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## Daily routine and leisure time behavior of obese children compared with their contemporaries

**Authors' Contribution:**

- A** Study Design
- B** Data Collection
- C** Statistical Analysis
- D** Data Interpretation
- E** Manuscript Preparation
- F** Literature Search
- G** Funds Collection

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### Summary

**Background:**

Childhood obesity is attributed to physical inactivity. The CHILT (Children's Health Interventional Trial) project examined pupils of 12 intervention and 5 control schools to discover how obese children differed from their contemporaries regarding daily and physical activities.

**Material/Methods:**

Anthropometric data of 802 children (52.2% male, 47.8% female) were collected. Mean age was 8.5±0.5 years, height 132.9±6.2 cm, weight 30.3±6.9 kg, body mass index (BMI) 17.0±3.0 kg/m<sup>2</sup>. A standardized questionnaire was used to record daily activity and leisure activities.

**Results:**

Obese children tended to watch television for the longest period ( $p=0.066$ ). Obese children exercised fewer days per week with a higher intensity and were taken to school by car more often ( $p<0.05$  for both variables).

**Conclusions:**

Obese children are less physically active and spend more time with sedentary activities. These findings underline the key messages of preventive measures: more physical activity and less inactivity, especially TV.

**Key words:**

**obesity • children • physical activity • inactivity**

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## BACKGROUND

Overweight and obesity in childhood are increasing in all countries [1]. Apart from genetic disposition, this is attributed to high caloric nutrition and a decrease in physical activity [2,3]. Current data about the nutrition behavior of German children are available from the Research Institute for Child Nutrition (Dortmund, Germany). Their DONALD study did not show any essential changes in children's alimentation in the last two decades [4]. In particular, obese children do not seem to differ significantly from their contemporaries with regard to food intake [5]. Consequently, examinations focus more and more on differences in physical activity in leisure time and everyday life. Results related to physical inactivity depend on the methods used [6]. Therefore, no uniform data are available concerning differences in the leisure time behavior of obese children [7].

The baseline data of our CHILT (Children's Health Interventional Trial) project did not reveal any differences concerning the active leisure behavior in the different BMI categories [8,9]. Daily routine activities, however, were initially hardly taken into account, though they seem to play the greater role according to numerous examinations [2,7]. Whether the daily energy consumption of obese children differs significantly from that of normal-weight children is a subject of controversy [2,7,10]. Nevertheless, a far-reaching consensus seems to exist that obese children spend more time with sedentary activities, mainly watching television (TV) [2,10,11]. In this cross-sectional interim analysis, the CHILT project examined the second-grade pupils of 12 intervention schools and 5 control schools by means of a standardized questionnaire to what extent the obese children differed from their contemporaries with regard to their daily routines and their leisure behaviors.

## MATERIAL AND METHODS

### Study group

The study group included 802 children (52.4% male, 47.6% female) for whom anthropometric data were taken. The children were on average  $8.5 \pm 0.5$  years old, had an average height of  $132.9 \pm 6.2$  cm, weighed  $30.3 \pm 6.9$  kg, and their average BMI was  $17.0 \pm 3.0$  kg/m<sup>2</sup> (Table 1). The CHILT project is presented elsewhere [8].

### Variables and data assessment

First we recorded the anthropometric data of the children. Using a standardized questionnaire designed by experts [8], the parents were asked about the time the children spent watching television (TV) and using a computer (PC). Information about organized activities (times per day), regular (times per day) and irregular (times per year) activities, and sport disciplines practiced was collected at the end of the second school year. The activities were summarized and classified as follows: no sport activity, only irregular sport activity, regular sport activity, organized, and organized and regular activity. Questions were asked about daily activities ("How long do they play?", in minutes per day), the intensity of activity ("Do they pant and sweat?"), and how the children got to school (on foot, by bicycle, by bus, or by car).

### Assessment of anthropometric data

Height and weight were measured in light gymnastic clothes. Body weight was measured on an electronic scale accurate to 0.1 kg. Height was measured to the nearest 0.1 cm using a stadiometer. From these data, BMI in kg/m<sup>2</sup> was calculated and classified according to the German percentile graphs of Kromeyer-Hauschild et al. [12] Children with a BMI < 10<sup>th</sup> percentile were classified as underweight,  $\geq 10^{\text{th}}$  to < 90<sup>th</sup> percentile as normal,  $\geq 90^{\text{th}}$  to < 97<sup>th</sup> percentile as overweight, and  $\geq 97^{\text{th}}$  percentile as obese [12].

