

# How beneficial to health do children and adolescents with early-onset type 1 diabetes eat after 10 years of diabetes?

A comparison with their peers in the general population

Christina Bächle, Anna Stahl-Pehe, Joachim Rosenbauer, Düsseldorf

## Summary

The average consumption of different food types by both study populations was determined by means of a standardized questionnaire on frequency of consumption and average portion size (Food Frequency Questionnaire [FFQ]). These study populations comprised 629 children and adolescents with early-onset type 1 diabetes of long duration and 6,813 participants of the same age in the representative KiGGS study (comparison group). Analysis of the data showed that, in spite of their unfavorable HbA<sub>1c</sub> levels, children and adolescents with type 1 diabetes had a better dietary pattern than their peers in the general population. They consumed more fruit and vegetables and fewer sugary drinks.

**Keywords:** diabetes mellitus type 1, dietary behavior, food intake, children and adolescents

who are following an intensified insulin therapy, have now aligned to those of their peers in the general population. This has not been the subject of major scientific study until now. The significance of most previous studies is limited due to low sample sizes.

Among those suffering from type 1 diabetes, children and adolescents with early-onset diabetes and a longer duration of illness, are of significant interest, as they must face various somatic and psychosocial challenges from a young age, and have a comparatively high risk of diabetes-related complications and secondary diseases [3]. Unhealthy dietary habits and insufficient metabolic control in the early years can significantly increase this risk [2, 4, 5].

## Introduction

Children with type 1 diabetes (depending on age) and their parents are regularly educated about the important issues in diabetes therapy. In the past, patients with type 1 diabetes had to adhere to a fixed meal schedule, but the medical advances of the last 15 years offer increasing flexibility in lifestyle and diet [1]. In principle, the same dietary recommendations now apply to people with type 1 diabetes as to people without any metabolic disorder [2]. They can decide freely on the time and amount of carbohydrates consumed, as long as this is factored in to the insulin dose administered. It therefore stands to reason that the dietary habits of children and adolescents with type 1 diabetes

## Question

This study therefore compares the dietary habits of children and adolescents with early-onset type 1 diabetes of at least 10 years duration with representative data from their peers in the general population.

## Methodology

### Study population

This study analyzed data from a Germany-wide questionnaire survey of 11- to 17-year-olds who had suffered

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from the disease for at least ten years from the age of 0–4 [6]. A total of 629 children and adolescents with type 1 diabetes took part in the diabetes study.

The comparison group comprised 6,813 participants of the same age from the representative KiGGS study (2003–2006, Robert Koch Institute, Berlin [7]). ♦ Table 1 shows a comparison between both study populations.

### Survey instrument

In both studies, the average consumption of different food types was determined by means of the same standardized questionnaire on frequency of consumption and average portion size [8].

### Statistical analysis

A comparison of both samples was carried out via simple description and linear regression models with adjustments for age group, gender, socio-economic status of parents, migrant background, area of residence, family structure, and weight status.

### Results

♦ Figure 1 illustrates the results of the comparison of average consumption between adolescents with early-onset type 1 diabetes and their peers in the KiGGS study. The average HbA<sub>1c</sub> level (glycated hemoglobin, enables conclusions on blood sugar levels over the preceding eight to twelve weeks) of the study population with type 1 diabetes was 8.3 %, significantly higher than the recommended HbA<sub>1c</sub> level of < 7.5 % for this age group [9].

After comprehensive adjustment, children and adolescents with type 1 diabetes consumed on average:

- 90 (standard error 16) g more fresh fruit (p < 0.001),
- 63 (8) g more fresh vegetables (p < 0.001),

- 26 (4) g more cooked vegetables (p < 0.001),
- 91 (32) g fewer soft drinks (p = 0.005) and
- 50 (9) g fewer sport and energy drinks (p < 0.001) per day.

The consumption of fast food (sausages, burgers, kebabs), wholegrain bread and white bread did not differ between both groups (p > 0.05).

### Discussion

Analysis of the data from the standardized Food Frequency Questionnaires (FFQ) showed that children and adolescents with early-onset type 1 diabetes of long duration

have a somewhat healthier dietary pattern than their peers in the general population. They consume more fruit and vegetables and fewer sugary drinks.

