

## A strength and neuromuscular exercise programme did not improve body composition, nutrition and psychological status in children with obesity

Even though a wide range of exercise recommendations exist for various patient groups, there is a lack of programmes, which are specifically designed for children and adolescents with obesity. This study is a secondary analysis of a trial, which evaluated the effectiveness of a physical intervention programme specifically designed for paediatric patients with obesity from a biomechanical and physical therapy point of view. It presents secondary results to body composition, nutrition and psychological status.

The main investigation entitled "The Children's KNEEs study<sup>1</sup>" (ClinicalTrials.gov. ID#NCT02545764) was a randomised controlled trial evaluating the effects of a 12-week strength and neuromuscular exercise programme for the lower extremity on knee load, pain and function. Patients with obesity were recruited from the Department of Pediatrics and Adolescent Medicine, Medical University of Vienna. Parents and children gave written informed consent for their participation. The study was approved by the local ethics committee (EC Nr: 1445/2013). Body composition was assessed with a bioelectrical impedance analysis device BIACORPUS RX 4000 (Medical Healthcare GmbH). For evaluating dietary habits, 24-hour recalls were assessed. Energy and nutrient contents of food and drinks were calculated by using NutriSurvey software (EBISpro). Under-reporting was determined by dividing reported energy intake by the basal metabolic rate. The total energy expenditure was computed from a validated formulation<sup>2</sup> for estimating basal metabolic rate with the NutriSurvey computer programme. Psychological status was evaluated with the questionnaires AD-EVA for eating and movement behaviour, and Youth Self-Report (YSR) and Child Behavior Checklist (CBCL) for behavioural and emotional problems. The scales "quality of life" and "obesity and movement motivation" from AD-EVA were used for further analysis.<sup>3</sup> Patterns in the normal range of reference cohort are defined by scores 40-59.<sup>3</sup> Behaviour patterns of 60 or above indicate increased motivation to move or increased quality of life compared with reference group.<sup>3</sup> The socio-economic status was determined based on graduation and net annual household income within the AD-EVA.<sup>3</sup>

Data were described as mean  $\pm$  SD, median and range, and percentage. Results are given as median with lower and upper boundaries of inter-percentile ranges for the control and intervention groups.

To investigate group differences during baseline, independent *t* tests or the Mann-Whitney *U* tests were used for all variables except for gender, where a chi-square test was used. Wilcoxon signed-rank tests were conducted between baseline and follow-up, due to the non-normal distribution of several variables. Data analysis was carried out using the software SPSS version 24 (IBM Corporation).

In total, 38 children and adolescents with obesity were allocated to an intervention group ( $n = 20$ , 50% male) and control group ( $n = 18$ , 78% male). Mean age was  $13.3 \pm 2.3$  years; mean body height,  $163 \pm 12.8$  cm; and mean BMI,  $34 \pm 6.8$  kg/m<sup>2</sup>, respectively.

In total, 60% (=median, range: 9%-87%) of the intervention group participated regularly (>60% attendance of training sessions) in the exercise programme. Reasons for missing training sessions were school commitments, illness and low motivation to participate. The programme did not show an effect on body fat percentage ( $P > .05$ ). However, both groups significantly increased in fat-free mass after 12 weeks ( $P < .02$ ). No significant changes in macronutrient intake were observed in any group over time (Table 1). In 79% of all patients, under-reporting of food and nutrient intake was detected from baseline to follow-up. For AD-EVA, YSR and CBCL, no significant differences were observed between both groups after 12 weeks. No differences were found between girls and boys. The motivation to perform physical activity was average (40-59) in both groups. Quality-of-life scale was increased (60-69) in all patients compared with the norm at baseline and after 12 weeks. The motivation to move and quality of life did not differ between groups at baseline and did not change after 12 weeks. One third of the parents, 32% of mothers (BMI:  $37 \pm 6$  kg/m<sup>2</sup>) and 35% of fathers (BMI:  $33 \pm 2$  kg/m<sup>2</sup>), had obesity, and the majority of our families had a low socio-economic status (56%). These factors are associated with an unhealthy food choice in quality and quantity and decreased physical activity.<sup>4</sup>

The fat-free mass increased in both groups from baseline to follow-up. Reasons for that might be physical growth and a placebo effect in control individuals. The control group consisted of more male individuals (78%), who have an increased muscle mass, which consequently affects the fat free-mass outcome. An explanation for the lack of intervention may be attributed to the limited training

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**TABLE 1** Median (interquartile range) differences between baseline and follow-up

	Intervention			P-value	Control			
	Median	IQR			Median	IQR	P-value	
BFP (%)	0.0	-1.4	1.3	.828	0.3	-1.0	1.0	.879
FFM (kg)	1.3	0.2	2.8	<b>.018</b>	1.3	0.4	3.1	<b>.005</b>
Protein (g)	3	-30	59	.351	-5	-33	29	.679
Fat (g)	-1	-18	32	.526	-10	-46	32	.528
Carbohydrates (g)	8	-58	91	.627	-18	-66	57	.586
Energy (kcal)	86	-450	690	.526	-190	-1044	527	.420

Note: Note that body fat percentage (BFP) and fat-free mass (FFM) were analysed using a dep. t test. The other variables were analysed using a Wilcoxon signed-rank test. Negative values represent a reduction from baseline to follow-up. Bold values indicate significant difference at the  $P < .05$  level.

compliance and that two training sessions of 60 minutes per week were not efficient enough. A per-protocol analysis with subjects, who participated in a minimum of 60% of the training sessions, did not show any different results. Under-reporting of dietary intake is a known problem in all patients.<sup>5</sup>

The patients of this study rated their self-reported quality of life higher than the reference group.<sup>3</sup> No patient had a co-morbidity.

A limitation is that about half of the patients participated regularly in the 12-week exercise programme and that psychological questionnaires were completed by 84%. The control group comprised an imbalance in gender in favour to boys. The sample size calculation was based on the primary outcome gait biomechanics<sup>1</sup> and not on these secondary outcome parameters, which might have influenced the results. Strengths of our study were the randomised controlled study design<sup>1</sup> and the use of validated methods and questionnaires.


The proposed training programme did not improve the body composition, diet and psychological status in children and adolescents with obesity. One could conclude that workout time, adherence to the training and power calculation were too low. Based on our study, we suggest that future studies add more cardiovascular training in comprehensive programmes that last for a longer period of time.

#### CONFLICT OF INTEREST

None.

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