### Statistical analysis

Descriptive statistics of the anthropometric data were provided, i.e. mean values (*M*), standard deviation (*SD*), and range: minimum (*min*), maximum (*max*). Analysis of covariance (ANCOVA) was used to compare the differences concerning individual characteristics in the groups (e.g. BMI in different exercise categories) adjusted for gender, age, and affiliation in an intervention school (IS) or a control school (CS) (=group). The effect between categories, e.g. BMI classification and day category, was analyzed by means of the chi-square test. *p*-values < 0.05 were considered statistically significant. All analyses were done with the statistics system SPSS 11.0.

## RESULTS

The anthropometric data within the whole population and between girls and boys are shown in Table 1. Sixty-six children were obese (8.2%), 77 overweight (9.6%), 857 normal weight (73.2%), and 72 underweight (9%). The anthropometric data according to the BMI classifications are shown in Table 2. All physical activities in the respective BMI classifications are shown in Tables 3 and 4. The children exercised  $170.3 \pm 112.7$  min/day on average, watched television for  $60.2 \pm 45.5$  min/day, and used a PC for  $20.8 \pm 24.0$  min/day. The obese children tended to watch TV for the longest period (*p*=0.066), adjusted for age, gender, and school affiliation. No differences were found concerning exercise and PC times between the BMI categories of the children and the sport activities (*p*>0.05 each). The obese children, however, exercised on fewer days per week (Figure 1), were more often taken to school by car, and the parents reported higher intensities of physical activity (Figure 2) (*p*<0.05 for each).

## DISCUSSION

Physical activity plays a decisive role in the prevention and therapy of obesity [13]. It has not yet been clarified, however, which type of exercise is crucial, i.e. whether organized sports or daily routine activities play the more decisive role. Correlations between less physical activity and obesity in childhood are also a subject of controversy [7]. Data on leisure physical activities are rare [9]. A Canadian examination of 7216 children aged 7 to 11 years showed a lower risk of overweight by about 10 to 24% and of obesity of about 23 to 43% if the children did organized sports or were regularly active [14]. In contrast, numerous examinations of daily energy consumption mostly showed no differences between normal-weight and obese children [7]. Also, several studies from various countries show a tendency to more

**Table 1.** Anthropometric data, total and gender differences (t-test).

	Total (n=802)		Boys (n=419)	Gender differences	Girls (n=383)
	range	M (SD)	M (SD)	p	M (SD)
Age (yrs.)	7.4–10.5	8.5 (0.5)	8.5 (0.5)	0.001	8.5 (0.4)
Height (cm)	115.0–153.5	132.9 (6.1)	133.9 (6.2)	<0.001	131.8 (5.9)
Weight (kg)	18.1–62.3	30.3 (6.9)	31.0 (7.4)	0.001	29.6 (6.1)
BMI (kg/m <sup>2</sup> )	11.7–36.8	17.0 (3.0)	17.2 (3.2)	n.s.	16.9 (2.7)

**Table 2.** Anthropometric data according to BMI-classification (ANCOVA).

	Obese (n=66)	Overweight (n=77)	Normal-weight (n=587)	Underweight (n=72)	p
	M (SD)	M (SD)	M (SD)	M (SD)	
Age (yrs.)	8.6 (0.5)	8.5 (0.5)	8.4 (0.5)	8.6 (0.6)	0.003
Height (cm)	136.8 (5.9)	135.8 (5.6)	132.3 (5.9)	131.2 (6.3)	<0.001
Weight (kg)	45.2 (6.7)	37.7 (3.6)	28.5 (4.0)	23.3 (2.6)	<0.001
BMI (kg/m <sup>2</sup> )	24.1 (2.7)	20.4 (0.8)	16.3 (1.4)	13.5 (0.6)	<0.001

**Table 3.** Physical activity, TV, and PC time according to BMI classifications (ANCOVA).

		n	M	SD	p
		Playing (min/day)	Obese	33	
Overweight	30		196.3	115.7	
Normal-weight	324		167.7	115.3	
Underweight	39		169.0	106.5	
TV (min/day)	Obese	54	73.5	46.2	0.066
	Overweight	50	63.4	47.8	
	Normal-weight	461	59.4	45.3	
	Underweight	57	51.1	42.8	
PC (min/day)	Obese	48	24.2	29.6	0.416
	Overweight	50	18.2	23.0	
	Normal-weight	407	21.2	23.7	
	Underweight	49	17.4	21.0	

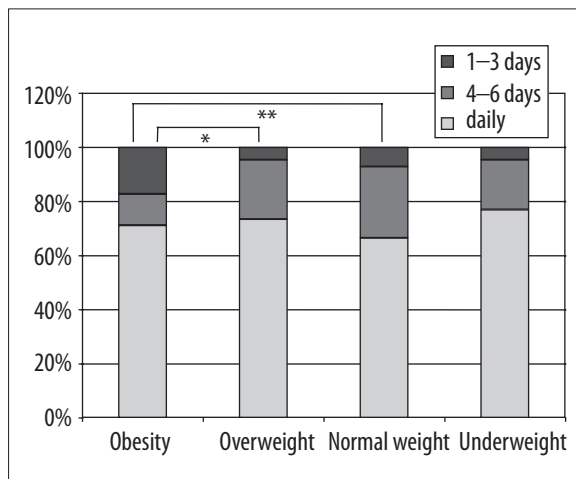
sedentary pastimes, mainly watching television and using the PC, by obese children [15,16].

