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Original Research Article

# Analysis of Body Composition Parameters in Type 1 Diabetics and Healthy Individuals in the Paediatric Age Group

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**Abstract**

**Background:** Type 1 Diabetes Mellitus (T1DM) is a chronic autoimmune disorder characterized by destruction of pancreatic β-cells resulting in absolute insulin deficiency. During childhood and adolescence, T1DM significantly affects growth, nutritional status, and body composition. Alterations in lean body mass and fat distribution may adversely influence metabolic health and long-term cardiovascular outcomes.

**Aim:** To compare body composition parameters between pediatric patients with T1DM and healthy age-matched controls.

**Materials and Methods:** This hospital-based case–control study was conducted in the Department of Physiology in collaboration with the Department of Pediatrics at BPS Government Medical College for Women, Khanpur Kalan, Sonipat, and Haryana. Ninety participants were enrolled, including 45 pediatric patients with T1DM and 45 healthy age-matched controls. Anthropometric and body composition parameters including body weight, Body Mass Index (BMI), Fat-Free Mass (FFM), Soft Lean Mass (SLM), Skeletal Muscle Mass (SMM), Body Fat Mass (BFM), and Percent Body Fat (PBF) were assessed using Bioelectrical Impedance Analysis (BIA). Statistical analysis was performed using SPSS version 25.0.

**Results:** The mean body weight was significantly lower in cases compared to controls (27.84 ± 11.19 kg vs 34.38 ± 11.81 kg; $p = 0.008$). BMI was significantly lower among T1DM children (15.39 ± 3.69 kg/m² vs 19.08 ± 2.14 kg/m²; $p < 0.001$). Fat-Free Mass and Soft Lean Mass were also significantly reduced in cases ($p = 0.002$ and $p = 0.005$ respectively). No statistically significant difference was observed in Skeletal Muscle Mass, Body Fat Mass, or Percent Body Fat between groups.

**Conclusion:** Children and adolescents with T1DM exhibit significant reductions in body weight, BMI, Fat-Free Mass, and Soft Lean Mass compared to healthy peers. The findings suggest that pediatric T1DM predominantly affects lean body compartments rather than adiposity. Routine body composition monitoring may help optimize growth and metabolic outcomes in pediatric T1DM.

**Keywords:** Type 1 Diabetes Mellitus, Body Composition, Pediatric Diabetes, Bioelectrical Impedance Analysis, Fat-Free Mass, Body Mass Index.

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## Introduction

Type 1 Diabetes Mellitus (T1DM) is one of the most common chronic endocrine disorders affecting children and adolescents worldwide. It is characterized by autoimmune destruction of pancreatic β-cells leading to absolute insulin deficiency and lifelong dependence on exogenous insulin therapy. The incidence of T1DM has been increasing globally, especially in pediatric populations, thereby posing major challenges to healthcare systems and long-term disease management. Insulin plays a vital role in growth, protein synthesis, glucose utilization, and maintenance of body composition. Deficiency of insulin produces a catabolic state characterized by proteolysis, lipolysis, and weight loss. Consequently, children with T1DM may develop

alterations in body composition during critical periods of growth and pubertal development. Body composition analysis provides a better understanding of nutritional and metabolic health than conventional anthropometric indices alone. Parameters such as Fat-Free Mass (FFM), Fat Mass (FM), Skeletal Muscle Mass (SMM), and Percent Body Fat (PBF) offer valuable insight into the physiological effects of T1DM. Previous studies have shown conflicting findings regarding adiposity and lean mass distribution among pediatric patients with T1DM.

Bioelectrical Impedance Analysis (BIA) is a practical, non-invasive, and cost-effective method for body composition assessment. It estimates body compartments based on resistance and reactance to electrical current passage through body tissues.

The present study was conducted to compare body composition parameters between children with T1DM and healthy age-matched controls.

## Materials and Methods

**Study Design:** Hospital-based case–control study.

**Study Setting:** The study was conducted in the Department of Physiology in collaboration with the Department of Pediatrics at BPS Government Medical College for Women, Khanpur Kalan, Sonipat, and Haryana after obtaining Institutional Ethics Committee approval.

**Study Population:** The study included pediatric patients diagnosed with Type 1 Diabetes Mellitus and age-matched healthy controls.

