

WEIGHT STATUS AND BODY COMPOSITION OF CHILDREN AND ADOLESCENTS DURING THE COVID-19 PANDEMIC

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INTRODUCTION

- The COVID-19 pandemic has tremendous effects on lifestyle
- Extreme preventive measures were taken, including the closure of schools and after school activities
- This dramatic alteration in daily routine could lead to adverse consequence of increasing obesity

AIMS

To investigate the change in weight status and body composition parameters of children and adolescents during the COVID-19 pandemic

METHODS

Design: Real-life, observational study

Setting: Pediatric endocrine unit in a tertiary medical center

Subjects

Inclusion criteria:

- Age 5-18 years
- Diagnosis of 'observation of growth' and/or 'observation of puberty'
- Body composition measurement during the COVID-19 pandemic (from May 15, 2020 until December 15, 2020) and pre-COVID-19

Exclusion criteria:

- Patients who entered puberty and/or initiated medication or underwent bariatric surgery between the two time periods

Body composition analysis: Bioelectrical impedance analysis (BIA, Tanita MC-780MA, GMON Professional Software) part of routine assessment of patients referred for consultation

Study variables:

- The BIA report includes fat percentage (FATP), fat mass (kilograms), and muscle mass (kilograms)
- Appendicular skeletal muscle mass (ASMM) was calculated as the sum of muscle mass of four limbs and muscle-to-fat ratio as [MFR = ASMM (kg)/fat mass (kg)].
- Z-scores for height, body mass index (BMI) and muscle-to-fat ratio (MFR) were calculated according to BIA pediatric reference curves
- Data collected from the participants' medical files included home address for socioeconomic position calculation, pubertal stage, and self-reported sleep duration and physical activity performance

RESULTS

220 pediatric subjects (109 boys)

- Mean age 11.8 ± 3.3 years
- During the pandemic the BMI z-scores significantly increased in subjects with underweight ($p < 0.001$) and normal weight ($p = 0.035$), while it did not change in subjects with overweight/obesity
- MFR z-scores significantly increased in subjects with underweight ($p = 0.05$) and normal weight ($p = 0.008$), but not in subjects with overweight/obesity ($p = 0.169$)

- The vast majority of the cohort (81.8%) had stable or improved MFR z-scores during the pandemic
- A multivariate linear regression model identified socioeconomic position, pre-pandemic BMI z-scores, pre-pandemic MFR z-scores, and physical activity levels during the pandemic as predictors for delta MFR z-scores ($F = 12.267$, $p < 0.001$)
- Sex, age, pre-pandemic physical activity level and the time that had elapsed between initiation of the first nationwide lockdown and the BIA assessment during the pandemic did not emerge as predictors for delta MFR z-score

Body composition and blood pressure characteristics before and during the COVID-19 pandemic stratified according to weight status

Characteristic	Before the COVID-19 pandemic	During the COVID-19 pandemic	p value
Underweight (BMI z-scores ≤ -1.645) n = 37 (26 boys)			
Body mass index, z-scores	-2.07 [-2.34, -1.88]	-1.73 [-2.35, -1.37]	<0.001
Fat percentage	17.5 [14.9, 19.9]	17.2 [13.8, 20.1]	0.154
Truncal fat percentage	13.7 [10.8, 15.4]	12.5 [10.0, 15.1]	0.078
Muscle-to-fat, z-scores	-0.08 ± 1.11	0.12 ± 0.95	0.050
Systolic BP, percentiles	69 [35, 87]	64 [35, 75]	0.544
Diastolic BP, percentiles	67 [29, 80]	65 [50, 78]	0.168
Normal weight (-1.645 < BMI z-scores < 1.036) n = 123 (60 boys)			
Body mass index, z-scores	-0.38 [-0.95, 0.27]	-0.24 [-0.87, 0.37]	0.035
Fat percentage	20.7 [18.2, 24.0]	20.6 [17.1, 24.3]	0.200
Truncal fat percentage	15.5 [13.3, 18.5]	15.3 [11.9, 18.4]	0.091
Muscle-to-fat, z-scores	-0.20 ± 0.84	-0.06 ± 0.81	0.008
Systolic BP, percentiles	73 [47, 83]	69 [50, 83]	0.760
Diastolic BP, percentiles	62 [48, 81]	63 [47, 79]	0.783
Overweight/obesity (BMI z-scores ≥ 1.036) n = 60 (23 boys)			
Body mass index, z-scores	1.74 [1.40, 2.03]	1.70 [1.36, 1.97]	0.412
Fat percentage	33.8 [29.4, 39.2]	33.7 [29.0, 38.5]	0.529
Truncal fat percentage	27.9 [23.7, 34.2]	29.1 [23.6, 33.1]	0.531
Muscle-to-fat, z-scores	-1.42 ± 0.48	-1.36 ± 0.50	0.169
Systolic BP, percentiles	87 [68, 95]	87 [79, 93]	0.122
Diastolic BP, percentiles	72 [53, 82]	75 [58, 86]	0.238

