ORIGINAL ARTICLES

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Potential effects of attention deficit hyperactivity disorder medication on body height and body weight in a longitudinal pediatric cohort study, the LIFE Child study

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Purpose: To investigate the potential impact of drugs for the treatment of attention deficit hyperactivity disorder (ADHD) on body weight and height in children and adolescents from the LIFE ('Leipzig Research Centre for Civilization Diseases', Leipzig, Germany) Child cohort. *Methods:* We included 2,115 participants aged ≥6 to <18.25 years who attended the LIFE study center between 2011 and 2020 in our analysis, of whom 48 used ADHD drugs. Anthropometric and medication data from baseline to the third follow-up visit were available for 659 participants. Body height and body weight measurements were subsequently converted to z-scores. A repeated measures analysis of variance (ANOVA) was performed on the z-scores of both ADHD drug users and non-users to determine potential trends in body weight and body height from baseline to the 3rd annual follow-up. *Results:* At the last visit with ADHD drug use of the 48 ADHD drug users, 40% (19/48) of the children and adolescents were below the 25th reference percentile for weight. Z-scores for body height declined from baseline to the 3rd annual follow-up in individuals who used ADHD drugs (n=10; $\text{Difference}_{\text{means}}$=-0.310; p=0.002) compared to non-users (n=649; $\text{Difference}_{\text{means}}$=0.102; p<0.001). Body weight also decreased from baseline to 3rd follow-up in the ADHD drug group (n=10; $\text{Difference}_{\text{means}}$=-0.473; p<0.001) compared to the non-user group (n=649; $\text{Difference}_{\text{means}}$=0.015; p=0.161). *Conclusion:* We observed a potential tendency towards lower Z-scores for body height and body weight in individuals taking ADHD medication for an extended period compared to the corresponding age- and sex-matched populations.

1. Introduction

The prevalence of attention deficit hyperactivity disorder (ADHD) in children and adolescents is estimated at 3-8% (Storebø et al. 2018). Several drugs can be used in the treatment of ADHD, including methylphenidate, lisdexamfetamine, and atomoxetine. These drugs can cause serious adverse drug reactions (Reddy 2013). In particular, possible effects on body height and weight are discussed (Storebø et al. 2018). In this regard, a study found that the use of ADHD drugs may lead to a reduction of obesity and body weight (Mellström et al. 2020). A review concluded that methylphenidate use has a small effect on body weight and body height (Carucci et al. 2021). In contrast, a 2018 Cochrane review was inconclusive about possible changes in body weight and body height (Storebø et al. 2018). Data on body height and body weight change in individual participants obtained from longitudinal cohort studies are scarce. To address the limited real-world data available, we analyzed data from a pediatric longitudinal cohort study. We used these data to analyze potential effects on participants' individual body weight and body height for each year after ADHD drug initiation in comparison to a general population of children and adolescents without ADHD drug use.

2. Investigations and results

2.1. Setting

The data utilized in this analysis were derived from the 'Leipzig Research Centre for Civilization Diseases (LIFE)' Child study, a longitudinal pediatric cohort study conducted in Leipzig, Saxony, Germany. The study population includes infants, children, and adolescents. The research center is located at the University Hospital of Leipzig. The LIFE Child cohort is designed to monitor the development of children from birth to adulthood and to gain an understanding of the causes of lifestyle-related diseases. The LIFE Child study was designed in accordance with the Declaration of Helsinki, and the Ethics Committee at the Medical Faculty of Leipzig University approved the study protocol. Written informed consent was obtained from both parents and children aged 12 years and older (Poulain et al. 2017).

2.2. Patients and drugs

We analyzed all available data of participants between 1 January 2011 and 31 December 2020 and evaluated potential effects on body weight and body height of drugs used for the treatment of

ADHD: methylphenidate, lisdexamfetamine, and atomoxetine. Since those ADHD drugs are approved from 6 years onwards and no prior use was observed in our study population, the lower age limit for inclusion in this analysis was set at 6 years. The upper age limit was set at <18.25 years, as reference values for body height and body weight were available up to this age (Neuhauser et al. 2013). Participants were excluded from analyses if they were taking drugs at any visit that could potentially affect body height and body weight, e.g., insulin, dimenhydrinate, beta-adrenergic antagonists, glucocorticoids (Supplementary Table 1). The selection of these drugs was based on an assessment conducted by three pharmacists. This assessment was based on the data presented in the Summaries of Product Characteristics and on the findings of studies that indicated a potential influence of the active ingredients or the underlying disease on body height and body weight.

last visit to the study center compared to the standard percentiles for Germany using both absolute body height and weight and the according z-scores.