### Sample Size

A total of 90 participants were enrolled in the study, comprising:

- Case group: 45 pediatric patients with T1DM
- Control group: 45 healthy age-matched individuals

### Inclusion Criteria

1. Pediatric patients diagnosed with T1DM.
2. Age below 18 years.
3. Written informed consent from parents/guardians.

### Exclusion Criteria

1. Refusal to provide informed consent.
2. Age above 18 years.
3. Type 2 Diabetes Mellitus.
4. Acute illness or infections.
5. Severe acute malnutrition.
6. Diseases affecting body composition such as nephrotic syndrome or inflammatory bowel disease.

### Methodology

Detailed demographic and clinical history was recorded for all participants. Anthropometric measurements including height and weight were obtained using standard protocols.

Body composition analysis was performed using InBody S10 Body Segment Analyzer based on Bioelectrical Impedance Analysis.The following parameters were assessed:

- Body Weight
- Body Mass Index (BMI)
- Fat-Free Mass (FFM)
- Soft Lean Mass (SLM)
- Skeletal Muscle Mass (SMM)
- Body Fat Mass (BFM)
- Percent Body Fat (PBF)

**Statistical Analysis:** Data analysis was performed using SPSS version 25.0. Quantitative variables were expressed as mean ± standard deviation. Independent samples t-test was used for normally distributed variables, while Mann–Whitney U test was used for non-normally distributed variables. A p-value <0.05 was considered statistically significant.

## Results

**Table 1: Comparison of Demographic and Body Composition Parameters between Cases and Controls**

| Parameter | Cases (n=45) Mean ± SD | Controls (n=45) Mean ± SD | p-value |
|---|---|---|---|
| Age (years) | 10.33 ± 3.42 | 9.56 ± 3.93 | 0.319 |
| Height (cm) | 133.22 ± 23.83 | 132.18 ± 23.23 | 0.834 |
| Weight (kg) | 27.84 ± 11.19 | 34.38 ± 11.81 | 0.008* |
| BMI (kg/m²) | 15.39 ± 3.69 | 19.08 ± 2.14 | <0.001* |
| Fat-Free Mass (kg) | 22.34 ± 8.70 | 29.04 ± 11.25 | 0.002* |
| Soft Lean Mass (kg) | 20.87 ± 8.32 | 26.64 ± 10.57 | 0.005* |
| Skeletal Muscle Mass (kg) | 10.91 ± 5.25 | 11.20 ± 4.40 | 0.780 |
| Body Fat Mass (kg) | 5.50 ± 5.40 | 2.78 ± 2.44 | 0.069 |
| Percent Body Fat (%) | 18.82 ± 13.71 | 20.32 ± 13.85 | 0.913 |

***Statistically significant**

The mean body weight and BMI were significantly lower among children with T1DM compared to healthy controls. Fat-Free Mass and Soft Lean Mass were also significantly reduced in the case

group. No significant difference was observed in Skeletal Muscle Mass, Body Fat Mass, or Percent Body Fat.

## Discussion

The present study evaluated body composition parameters in children and adolescents with Type 1 Diabetes Mellitus and compared them with healthy age-matched controls.

No significant differences were observed in age and height between groups, indicating appropriate matching and preserved linear growth among T1DM patients. Adequate insulin therapy likely contributed to maintenance of normal growth.

A significant reduction in body weight and BMI was observed among T1DM children. Insulin deficiency promotes a catabolic state leading to enhanced protein breakdown and reduced body mass. Similar findings have been reported in previous studies by Minges et al. and Zheng et al.

Fat-Free Mass and Soft Lean Mass were significantly lower in children with T1DM. Lean body compartments are highly dependent on insulin-mediated anabolic processes. Chronic insulin deficiency and altered metabolic regulation may impair muscle protein synthesis and lean tissue accretion.

No statistically significant differences were observed in Skeletal Muscle Mass, Body Fat Mass, or Percent Body Fat between groups. Although some previous studies have reported increased adiposity among children with T1DM, the present findings suggest relative preservation of adipose tissue despite reduced lean mass.

The findings of the present study emphasize that body composition abnormalities in pediatric T1DM predominantly involve lean body compartments rather than increased fat accumulation.

