-term adherence, and beneficial effects on health and well-being.
 - Endurance training appears to be the most effective in this respect, although resistance training and high-intensity interval training play distinct roles in the effectiveness of exercise interventions.
 - Exercise has the potential to alleviate the health consequences of obesity, even in the absence of weight loss.





Exercise Volume

- exercise consistent with the minimum levels of physical activity recommendations (approximately 150 min of moderate-intensity exercise per week) without dietary restriction may induce modest weight loss (about 2 to 3 kg) but is inadequate for clinically significant weight loss ($\geq 5\%$).
- To achieve that, individuals should complete approximately 225 to 420 min of exercise per week



Exercise Type


- Endurance exercise is probably the most popular and effective exercise type for body weight loss, as it is easily applicable to obese people and ensures high energy expenditure
- Resistance exercise stimulates adipose tissue lipolysis in both lean and obese men, similar to endurance exercise, suggesting that it can aid in fat mobilization, although lipolysis is only the first step in this process, the oxidation of the resulting fatty acids constituting the determining step in body fat loss
- resistance exercise may influence body weight by increasing fat-free mass, which may result in increased resting metabolic rate. Resistance exercise also improves muscular strength, which may result in more free-living physical activity and, hence, increased total daily energy expenditure

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- High-intensity interval training (HIIT) is characterized by short bouts of high-intensity exercise alternating with periods of rest or low-intensity exercise
 - HIIT and MICT appear to be similarly effective in body fat reduction, even in the absence of changes in body weight, in obese people, despite the fact that HIIT requires approximately 40% less time commitment.
 - A meta-analysis by Türk and collaborators showed a significant reduction in percentage body fat by HIIT compared to “traditional” exercise (that is, MICT), but no difference in the amount of weight, BMI or waist circumference reduction between the two



Effect of different types of regular exercise on physical fitness in adults with overweight or obesity

- Türk et al. compared the effects of high intensity (continuous and interval) exercise and lower intensity endurance exercise or no exercise on $\text{VO}_{2\text{max}}$. Fifteen studies were included.
- The conclusion of the authors was that high intensity exercise was superior to improve cardiopulmonary fitness in comparison with lower intensity or no exercise in adults with obesity.
- Su et al. compared the effects of HIIT with those of moderate intensity continuous training (MICT). Sixteen studies were included. Overall HIIT was equally effective as MICT in improving $\text{VO}_{2\text{max}}$, but HIIT training with longer (≥ 2 min) intervals appeared to be more effective than MICT.



Effect of aerobic exercise training on cardiorespiratory fitness

- aerobic exercise training significantly improved $\text{VO}_{2\text{max}}$ (mean difference (MD) 4.08 ml/min/kg (95% CI 3.22, 4.95), $P < 0.00001$).
- resistance training significantly improved $\text{VO}_{2\text{max}}$ (MD 4.52 ml/min/kg (95% CI 1.56, 7.28), $P = 0.001$)
- combined aerobic plus resistance training significantly improved $\text{VO}_{2\text{max}}$ (MD 4.57 ml/min/kg (95% CI 2.14, 7.00), $P = 0.0002$).
- HIIT significantly improved $\text{VO}_{2\text{max}}$ (MD 4.31 ml/min/kg (95% CI 2.81, 5.80), $P < 0.00001$).



➤ **Aerobic training versus resistance training**

aerobic training improved $\text{VO}_{2\text{max}}$ more than resistance training

➤ **Aerobic training versus combined aerobic plus resistance training**

showed that there was no statistically significant difference in effect between the two types of training

➤ **Aerobic training versus high-intensity interval training**

small, but statistically significant, difference in effect between the two types of training in favour of HIIT



Effect of exercise training on muscle strength

- **Effect of aerobic exercise training on muscle strength**

The meta-analysis showed no significant difference in effect (SMD 0.26 (95% CI -0.06, 0.58), $P = 0.12$)

- **Effect of resistance exercise training on muscle strength**

The meta-analysis showed a significant difference in effect in favor of resistance training (SMD 0.74 (95% CI 0.54, 0.93), $P < 0.00001$). The heterogeneity was low ($I^2 = 0\%$)

- **Effect of combined aerobic and resistance exercise training on muscle strength**

The meta-analysis also showed a significant difference in effect (standardized mean difference (SMD) 0.62 (95% CI 0.27, 0.96), $P = 0.0004$).