Data are presented as median [interquartile range] and mean ± SD. Bold indicates statistical significance.

Characteristics of the study cohort before COVID-19 pandemic stratified by change in muscle-to-fat ratio (MFR) z-scores

Parameter	👍	⚖️	👎	p value
	delta-MFR z-score > 0.3	-0.3 ≤ delta-MFR z-score ≤ 0.3	delta-MFR z-score < -0.3	
Number	70 (31.8)	110 (50)	40 (18.2)	
Male, n (%)	38 (34.9)	51 (46.8)	20 (18.3)	0.583
Age, years	10.3 ± 3.5	10.8 ± 3.1	11.6 ± 2.6	0.114
Socioeconomic position, cluster	8 [7, 9]	8 [7, 9]	8 [7, 9]	0.686
Socioeconomic position, index	1.532 [0.789, 1.985]	1.463 [0.872, 1.919]	1.271 [0.736, 1.748]	0.339
Height, z-scores	-0.67 [-1.39, 0.22]	-0.34 [-1.32, 0.60]	-0.81 [-1.49, 1.04]	0.293
Body mass index, z-scores	-0.44 [-1.49, 0.54]	0.11 [-1.18, 1.46]	-0.04 [-1.24, 1.15]	0.085
Delta body mass index, z-scores	-0.03 [-0.28, 0.18] ^a	0.09 [-0.10, 0.27] ^b	0.29 [-0.02, 0.50] ^c	<0.001
Fat percentage	21.5 [18.1, 25.7] ^{a,b}	23.3 [18.9, 29.8] ^b	20.1 [14.2, 29.2] ^a	0.050
Truncal fat percentage	16.8 [13.8, 20.8] ^a	17.6 [14.2, 25.5] ^a	14.7 [9.7, 23.5] ^b	0.026
Muscle-to-fat ratio, z-scores	-0.73 ± 0.88 ^a	-0.63 ± 0.90 ^a	0.16 ± 1.13 ^b	<0.001
Delta muscle-to-fat ratio, z-scores	0.69 ± 0.37 ^a	0.04 ± 0.16 ^b	-0.61 ± 0.31 ^c	<0.001

The data are expressed as mean ± SD, number (percent) and median [IQR]. SEP was determined by cluster of localities of residence, with 1 being the lowest rating and 10 the highest. The SEP index is an adjusted calculation of 14 variables that measure social and economic levels in the domains of demographics, education, standard of living, and employment (ranging from the lowest -2.797 to the highest 2.590). The values with different superscript letters (a, b) in a column are significantly different from each other in pairwise comparisons ($p \leq 0.05$). Bold indicates statistical significance.