Second, we analyzed whether ADHD drug intake effects body height and weight with increasing duration of ADHD drug use compared to non-users in our study cohort. For this analysis, we considered the visit before the intake of ADHD drugs (=baseline) and three subsequent annual visits (=1st, 2nd, 3rd follow-up) with ADHD drug intake (ADHD drug group), excluding those who used ADHD drugs for less than four consecutive visits, who did not visit the study center four times during the observation period (e.g., due to dropout), or who were already being treated with ADHD drugs at the first visit. For the non-user group, the first four recorded visits (=baseline, 1st, 2nd, 3rd follow-up) with available data on body height and weight of the participants without ADHD drug use were

Table 1: Results of the repeated measures analysis of variance (ANOVA) and split-plot ANOVA between the non-user group and the ADHD drug group and from baseline to third annual follow-up

Visit[a]	z-Height		z-Weight	
	Non-user group	**ADHD drug group**	**Non-user group**	**ADHD drug group**
Baseline	N: 649 M: 0.124 (55th P) SD: 0.999	N: 10 M: 0.283 (61st P) SD: 1.055	N: 649 M: -0.083 (47th P) SD: 0.959	N: 10 M: 0.288 (61st P) SD: 0.756
1st follow-up	N: 649 M: 0.174 (57th P) SD: 0.985	N: 10 M: 0.217 (59th P) SD: 1.114	N: 649 M: -0.077 (47th P) SD: 0.921	N: 10 M: 0.143 (56th P) SD: 0.760
2nd follow-up	N: 649 M: 0.199 (58th P) SD: 0.986	N: 10 M: 0.154 (56th P) SD: 1.049	N: 649 M: -0.054 (48th P) SD: 0.929	N: 10 M: -0.124 (45th P) SD: 0.754
3rd follow-up	N: 649 M: 0.226 (59th P) SD: 0.982	N: 10 M: -0.027 (49th P) SD: 1.001	N: 649 M: -0.068 (47th P) SD: 0.943	N: 10 M: -0.185 (43rd P) SD: 0.680
Results of repeated measures ANOVA	$F(1.866, 1208.925) = 21.781$ $p < 0.001$ $\eta_p^2 = 0.033$	$F(3, 27) = 6.686$ $p = 0.002$ $\eta_p^2 = 0.426$	$F(1.956, 1267.269) = 1.833$ $p = 0.161$ $\eta_p^2 = 0.003$	$F(3, 27) = 17.830$ $p < 0.001$ $\eta_p^2 = 0.665$
Results of split-plot ANOVA	$F(1.870, 1228.480) = 5.310$ $p = 0.006$ $\eta_p^2 = 0.008$		$F(1.962, 1288.782) = 9.232$ $p < 0.001$ $\eta_p^2 = 0.014$	

In addition, the number of participants (N), mean (M), and standard deviation (SD) for z-scores of body height (z-height) and weight (z-weight) for baseline and each follow-up are reported. Effect sizes are reported according to Cohen's classification (small effect $\eta_p^2 \geq 0.01$; medium effect $\eta_p^2 \geq 0.06$; large effect $\eta_p^2 \geq 0.14$). Calculations are based on z-scores, and percentiles (P) are provided for enhanced clarity.
[a] Baseline in the ADHD drug group represents the visit before the first use of ADHD drugs. The 1st, 2nd and 3rd follow-up are accordingly the three visits after initiation of ADHD drugs.

2.3. Data collection

To obtain data, professional study assistants conducted interviews and anthropometric measurements at the study center using a standardized procedure. Participants were asked to bring the drugs they were taking to their appointments. If they forgot their drugs, they were called after their visit to the study center to get the respective information. Data were collected annually for each participant, as the LIFE Child study is longitudinal in its design. Further information on data collection has been published previously (Poulain et al. 2017).