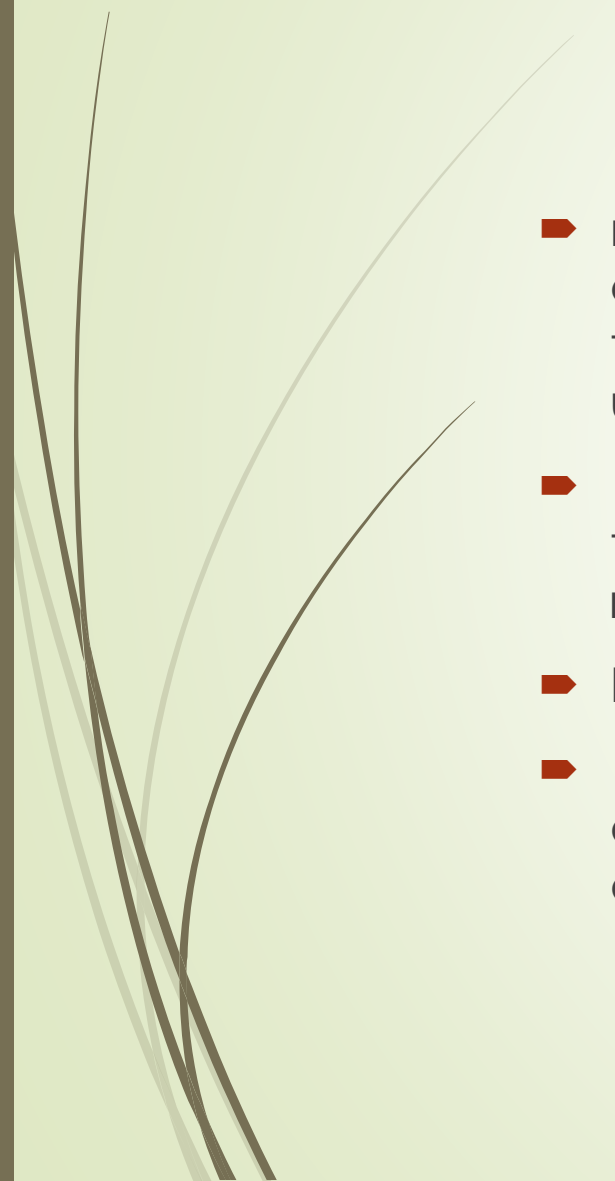
- **Effect of high-intensity interval training on muscle strength**

There were no studies that investigated the effect of HIIT on muscle strength in comparison to no exercise training.



Comparison of the effect of different types of training on muscle strength

- **Resistance training versus aerobic training**
- The meta-analysis showed a significant difference in effect in favour of resistance training (SMD 0.49 (95% CI 0.19, 0.78), $P = 0.001$).
- **Resistance training versus combined aerobic plus resistance training**
- No significant difference was found: SMD 0.50 (95% CI -0.21, 1.21)
- **Resistance training versus HIIT**
- No studies.

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- main findings are that all included training modalities (aerobic, resistance, combined aerobic and resistance and forms of high-intensity interval training) improve cardiorespiratory fitness, as measured by maximal oxygen uptake per kg body weight.
 - In direct comparisons, resistance training was less effective than aerobic training and there was no difference between combined aerobic plus resistance training and aerobic training alone.
 - HIIT had a slightly larger effect on $\text{VO}_{2\text{max}}$ than aerobic training.
 - With respect to muscle strength, resistance training and combined aerobic and resistance training increased muscle strength, whereas aerobic training did not.