## Conclusion

Children and adolescents with Type 1 Diabetes Mellitus demonstrate significant reductions in body weight, Body Mass Index, Fat-Free Mass, and Soft Lean Mass compared to healthy controls. The study suggests that pediatric T1DM predominantly affects lean body compartments rather than adiposity. Regular assessment of body composition may help in early identification of nutritional and metabolic abnormalities and improve long-term clinical management.

## Limitations

1. Single-center hospital-based study.
2. Relatively small sample size.
3. Pubertal status, dietary intake, physical activity, and duration of diabetes were not independently analyzed.
4. Bioelectrical Impedance Analysis is less precise than DEXA.
5. Cross-sectional design limits causal interpretation.

**Ethical Considerations:** Institutional Ethics Committee approval was obtained prior to commencement of the study from BPS Government Medical College for Women, Khanpur Kalan, Sonipat, and Haryana. Written informed consent was obtained from parents or guardians of all participants before enrollment in the study. Confidentiality and anonymity of participant data were strictly maintained throughout the study period. Participants were informed that participation was voluntary and they were free to withdraw from the study at any stage without affecting their medical care. No invasive procedure or research-related harm was involved during the study.

## References

1. Atkinson MA, Eisenbarth GS, Michels AW. Type 1 diabetes. Lancet. 2014;383(9911):69–82.
2. Wells JCK, Fewtrell MS. Measuring body composition. Arch Dis Child. 2006;91(7):612–17.
3. Kyle UG, Bosaeus I, De Lorenzo AD, Deurenberg P, Elia M, Gómez JM, et al. Bioelectrical impedance analysis—Part I: review of principles and methods. Clin Nutr. 2004;23(5):1226–43.
4. Marcovecchio ML, Chiarelli F. Relationship between growth, puberty, and glycaemic control in children with type 1 diabetes. J Endocrinol Invest. 2015;38(9):905–13.
5. Nsamba J, Ndugwa CM, Namayanja R, Kibirige D, Kalyesubula R. Body composition and phase angle in children and adolescents with type 1 diabetes mellitus in Uganda. BMC Endocr Disord. 2022;22(1):1–10.
6. Karagüzel G, Akçurin S, Bircan I. Evaluation of nutritional status, body composition, and glycaemic control in children and adolescents with type 1 diabetes mellitus. J Pediatr Endocrinol Metab. 2006;19(7):875–82.
7. Zheng Y, Hu FB. Adiposity and type 1 diabetes in children and adolescents: a systematic review and meta-analysis. Diabetes Obes Metab. 2022;24(5):789–99.
8. Calella P, Valerio G, Brodsky IG, Taylor J, Moorehead K, Koves I, et al. Body composition assessment in children and adolescents with type 1 diabetes: a systematic review. Nutrients. 2020;12(3):1–20.
9. Minges KE, Whittemore R, Weinzimer SA, Grey M. Changes in body composition during the first year after diagnosis of type 1 diabetes in children and adolescents. J Pediatr. 2013;163(1):191–97.

10. Wierzbicka E, Świercz A, Płudowski P, Jaworski M, Szalecki M. Skeletal status, body composition, and glycemic control in adolescents with type 1 diabetes mellitus. J Diabetes Res. 2018; 2018:8121634.
11. Al-Goblan AS, Al-Alfi MA, Khan MZ. Mechanism linking diabetes mellitus and obesity. Diabetes Metab Syndr Obes. 2014;7: 587–91.
12. Särnblad S, Johansson C, Ekelund U, Aman J. Girls with type 1 diabetes have higher body fat than boys during adolescence despite similar BMI. Diabet Med. 2007;24(8):905–10.
13. Szadkowska A, Pietrzak I, Szlawska J, et al. Abdominal obesity, metabolic syndrome, and cardiovascular risk in adolescents with type 1 diabetes mellitus. Pediatr Diabetes. 2015;16 (2):85–93.
14. Bjornstad P, Snell-Bergeon JK, Nadeau KJ. Insulin sensitivity and complications in youth with type 1 diabetes. J Diabetes Complicati ons. 2015;29(1):111–16.
15. Chillarón JJ, Flores-Le Roux JA, Benaiges D, Pedro-Botet J. Type 1 diabetes, metabolic syndrome and cardiovascular risk. Metabolism. 2014;63(2):181–87.