2.4. Data analysis

For each participant and visit, z-scores were calculated for body height (z-height) and body weight (z-weight). The z-score standardizes participants' original values of body height and body weight for age and sex, and indicates by how many standard deviations a given value is away from the mean value of a data set. There is a direct relationship between z-scores and the percentiles applicable to age and sex. This standardization via z-scores enables a direct comparison of the original values relative to the percentiles across different age groups and sex. National reference values and formulas were used for z-score calculations (Neuhauser et al. 2013).

First, we analyzed body height and weight of ADHD drug users at their last visit with ADHD drug use and of non-users at their

considered. Repeated measures analysis of variance (ANOVA) was used to examine changes in z-height and z-weight from baseline to 3rd annual follow-up separately for the ADHD drug users and the non-user group. A split-plot ANOVA was then used to determine if the repeated measures ANOVA differed between the two analyzed groups for z-height and z-weight.

Third, to calculate the individual development, differences in the z-scores of each ADHD drug user between baseline and each follow-up were calculated using paired t-tests of z-scores for the ADHD drug group. For this analysis, participants were included if they had visited the study center prior to their first ADHD drug intake (=baseline), and subsequently attended at least one follow-up visit up to three follow-up visits.

We report means and standard deviations (SD) of z-height and z-weight for each visit and group. We report mean differences, F-value (ratio of two variances), F-distribution (degrees of freedom), p-values, effect size according to Cohen's classification (small effect $d \geq 0.2/\eta_p^2 \geq 0.01$; medium effect $d \geq 0.5/\eta_p^2 \geq 0.06$; large effect $d \geq 0.8/\eta_p^2 \geq 0.14$) (Cohen 1988).

2.5. Participants' characteristics

As shown in Fig. 1, a total of 2,115 participants (male: 1,156 [55%]; female: 959 [45%]) from the LIFE Child study cohort met the inclusion criteria for our analysis, of whom 48 participants were identified as using ADHD drugs (male: 39 [81%]; female:

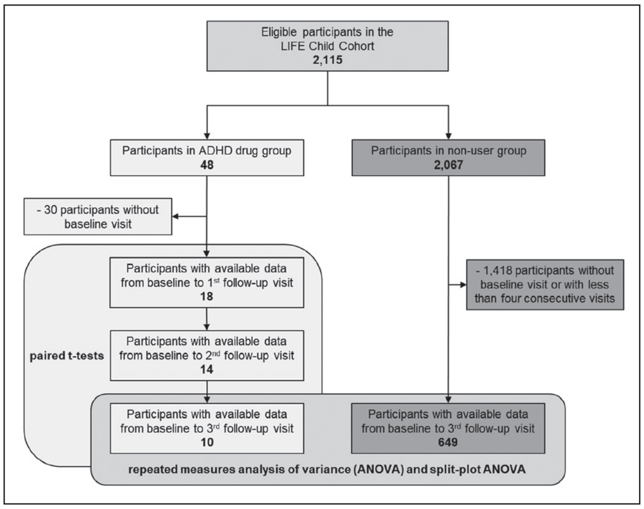

Fig. 1: Flowchart illustrating the allocation of study participants to the different groups and the subsequent utilization of these groups for the various statistical analyses.

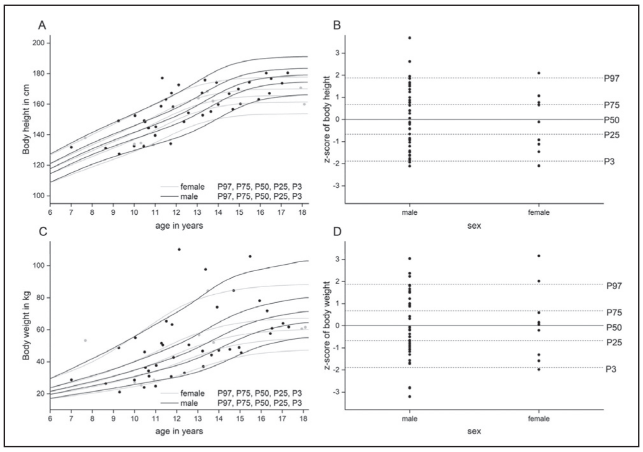

Fig. 2: Body height and body weight of the 48 participants at their last visit with ADHD drug use. The individual measured values for body height and body weight of the participants are shown in comparison to the standard percentiles according to age and sex (**A,C**). The corresponding z-scores of body height and body weight are shown in comparison to the standard percentiles according to sex (**B,D**).