Aerobic or Resistance Exercise, or Both, in Dieting Obese Older Adults


- ▶ Peak oxygen consumption increased more in the combination and aerobic groups [17% increase] and [18% increase], respectively) than in the resistance group [8% increase]) ($P < 0.001$ for both comparisons).
- ▶ Strength increased more in the combination and resistance groups [18% increase] and [19% increase], respectively) than in the aerobic group [4% increase]) ($P < 0.001$ for both comparisons).
- ▶ Body weight decreased by 9% in all exercise groups but did not change significantly in the control group.
- ▶ Lean mass decreased less in the combination and resistance groups than in the aerobic group [3% decrease] and [2% decrease], respectively, vs [5% decrease]), as did bone mineral density at the total hip (grams per square centimeter; [1% decrease] and [0.5% decrease], respectively, vs. [3% decrease]) ($P < 0.05$ for all comparisons)



CONCLUSIONS







weight loss plus combined aerobic and resistance exercise was the most effective in improving functional status of obese older adults




Exercise in the treatment of childhood obesity

- In a study conducted in 17 countries by the World Health Organization (WHO), the prevalence of overweight and obesity were reported as 15% and 6,6%, respectively, in school-age children in Turkey .
- Considering that childhood obesity continues into adulthood, and leads to a predisposition to many chronic diseases, the importance of fighting obesity in this period is clear
- Poor patient motivation and inability of parents to spare time for their children have been reported as the most important factors that cause low treatment efficiency in children and adolescents .
- Children who are stuck among courses/classes in an exam marathon with career anxiety cannot find time for physical activity and even for referring to healthcare institutions for these problems



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- Daily activity status in children
 - Changing lifestyles reduces the daily time period during which children are active.
 - Television and computers are factors for this change, and insufficient recreation/play areas in districts of low development levels, the fact that families do not give permission for their children to play outside because of unsafe external environments, and transportation of children to school by vehicles are the main causes that lead to a reduction in physical activity
 - Physical activity tends to decrease especially in the 11–15-year age group



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- For successful treatment, the causes of obesity should primarily be identified accurately, and good team work is essential.
 - In the treatment of obese children, cooperation of pediatricians, psychiatrists (Child-Adolescent), dieticians, and sports physicians, if possible, will provide an increase in treatment compliance and positive outcomes



Exercise model to recommend for children

- Total and visceral adipose depots decrease,
- lean mass index increases,
- energy consumption at rest, and the insulin sensitivity of adipose tissue increases with exercise.
- In the vessels improve endothelial function,
- free fatty acids, low-density lipoprotein (LDL) cholesterol and triglyceride levels decrease, high-density lipoprotein (HDL) cholesterol increases,
- metabolic and cardiovascular complications are reduced

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- Lean body mass is the most important factor that determines basal metabolism rate. Therefore, exercises that aim at increasing muscle mass are generally recommended. Exercise alone provides little weight reduction, but causes a significant reduction in mortality rates because of the above-mentioned effects
 - Regular physical exercise is an important factor for the regulation of body composition during growth. However, the point to be noted is that changes occurring in children's bodies during growth influence motor strength and performance. Therefore, exercise should be planned according to the child's individual characteristics, age, and sex

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- Lean body mass develops with a two-fold higher rate in boys compared with girls when transferring from early adolescence to late adolescence. In girls, however, adipose mass develops with a two-fold higher rate compared with boys.
 - Great lean mass is important in terms of exercises that need strength including pushing and weightlifting. However, this is the exercise type that should be limited during this period; jumping or sprinting should be recommended more.
 - Generally, exercises that increase strength are recommended at the end of somatic growth after the age of 16–18 years (late adolescence)



Exercise types and examples for children

- Aerobic exercise: This type of exercise increases heart rate and respiratory strength. Examples include: skateboarding, paddle, dancing, basketball, soccer, volleyball, tennis, swimming, gymnastics, jumping rope, house cleaning, running, and cycling.
- Muscle strengthening: climbing a rope, tree, rock, push-ups, weightlifting
- Bone strengthening: Recommended to perform at least three times weekly, e.g. jumping rope, climbing mountain, walking, basketball, volleyball, running.
- Extension (Strain): Causes muscles to become more elastic and there is less risk of injury, e.g. yoga, dancing, gymnastics.