CONCLUSIONS

- The weight status and body composition of children and adolescents attending our pediatric endocrine clinic were relatively stable during the COVID-19 pandemic.
- Subjects with underweight and normal weight had improved body composition parameters, while those with overweight/obesity remained stable.
- Engagement in physical activity during the pandemic predicted an improvement in body composition, while lower socioeconomic position predicted deterioration.
- These encouraging findings may well be attributed to the regular growth surveillance and healthy lifestyle education provided to the study participants

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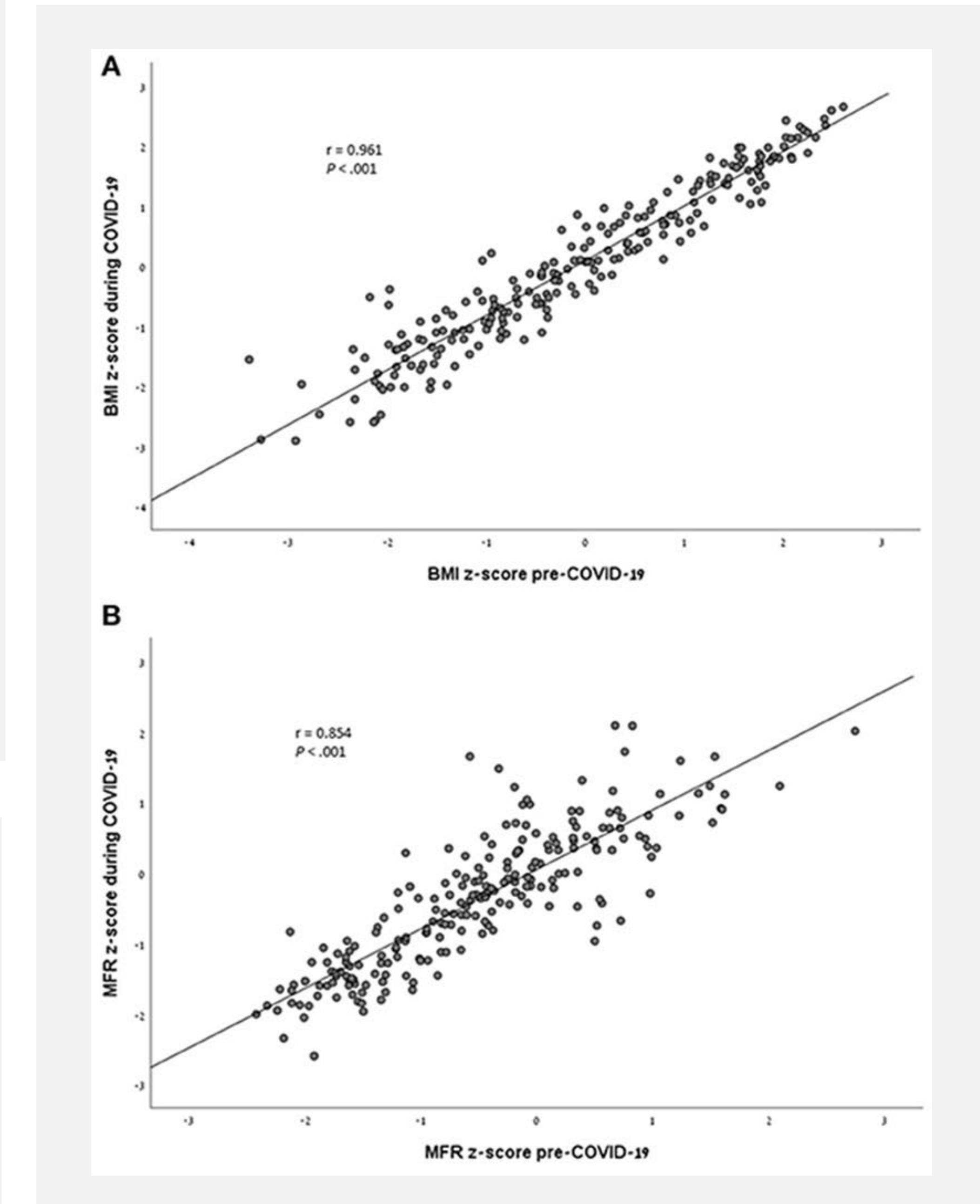
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Correlation analysis between

BMI z-scores before and during the COVID-19 pandemic ($r=0.961$, $p < 0.001$)

MFR z-scores before and during the COVID-19 pandemic ($r = 0.854$, $p < 0.001$)