The higher consumption of fruit and vegetables by children and adolescents with type 1 diabetes found in this study broadly corresponds to results from previous studies [10, 11] (only vegetables), [12, 13] (only fruit). In this regard, the amount of vegetables consumed by children and adolescents with and without type 1 diabetes in this study was similar to the 6- to 17-year-olds from Crete/Greece [11]. Comparable data on the consumption of raw and cooked vegetables is not available.

	type 1 diabetes *	KiGGS #	p-value +
number	629	6,813	
boys [%]	54.1	51.3	0.188
age (SD) [years]	15.3 (1.7)	14.6 (2.0)	
11–13 years [%]	24.0	39.6	< 0.001
14–17 years [%]	76.0	60.4	
migrant background [%]	1.8	17.5	< 0.001
socio-economic status			
low [%]	17.9	27.4	
medium [%]	48.2	47.2	< 0.001
high [%]	33.9	25.3	
family structure			
lives with biological parents [%]	79.2	74.6	
lives with mother/father and partner [%]	9.3	10.6	0.070
lives with single mother/father [%]	10.4	13.6	
other [%]	1.1	1.3	
HbA <sub>1c</sub> (SD) [%]**	8.3 (1.3)	---	---
weight status			
underweight [%]	3.3	7.5	
normal weight [%]	80.7	74.8	< 0.001
overweight [%] (including obesity)	16.0	17.7	

Tab. 1: Features of both study populations

\* percentage or average (standard deviation [SD])

# weighted percentage or average (standard deviation [SD])

+ p-value for comparison between both study populations (t-test for continuous variables,  $\chi^2$ -test for categorical variables)

\*\* percentage of glycated hemoglobin in total hemoglobin in the blood; the recommended HbA<sub>1c</sub> level is < 7.5 %

--- not specified/no data

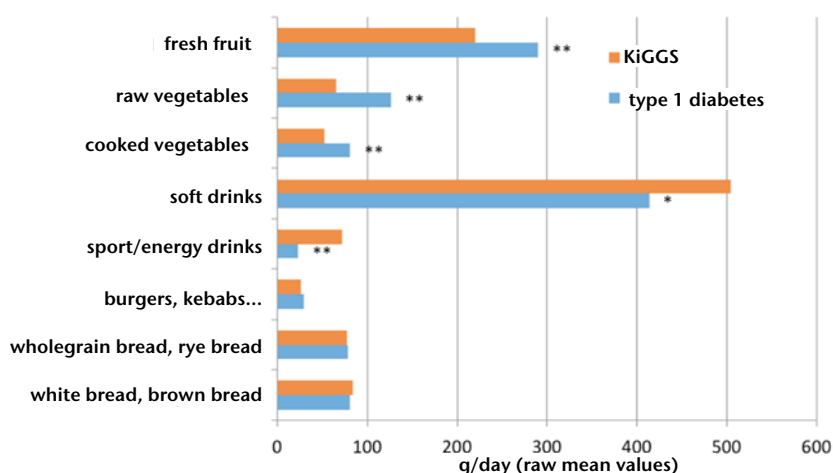


Fig. 1: Comparison of average consumption among children and adolescents with early-onset type 1 diabetes and their peers in the general population (non-adjusted mean values)  
\*p < 0.05; \*\*p < 0.001

This study only recorded the overall intake of soft drinks; the Norwegian study made a distinction between sugary and sugar-free soft drinks. Test persons with type 1 diabetes exclusively drank diet soft drinks; however, the control group exclusively drank sugary drinks [12]. Bread consumption was also surveyed in the same study. In contrast to the results of this study, the 9- to 13-year-old test persons with type 1 diabetes consumed significantly less white bread; however, there was no difference for wholegrain bread. The scale of bread consumption was also significantly lower than in this study.

### Limitations

All data was provided by the study participants themselves. Levels of consumption were estimated on the basis of average portion sizes. The survey method is less detailed and less accurate, but enables comparison with a representative sample (KiGGS study). Due to the limited number of foods surveyed, we are unable to provide information on energy and nutrient intake.

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### Conflict of Interest

The authors declare no conflict of interest.

Dr. Christina Bächle<sup>1</sup>

Dr. rer. nat. Anna Stahl-Pehe

Dr. med. Dipl.-Math. Joachim Rosenbauer

Deutsches Diabetes-Zentrum

Institut für Biometrie und Epidemiologie

Auf'm Hennekamp 65, 40225 Düsseldorf

<sup>1</sup>E-Mail: christina.baechle@ddz.uni-duesseldorf.de

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