9 [19%]). A total of 40 participants received methylphenidate, 5 participants received lisdexamfetamine, and 3 participants received atomoxetine. Two of the 40 participants using methylphenidate were also receiving atomoxetine.

At the last recorded visit with ADHD drug use of the 48 participants, which was used to analyze the effects of ADHD drug use in comparison to standard percentiles, the mean age of the participants with ADHD drug use was 12.6 years (SD: 2.7). The mean z-height after variable durations of ADHD drug use was 0.001 (50th percentile; SD: 1.364) and the z-weight was -0.056 (48th percentile; SD: 1.525). The mean z-height at the last visit of the 2,067 non-users of ADHD drugs was 0.221 (59th percentile; SD: 1.023) and the z-weight was 0.113 (55th percentile; SD: 1.125).

With regard to the 48 participants taking ADHD drugs, 35% (17/48) of children and adolescents (males: 33%, 13/39; females: 44%, 4/9) were below the 25th reference percentile for height (Fig. 2). For weight, this applied to 40% (19/48) of participants (males: 41%, 16/39; females: 33%, 3/9; Fig. 2).

2.6. Trend of z-height and z-weight from baseline to 3rd annual follow-up between ADHD drug users and non-user group

Of the 2,115 participants of the LIFE child study, information from baseline to 3rd follow-up was available for 659 participants (non-user group: 649; ADHD drug group: 10; Fig. 1). As shown in Fig. 3 and Table 1, ADHD drug group participants had a higher mean z-height and z-weight at baseline than non-user group participants. Repeated measures ANOVA showed that z-height developed differently between the groups, with an increase in z-height from baseline to 3rd follow-up in the non-user group (n=649; $\text{Difference}_{\text{means}}$=0.102; p<0.001, η_p^2=0.033, small effect) and a decrease in z-height in the ADHD drug group (n=10; $\text{Difference}_{\text{means}}$=-0.310; p=0.002, η_p^2=0.426, large effect), resulting in a lower mean z-height than in the non-user group at 3rd follow-up. Similarly, repeated measures ANOVA showed a difference in development between the groups, with an unchanged z-weight from baseline to third follow-up in the non-user group (n=649; $\text{Difference}_{\text{means}}$=0.015; p=0.161, η_p^2=0.003; Table 1) and a large decrease in z-weight in the ADHD drug group, which ended up below the mean z-weight of the non-user group (n=10; $\text{Difference}_{\text{means}}$= -0.473; p<0.001, η_p^2=0.665, large effect).

Table 2: For the number of participants with ADHD drug use (N) with available data, mean (M) and standard deviation (SD) for z-scores of body height (z-height) and body weight (z-weight) for baseline and each annual follow-up are given

Visits[a] used for paired t-test		**z-height**		**z-weight**	
Baseline <-> 1st follow-up	Baseline	N: 18 M: 0.030 (51st P) SD: 1.240	-	N: 18 M: 0.125 (55th P) SD: 1.538	-
	1st follow-up	N: 18 M: -0.009 (50th P) SD: 1.233	t(17) = 0.540 p = 0.597 d = 0.121	N: 18 M: -0.122 (45th P) SD: 1.487	t(17) = 2.802 p = 0.012 d = 0.631
Baseline <-> 2nd follow-up	Baseline	N: 14 M: 0.330 (63rd P) SD: 1.085	-	N: 14 M: 0.562 (71st P) SD: 1.349	-
	2nd follow-up	N: 14 M: 0.201 (58th P) SD: 1.117	t(13) = 1.488 p = 0.161 d = 0.374	N: 14 M: -0.012 (50th P) SD: 1.384	t(13) = 4.393 p < 0.001 d = 1.105
Baseline <-> 3rd follow-up	Baseline	N: 10 M: 0.283 (61st P) SD: 1.055	-	N: 10 M: 0.288 (61st P) SD: 0.756	-
	3rd follow-up	N: 10 M: -0.027 (49th P) SD: 1.001	t(9) = 3.414 p = 0.008 d = 0.987	N: 10 M: -0.185 (43rd P) SD: 0.680	t(9) = 6.031 p < 0.001 d = 1.743

