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Early Effects of Testosterone Initiation on Body Mass Index in Transmasculine Adolescents

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Abstract

Purpose: Increasing numbers of transgender youth are receiving hormone therapy in accordance with national and international guidelines. This study sought to determine the effect of testosterone on body mass index (BMI) z-score in transmasculine adolescents at 6 and 12 months after initiation.

Methods: A retrospective chart review collected anthropomorphic data on transmasculine adolescents, aged 13 to 19 years, before and during testosterone use. These measurements were used to create a linear mixed model to explore the change in BMI z-score after initiating testosterone.

Results: The increase in BMI z-score in transmasculine adolescents was significantly higher after six months of testosterone use, but there was no significant change between baseline and 12 months.

Conclusions: Additional study is needed to understand the full short- and long-term impact of testosterone use on BMI z-score in transmasculine adolescents to provide appropriate informed consent and develop interventions to improve health outcomes.

Keywords

Transgender youth; Gender-affirming hormone therapy; BMI

Transmasculine individuals were assigned female at birth but identify as masculine. Increasing numbers of transmasculine adolescents are receiving testosterone therapy in accordance with recommendations from the World Professional Association for Transgender Health and the Endocrine Society [1,2]. Exogenous testosterone administration induces anabolic effects such as increased muscle mass and bone mineral density and virilizing

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effects including lower voice pitch, clitoral enlargement, and increased body hair [1]. Prior studies also suggest an association between hyperandrogenism and an abdominal obesity phenotype [3].

Although gender-affirming care is critical to improving the overall health and well-being of transgender youth, little is known about the impact of testosterone on body weight in adolescents [3]. Research suggests that testosterone increases body mass index (BMI) in transmasculine adults, but few studies have examined the effects in youth, and none have accounted for increases in BMI expected in adolescence [4]. We are unaware of prior studies in this population using BMI z-score, a more accurate measure of body weight in growing adolescent bodies [5].

Given the prevalence of obesity and its association with poor health outcomes in adulthood, understanding the effects of testosterone on weight in transmasculine youth is critical. The aim of this study was to understand the impact of testosterone administration on BMI z-score in transmasculine adolescents 6 and 12 months after initiation.

Methods

A retrospective chart review was conducted of transmasculine adolescents aged 13–19 years visiting an adolescent medicine clinic at a large, urban, children's hospital for gender-affirming hormone therapy between September 2014 and May 2017. Data collected included sex assigned at birth, gender identity, and baseline age, height, and weight. Height and weight documented in each clinical encounter were used to calculate BMI in kg/m^2 [2]. Time since testosterone initiation, testosterone dosage, and delivery method were also collected. Subcutaneous testosterone cypionate was initiated at weekly doses of 12.5 or 25 mg and gradually increased over months until serum testosterone levels were in a natal male range [1]. Follow-up BMI data were collected via electronic health record abstraction from each clinical encounter in the year following testosterone initiation. BMI percentile was calculated using Centers for Disease Control and Prevention growth charts corresponding to the individual's sex assigned at birth. BMI z-scores were calculated using Centers for Disease Control and Prevention growth charts to control for age and sex assigned at birth [6]. Growth charts corresponding patients' sex assigned at birth were used to calculate BMI z-score as all participants were postmenarchal at the time of testosterone initiation and none had undergone pubertal blockade. Patients receiving medroxyprogesterone were excluded, given its known association with weight gain. Approval was obtained from the institutional review board.

Statistical analysis

Descriptive statistics were used to summarize the BMI, BMI percentile, and BMI z-score ($n = 46$). A linear mixed model fit via maximum likelihood estimation was constructed to explore change in BMI z-score from baseline over a 12-month follow-up period. Change in BMI z-score from baseline was the primary outcome. Fixed effects included time from baseline, hormone dose rate, baseline age, and baseline BMI z-score. Dose rate was defined as the difference between most recent testosterone dose and first testosterone dose divided by the time between doses. A fixed effect for time-squared was also added to the model

to allow change in BMI z-score to follow a quadratic function of time. Random effects for subject and time were included in the model to account for repeated measurements from individual patients. The model was fit using SAS, version 9.4 (SAS Institute), and a type 1 error rate of 5% was assumed.

Results

A total of 46 patients with up to 8 observations per patient were included in this model (N=123 total observations). Baseline, 6-month, and 12-month BMI, BMI percentile, and BMI z-score are shown in Table 1. BMI z-score increased significantly between baseline and 6 months of hormone use ($p = .006$), but no significant difference was seen between baseline and 12 months ($p = .519$). Effects of time and time-squared on BMI z-score were statistically significant ($p = .015$ and $p = .009$) (Table 2). Given the estimated coefficient for time was positive and for time-squared was negative, BMI z-score demonstrated a concave trajectory over time. Testosterone dose rate was a significant predictor of change in BMI z-score with a positive estimated coefficient ($p = .032$). Baseline age and BMI z-score were not significant predictors of change in BMI z-score.