Table 3

Exercise intensity ([20](#))

Intensity	% MVC	Effect on strength
Low	<20	Almost none
Moderate	20-50	Rehabilitating
High	50-70	Increases muscle strength to optimal level
Very high	>70	Increases muscle mass to optimal level

MVC: maximum voluntary contraction

Table 4

Physical exercise programs that can be recommended by applying FITT principles in children and adolescents (20, 23)

FITT	Cardiovascular (aerobic) program	Interval program	Muscle resistance program
Frequency	≥3/week	≥3/week	2-3/week
Intensity	Moderate-severe exercise	3-5 min. Mild-moderate Interrupting for 6-8 times 1-3 min high intensity exercise	High (50-70% MVC)
Time	20-60 min	Total 20-60 min	2-3 min. per muscle group (8-20 repetitions) Total ≥30
Type	Running, jumping, biking, Swimming, soccer	Running, jumping, swimming, biking	push-ups, climbing, paddle
Program duration	8-12 weeks	6-12 weeks	6-12 weeks

FITT: Frequency, intensity, time, and type; MVC: Maximum voluntary contraction



LESS

TV, PC

2-3 times weekly


Swimming, paddle,
tumbling, dacing,
gymnastics, combat sport

3-5 times weekly

Running, swimming, skateboard,
climbing, skate, volleyball,
basketball, soccer, skiing

Everyday

Walking, using stairs, tidying the room,
washing pet, going to the market



Compatibility recommendations in exercise treatment in obesity (FITT) ([20](#))

Frequency: Frequent/each day of the week

Intensity: 55–90% of maximum heart rate


Time: 30–80 minutes



Should increase gradually



Beginning; 10 minutes of walking, 3–5 days/week

Continued; 60–80 min, almost every day /week

Type: Aerobic, resistant



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- Addition of moderate aerobic exercise to diet therapy increases weight loss slightly.
 - During weight loss, aerobic exercise decreases loss of lean mass, and resistance exercise enhances weight loss while preserving lean mass. Diet alone causes a marked reduction in lean body mass (LMN) in addition to reducing fat.
 - However, aerobic exercise preserves LMV (less LMV loss occurs as BMI increases) .
 - In addition, exercise may contribute to weight loss by leading to a behavioral change enabling children to pay attention to their diets.

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- In children, starting with very high intensity exercise may cause injuries. Therefore, one should start with low intensity exercise and the intensity should be increased gradually.
 - Programs given to children are not different from adults. One may need to prepare more entertaining short programs for children because they may easily become bored and discontinue the program.
 - Generally, all exercise programs should consist of a dynamic warm-up period of 10–15 minutes, an educational exercise period of 20–60 minutes, and a cooling period that includes low intensity movements