Differences between baseline and each follow-up were calculated using paired t-tests. Effect sizes are reported as Cohen's d (small effect ≥ 0.2; medium effect ≥ 0.5; large effect ≥ 0.8). Calculations are based on z-scores, and percentiles (P) are provided for enhanced clarity

[a] Baseline represents the visit before the first use of ADHD drugs. The 1st, 2nd and 3rd follow-up are accordingly the three visits after initiation of ADHD drugs.

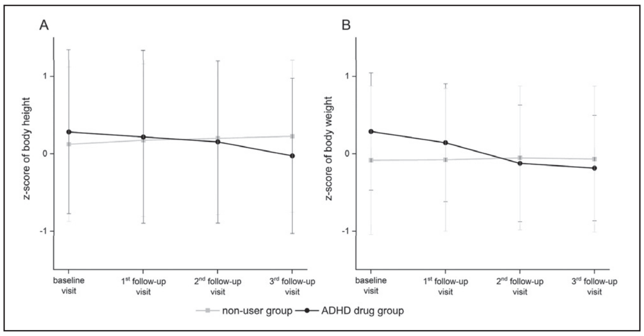

Fig. 3: Results of split-plot analysis of variance of mean z-scores and standard deviation of body height (**A**) and body weight (**B**) for baseline and the three annual follow-up visits are shown for both the non-user (n=649) and ADHD drug group (n=10). Baseline in the ADHD drug group represents the visit before the first use of ADHD drugs.

2.7. Intraindividual changes in z-height and z-weight from baseline to 3_{rd} annual follow-up in ADHD drugs users

As shown in Table 2, the paired t-test revealed an intraindividual lower z-height not until the third follow-up, but with a large effect according to Cohen's classification ($mean_{baseline}$: 0.283 [61st percentile]; $mean_{3rd\_follow-up}$: -0.027 [49th percentile]; p=0.008; d: 0.987). In contrast, z-weight was already lower at the 1st follow-up ($mean_{baseline}$: 0.125 [55th percentile]; $mean_{1st\_follow-up}$: -0.122 [45th percentile]; p=0.012; d: 0.631), and decreased further to the 3rd follow-up.

3. Discussion

In our study, we found that about 40% of the 48 included participants with ADHD drug use had a weight below the 25th percentile at their last visit with ADHD drug use. We observed a potential tendency towards lower z-scores and mean percentiles for body height and body weight at the third annual follow-up in individuals taking ADHD drugs compared to participants not taking ADHD drugs. With regard to body weight, the z-score in the non-user group remained constant between baseline and the third follow-up (47th percentile). In contrast, there was a notable large decrease in z-weight in the ADHD drug group (61st to 43rd percentile). Additionally, a small increase in z-height in the non-user group and a large decrease in the ADHD drug user group was observed (non-user group: 55th to 59th percentile; ADHD drug group: 61st to 49th percentile).

Existing studies vary in their findings regarding the potential effects of ADHD drugs on body weight and body height (Faraone et al. 2008; Storebø et al. 2018). For instance, the analyzed studies of a 2018 Cochrane review yielded inconsistent results on whether the use of methylphenidate leads to a change in body weight (Storebø et al. 2018). Most of the referenced studies that used the z-score for calculations showed that methylphenidate did not lead to a decrease in body weight z-score (Storebø et al. 2018). This is in contrast to randomized controlled trials that showed a decrease in body weight associated with the use of methylphenidate (Storebø et al. 2015). A recent randomized trial in children up to 12 years old using methylphenidate showed a decrease in z-weight, and z-height (Waxmonsky et al. 2022). In the mentioned study, however, no statements could be made for adolescents. In contrast, half of our included participants taking ADHD drugs were older than 12 years. Our data indicate a negative z-weight in participants using ADHD drugs compared to the general pediatric population of Germany. Furthermore, we observed a strong decrease in z-weight in participants with increasing ADHD drug intake duration, as the mean z-weight prior to initiation was considerably higher in the group taking ADHD drugs compared to the non-user group, and then substantially below the non-user group in the third year after initiation. The increased z-weight compared to the non-user group at the baseline visit is in line with the literature, as ADHD is associated with an increased body weight (Mellström et al. 2020).

