

# HbA1c and BMI after lockdown for COVID-19 in children and adolescents with type 1 diabetes mellitus

## 1 | INTRODUCTION

Despite the potential deleterious effect of COVID-19 lockdown on individuals with type 1 diabetes mellitus (T1DM), a stable or even improved glycaemic control has been reported in paediatric subjects treated with continuous subcutaneous insulin infusion (CSII) using continuous or flash glucose monitoring (CGM/FGM).<sup>1,2</sup> To date, only two Indian studies evaluated the changes in HbA1c in paediatric individuals treated with multi-daily injections (MDI) with conflicting results.<sup>3,4</sup> Additionally, although there are some weight gain reports in children during the lockdown, only one study focused on individuals with T1DM.<sup>3</sup>

The study aimed to evaluate the effects of the first COVID-19 lockdown on HbA1c and body mass index (BMI) in an unselected population of paediatric T1DM individuals treated with MDI and CSII, with or without CGM/FGM. We also investigated the potential role of telemedicine, physical activity and increased meals/snacks during this period.

## 2 | METHODS

After the lockdown (9 March–3 May 2020), we consecutively recruited subjects <18 years with T1DM for at least 6 months, followed at the Diabetes Paediatric Unit of the Institute for Maternal and Child Health 'Burlo Garofolo' who underwent a follow-up visit. We collected pre-lockdown (6 December 2019–8 March 2020) data from medical records and post-lockdown (4 May–5 August 2020) data when children came for follow-up. HbA1c was measured with point-of-care testing (DCA2000+, Siemens). The BMI SDS were determined employing Growth Calculator 3 Software using WHO reference charts. Tele-visits (via video call) were retrieved from reporting database. Physical activity and an increase in meals/snacks during lockdown were investigated with an interview during the visits.

Statistical analysis was conducted using JMP™ software (version 15.1.0, SAS Institute Inc.). Data are presented as percentages or as median and IQR. Mann-Whitney rank-sum tests were executed to study the relations between variables. Wilcoxon signed-rank test was performed to check the differences of paired continuous

data. A  $p$ -value <0.05 was considered statistically significant. Fixing alpha = 0.05 and beta = 0.20, supposing a paired mean difference between pre-post HbA1c equal to 4 mmol/L (SD = 9, effect size = 0.44), a sample size of 44 subjects was needed.

## 3 | RESULTS

Overall, we collected data on 50 paediatric subjects with T1DM: 50% female, 62% utilising CSII and 84% using CGM/FGM. Median age was 15.0 years (IQR, 11.9–17.2), with a median duration of diabetes 7.3 years (IQR 4.1–9.7).

The median interval between pre-lockdown and post-lockdown visits was 119 days (IQR 95–178). During the lockdown, 36% of individuals (all CSII users) underwent a tele-visit and there was a reduction in children who engaged in regular physical activity (60 vs. 88%,  $p < 0.01$ ).

Data on HbA1c and BMI before and after lockdown are reported in Table 1.

At the first visit after lockdown, a median reduction in HbA1c of 2 mmol/L (IQR -5–4) was found, and HbA1c improved in 58% of the cohort. The reduction in HbA1c was inversely associated with pre-lockdown HbA1c ( $p = 0.01$ ), while no association was found with sex, age, duration of diabetes, pre-lockdown BMI, CSII and FGM/CGM use, interval between visits, physical activity, tele-visits and increase in meals/snacks during lockdown.

Overall, 52% of the cohort showed a rise in BMI SDS during the lockdown; however, the median BMI SDS increasing trend (0.03 [IQR -0.08–0.14]) was not statistically significant. The change in BMI was more visible in children (26%) who self-reported an increase in the number of meals/snacks than in those who did not refer such consumption (median 0.2 vs. 0.0,  $p = 0.01$ ), while no association was found with all the other aforementioned variables.

## 4 | DISCUSSION

In the present study, improvement in HbA1c was reported during COVID-19 lockdown in young subjects with T1DM, especially in

**TABLE 1** Data on HbA1c and BMI at last visit before lockdown (6 December 2019–8 March 2020) and at first visit after lockdown (4 May–5 August 2020)

	Pre-lockdown	Post-lockdown	<i>p</i>
HbA1c	60 mmol/L (53–66) 7.6% (7.0–8.2)	57 mmol/L (53–65) 7.4% (7.0–8.1)	<b>0.04</b>
BMI	0.27 SDS (–0.27–1.18)	0.35 SDS (–0.23–1.29)	0.81

Note: Data are expressed as median and interquartile range or percentage; differences of paired data evaluated with Wilcoxon signed-rank test.

*P* values which are less than .05 are considered statistically significant and indicated in bold.

those with higher baseline HbA1c. Remarkably, no association was found between HbA1c reduction and the use of CSII and FGM/CGM, physical activity or tele-visits during lockdown. We can speculate that the primary cause for these beneficial effects on T1DM management can be found in a more regular timetable during the day and the continual presence of parents at home.<sup>2</sup> These considerations are supported by evidence from an Indian study, which found better glycaemic control in young individuals with T1DM with a more stable daily routine and strong family support system.<sup>3</sup> We suggest that the relevance of these findings should be strongly taken into account by physicians even beyond the lockdown period.<sup>5</sup>

Furthermore, no significant overall increase in BMI during the lockdown was found in our cohort and those who increased their BMI the most were the same ones who reported higher consumption of meals and snacks.<sup>3</sup>

Although the present study relies on a limited number of children retrospectively observed in a single centre, it is the first study that analyses paediatric individuals with diabetes, regardless of the use of technologies. Furthermore, our study is the first in Europe to assess BMI changes along with HbA1c levels.







In conclusion, this study suggests that an improvement of the HbA1c in an unselected population of paediatric T1DM subjects during COVID-19 lockdown was independent of physical activity, telemedicine and use of CSII and CGM/FGM.

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#### CONFLICT OF INTEREST

No conflicts of interest to disclose.

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