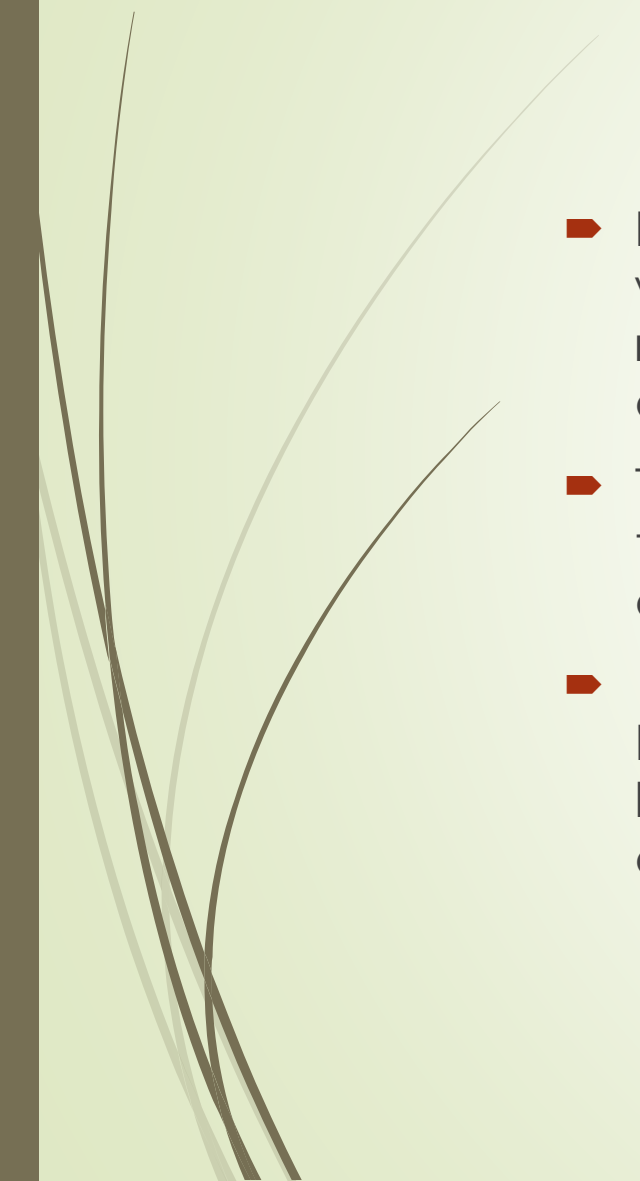


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- It has been reported that combined exercise is more efficient compared with weightlifting exercises alone in correcting insulin resistance, but resistance exercises are more efficient in increasing lean body mass in obese children
 - The International Association for the Study of Obesity (IASO) recommends that adults perform moderate physical activity for at least 30 minutes each day of the week to prevent chronic diseases and protect health.
 - However, this activity level is not sufficient for weight loss or for preserving body weight. Obese individuals should perform mild-moderate exercise at least 60–90 minutes daily and normal individuals should perform moderate exercise at least 45–60 minutes daily to avoid obesity



Table 5

Types of moderate exercise that can burn 150 kcal ([22](#))

Daily activities	Sports activities	
Washing or polishing a car for 45–60 min	Playing volleyball for 45–60 min	Less tiresome, more time consuming
Washing windows or the floor for 45–60 min	Playing with soccer ball for 45–60 min	
Gardening for 30–45 min	Walking 1.5 km in 35 min	
Using wheelchair for 30–40 min	Shooting a basketball for 30 min	
Pushing a wheel for 30 min for 2 km	Biking 6 km in 30 min	More tiresome, less time consuming
Walking 2.5 km in 30 min	Dancing swiftly for 30 min	
Climbing stairs for 15 min	Exercising in water for 30 min	
	Swimming cycles for 20 min	
	Playing basketball for 15–20 min	
	Biking 5 km for 15 min	
	Jumping rope for 15 min	
	Running 2 km in 15 min	

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- In a meta-analysis study conducted with overweight and obese children, it was found that a 0.4% (0.1–0.7%) reduction in body fat occurred with moderate-high intensity physical activity performed for 155–180 minutes weekly, though marked weight loss was not obtained .
 - In conclusion, an exercise program that included moderate exercising for 10–45 minutes 3–5 days weekly or 60–80 minutes every day in the beginning, and targeted consumption of 1000–2000 kcal, was recommended.
 - An entertaining exercise program for at least 1 hour every day was recommended for children aged 6 years and older and free playing programs were recommended for young children