Our current examination did not show differences concerning the number of sport-related behaviors of obese and normal-weight children. The former were not less active in sport clubs or regular exercise. They spent just as much time on exercise as their contemporaries. However, the obese children exercised on average on fewer days per week, but with higher intensity, and spent more time with sedentary habits instead. The obese children tended to watch television longer than their contemporaries. A similar result was obtained with another population of 344 first-graders [15]. To

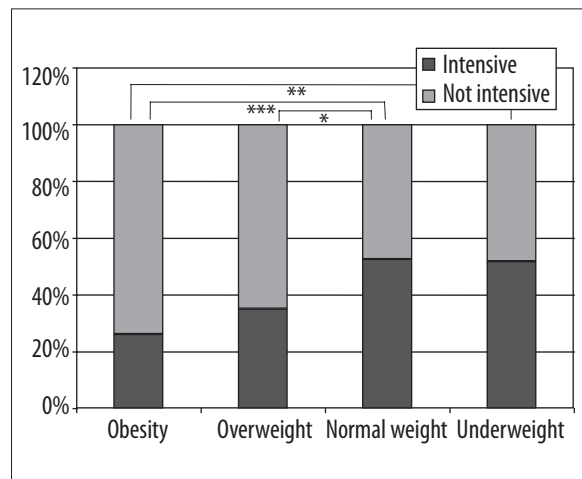
what extent these cross-sectional examinations actually reveal some association is certainly speculative, but it is supported by a large number of examinations. The Canadian study by Tremblay et al. showed an increase in overweight between 17 to 44% and obesity between 10 to 61% with increased TV watching and video games [14]. The longitudinal study by Saelens et al. showed that higher weight correlated with increased television watching in 169 families with children who were followed from their 6<sup>th</sup> to 12<sup>th</sup> year of life [17]. Nevertheless, there are studies that emphasize the complexity of physical inactivity and do not find any direct inverse correlation between sedentary and active habits [18].

**Table 4.** Physical and daily activities according to BMI classifications (chi-square test).

		Obese	Overweight	Normal-weight	Underweight	p
Playing outside	Daily	39	47	331	48	0.017
	4–6 days	8	11	135	10	
	1–3 days	9	4	36	2	
Intensity	Intensive	36	37	220	25	0.001
	Moderate	14	18	246	28	
Way to school	On foot	36	41	374	41	0.001
	By bike	1	5	10	4	
	By car	16	4	61	9	
	By bus	3	12	55	6	
Leisure activities	No sport activity	11	9	62	13	0.670
	Only irregular sport activity	2	2	14	0	
	Regular sport activity	9	16	107	13	
	Organized sport activity	12	13	99	10	
	Regular and organized sport activity	22	21	216	26	



**Figure 1.** Playing (days per week) according to the BMI classifications.



**Figure 2.** Intensity of physical activity according to the BMI classifications.

Concerning intensity, most studies show an inverse correlation between body fat and the time actively spent [19]. This negative correlation is possibly supported by the subjective perception of the parents of obese children who describe the activity of their children as more intensive, and their children are active on less days per week and also cover their way to school passively.

A limitation of the study is the measurement of leisure activities. With questionnaires, for example, there is always the risk that the exercise time is reported higher and computer and television time are underreported. Also, parental influences and eating behavior were not taken into consideration. The rate of responders amounted to 84.8%, but not every question was answered. Despite this critical consideration, clear indications of reduced exercise behavior can be seen, combined with longer TV watching in obese

children, as early as in the second grade. Therefore, such results should definitely be taken into account in the implementation of preventive measures and recommendations [10,13]. The restriction of television time to less than 60 minutes at primary school age cannot be emphasized often enough. This should be contrasted with active exercise stimuli, including an active way to school. These results not only imply the benefits of physical activity, but also the fact that time spent in physical activity is a time during which the children can neither watch TV nor eat.

**CONCLUSIONS**

Obese children are less physically active than their contemporaries and spend more time with sedentary habits, especially TV. These findings underline the key messages of preventive measures: more physical activity, almost eve-

ry day a week and including daily activities, and less inactivity, especially TV.

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