Discussion

Our study sought to identify the temporal relationship between testosterone administration and weight over time among transmasculine adolescents. The findings from our linear mixed model suggest higher dose rates are associated with larger increases in BMI z-score in the first 6 months of therapy. These data are consistent with prior studies demonstrating weight gain and increased BMI with testosterone use [4,7]. In a Belgian sample, testosterone use, in addition to an androgenic progestin (lynestrenol), was associated with significant weight gain both at 6 and 12 months after initiation [7]. Authors of that study noted the possibility that weight gain was associated with accrual of lean body mass as seen in anabolic steroid use; however, no analysis of lean tissue mass or adiposity was conducted [7]. Our findings that testosterone dose rate is associated with increased BMI z-score add to these prior findings, with the unique observation that the significant difference in BMI z-score seen between baseline and 6 months was not present between baseline and 12 months. This conflicts with the proposed explanation that weight changes related to testosterone initiation are solely due to the addition of lean body mass, which would persist. Further investigation on how testosterone initiation impacts body composition, mood, diet, and exercise is critical to providing an explanation for these findings.

Limitations

This study is limited by its small sample from a single academic institution and use of retrospective electronic health record data. However, it adds to our understanding of the potential impact of testosterone on BMI z-score. It also suggests a temporal, dose-rate relationship with increasing BMI z-scores which requires further investigation. Prospective studies are needed to both advance our understanding of the effect of testosterone on BMI z-score and allow for the creation of interventions to improve health outcomes in this population.

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References

- [1]. Hembree WC, Cohen-Kettenis PT, Gooren L, et al. Endocrine treatment of gender-dysphoric/gender-incongruent persons: An Endocrine Society clinical practice guideline. *Endocr Pract* 2017;23:1437. [PubMed: 29320642]
- [2]. WPATH Standards of care for the health of transsexual, transgender, and gender nonconforming people. 2011. Available at: https://www.wpath.org/media/cms/Documents/SOC%20v7/Standards%20of%20Care_V7%20Full%20Book_English.pdf. Accessed January 12, 2019.
- [3]. Pasquali R. Obesity, fat distribution and infertility. *Maturitas* 2006;54: 363–71. [PubMed: 16725287]
- [4]. Jarin J, Pine-Twaddell E, Trotman G, et al. Cross-sex hormones and metabolic parameters in adolescents with gender dysphoria. *Pediatrics* 2017;139: e20163173. [PubMed: 28557738]
- [5]. de Onis M, Lobstein T. Defining obesity risk status in the general childhood population: Which cut-offs should we use? *Int J Pediatr Obes* 2010; 5:458–60. [PubMed: 20233144]
- [6]. Kuczmarski RJ, Ogden CL, Guo SS, et al. 2000 CDC growth charts for the United States: Methods and development. *Vital Health Stat* 11 2002:1–190.
- [7]. Tack LJ, Craen M, Dhondt K, et al. Consecutive lynestrenol and cross-sex hormone treatment in biological female adolescents with gender dysphoria: A retrospective analysis. *Biol Sex Diff* 2016;7:14.

IMPLICATIONS AND CONTRIBUTION

Transmasculine adolescents had a significant increase in body mass index z-score 6 months after starting testosterone, but no change was seen between baseline and 12 months. More research is needed to understand the role of testosterone therapy on weight gain in this population to inform the development of gender-affirming health-promoting interventions.

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Table 1

Mean BMI, BMI percentile, and BMI z-score at baseline and follow-up

	Baseline	6 months	12 months
BMI (kg/m ²)	26.2 ± 5.7	27.3 ± 5.8	25.6 ± 4.9
BMI percentile	72.3 ± 26.6	76.2 ± 25.1	70.0 ± 28.5
BMI z-score	.9 ± 1.0	1.0 ± 1.0	.7 ± 1.0

BMI = body mass index.

Table 2

Change in BMI Z-score from baseline in transmasculine adolescents aged 13–19 years

	Coefficient estimate	Standard error	<i>p</i> -value	95% CI
Time	.054	.022	.015 ^a	(.01, .097) ^a
Time-squared	−.005	.001	.009 ^a	(−.008, −.001) ^a
Dose rate	.02	.008	.031 ^a	(.002, .034) ^a
Age	−.027	.035	.433	(−.099, .043)
Baseline z-score	−.060	.044	.185	(−.149, .030)

BMI = body mass index; CI = confidence interval.

^aStatistically significant change ($p < .05$).