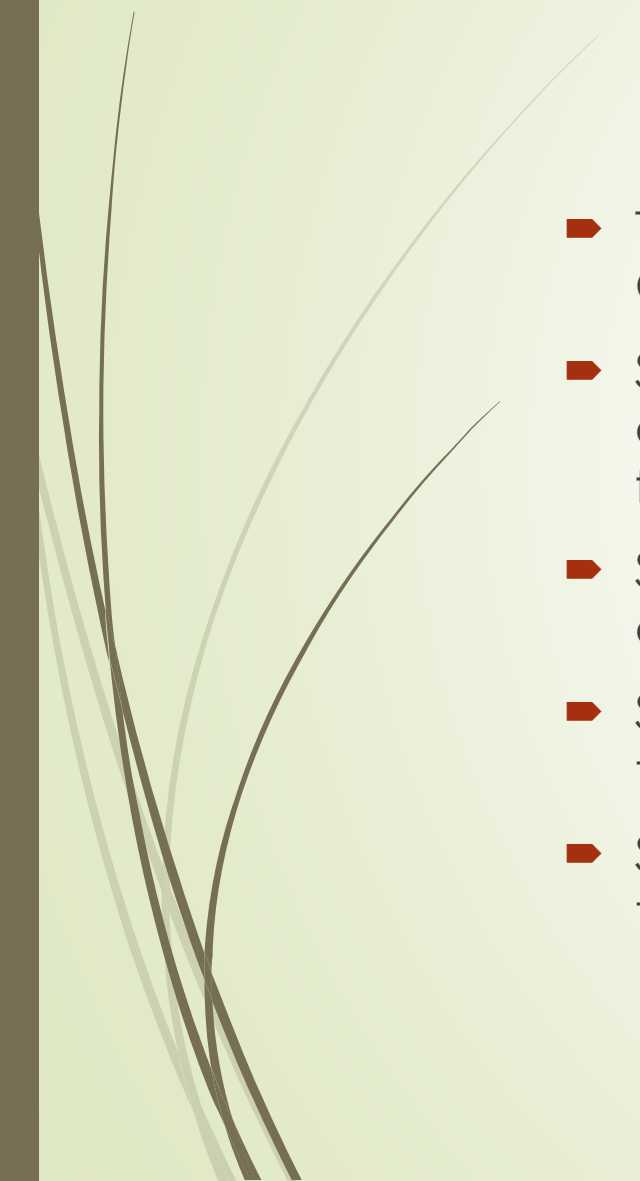

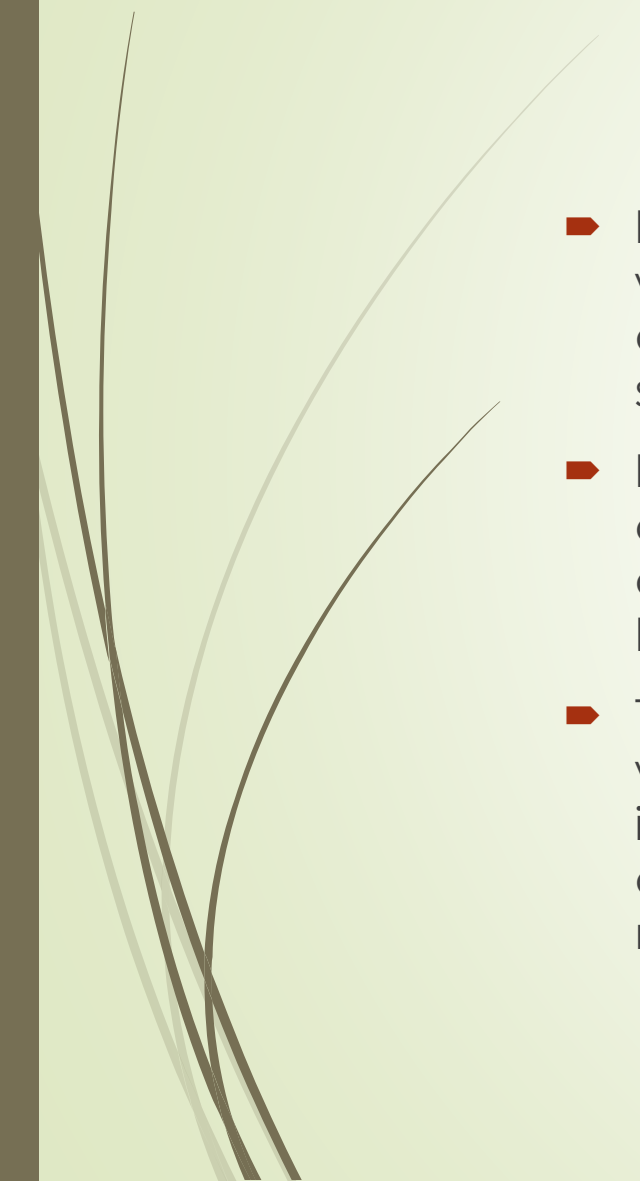
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- The Korean Pediatric Gastroenterology Hepatology and Nutrition Obesity Group classified obesity treatment and exercise strategies in four steps.
 - Step 1: Strategies for protection against obesity will be applied and physical activity will be performed for one hour or less. Unstructured physical activity for young children and entertaining physical activities for older children.
 - Step 2: Structured and planned exercise under supervision for 1 hour every day.
 - Step 3: Specification of physical activity targets in multidisciplinary obesity treatment. Exercise plan targeting negative energy balance.
 - Step 4: Appropriate exercise program in addition to drug and surgical treatment options.

Table 6

Exercise treatment strategies according to age and the degree obesity in children

Age group	Degree of obesity	Primary option	Advanced option
Infant (≤2 years)	Weight for height ≥95 th pc	Preventive precautions	Preventive precautions
Early childhood (2–5 y)	BMI 5–84 th pc	Preventive precautions	Preventive precautions
	BMI 85–94 th pc risk Ø	Preventive precautions	Preventive precautions
	BMI 85–94 th pc risk present	Step 1	Step 2
	BMI ≥95 th pc	Step 1	Step 3
School-age child (6–11 y)	BMI 5–84 th pc	Preventive precautions	Preventive precautions
	BMI 85–94 th pc risk Ø	Preventive precautions	Preventive precautions
	BMI 85–94 th pc risk present	Step 1	Step 2
	BMI 95–99 th pc	Step 1	Step 3
	BMI ≥99 th pc	Step 1	Step 3
Adolescent (12–18 y)		If the family is motivated	If appropriate
		Step 2 or 3	Step 4
	BMI 5–84 th pc	Preventive precautions	Preventive precautions
	BMI 85–94 th pc risk Ø	Preventive precautions	Preventive precautions
	BMI 85–94 th pc risk present	Step 1	Step 2
	BMI 95–99 th pc	Step 1	Step 3
	BMI ≥99 th pc	Step 1	Step 3
		If the family is motivated	If appropriate

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- In a different program, it was recommended that exercise programs in children with obesity should begin with 20 minutes three days a week, the exercise duration should be prolonged to 30–60 minutes subsequently, and exercise should be performed every day, if possible .
 - It has been reported that exercises that burn 100–200 kcal/day (total energy consumption 1000 kcal/week) should be selected, and exercises should be adjusted such that joint loading is avoided, especially in individuals who have back, knee or heel pain.
 - The same group emphasized that physical activity had to be pursued together with calorie limitation for efficient weight loss. The easiest activity for obese individuals is walking. Walking should be increased gradually up to 12 000 steps a day. One or two sets of weightlifting exercises with 8–10 repetitions that train main muscle groups 1–2 days a week are also recommended.



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- In conclusion, treatment of obesity is difficult. Therefore, the easiest way is prevention. In prevention, the 5-2-1-0 rule (5 or more vegetables and fruit, sitting in front of the TV/computer for less than 2 hours, physical activity for at least 1 hour daily, and zero sugary drinks) seems to be the easiest recommendation

Table - PMC - Google Chrome

ncbi.nlm.nih.gov/pmc/articles/PMC7096559/table/T7/?report=objectonly

Table 7

Feasible exercise recommendations in prevention of obesity

5 - 2 - 1 - 0 Rule;

- 5 or more vegetables and fruit
- Sitting in front of the TV/computer and inactivity for less than 2 hours
- 1 hour of structured physical activity
- Low-fat milk or water instead of sugary drink









10 000 steps each day (2000 steps in excess daily burns 100 calorie) (difficult in children, but they should be informed)







Participation in moderate-high intensity physical activity at least 60 min/day weekly is recommended for children and adolescents, but this time period should be 90 minutes for reducing insulin resistance and cardiovascular risk. Glucose and glycogen are oxidized primarily with exercise, and fat oxidation begins in 90–120 minutes.

The benefit of exercise persists for 24–72 hours. Therefore, physical activity should be pursued for at least 3 times weekly

All types of exercise provide weight loss if its duration is at least 4–10 hours/week

Children may comply better with frequent short-term exercises





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