The situation is similar with regard to body height, as the 2018 Cochrane review identified studies showing no change in body height as well as studies showing both increased and decreased body height in follow-ups (Storebø et al. 2018). A 2020 systematic review found weak evidence for a decreased body height z-score in participants using methylphenidate (Carucci et al. 2021). Consistent with these findings, our data indicate a lower height z-score in the group taking ADHD drugs three years after initiation, compared to a slightly higher height z-score in the non-user group. Our study, which utilized real-world data, can provide new knowledge from a longitudinal pediatric cohort suggesting that patients with ADHD drug use may be affected by body weight loss and reduced body height. This is strongly supported by the large effect sizes observed, such as the z-weight in the ADHD drug group, even with a relatively small sample size in our study cohort. It is noteworthy that, while the mean z-weight of the 48 ADHD drug users is approximately 0 – corresponding to the 50th percentile –, a closer examination reveals that 40% of these patients weigh below the 25th percentile. Given the varying periods of time that these participants have been taking ADHD drugs, cross-sectional observations are therefore limited in capturing the potential inter-individual effects on weight and height. Longitudinal data are essential for understanding these inter-individual effects of intake over time. However, these observed effects can be beneficial or detrimental to the individual patient. For example, an initial overweight may be reduced to regular body weight, which is desirable. Further reduction to underweight would be clinically undesirable and would necessitate the implementation of appropriate interventions. According to the "S3 guideline on the diagnosis and treatment of eating disorders" (DGPM et al. 2018), different threshold values for underweight requiring treatment are discussed, whereby a target weight of at least the 25th percentile is recommended (z-score -0.674). In the context of ADHD, we propose to adopt this recommendation as values below the 25th percentile are potentially indicative of the need for intervention. Therefore, patients taking ADHD drugs should be routinely monitored for possible alterations. In particular, the potential effect of ADHD drugs on body weight requires special attention in the treatment of adolescents, as concern about one's body image is widespread during puberty, leading to increased judgment and attention to body and appearance (Senín-Calderón et al. 2017).

One strength of our study is that the data are drawn from a large epidemiological cohort study with a longitudinal study design. The children and adolescents included were between the ages of 6 and 18.25 years, covering the entire pediatric age range for which ADHD drugs are approved. Furthermore, we calculated standardized age- and sex-specific z-scores to compensate the impact of age and sex on body weight and body height. Also, in contrast to many other studies, body weight- and body height-influencing co-medication was excluded as a potential confounder.

However, it is worth noting that the number of participants taking ADHD drugs included in repeated measures ANOVA and split-plot ANOVA was limited, as participants could not be included in the analysis if they took ADHD drugs for less than four consecutive visits, dropped out before visiting the study center four times, or were already being treated with ADHD drugs at the first visit, thus lacking reference values before treatment initiation. This might influence the outcomes of this study. A larger number of participants could have permitted a more robust analysis, as potential confounding variables or individual variations could have been taken into account in the calculations. Furthermore, the observation period per participant was limited up to three follow-up visits. Potential effects on body weight and height, which might occur over a longer period of time, could therefore possibly not be observed in this time frame. Moreover, it would have been interesting to compare the included patients with ADHD medication to a group of patients with ADHD without any treatment, in addition to the control group of patients without ADHD. Yet, patients with ADHD without ADHD drug use were not identified in our cohort. However, such a control group is absent in many studies (Carucci et al. 2021). Furthermore, the data on drug use available to us were self-reported by the participants and could therefore be subject to recall bias. However, the data could reflect more accurately what patients actually took than prescription data, as not everything that is prescribed is actually used by patients exactly as intended.

Regarding the statistical methodology, we chose a split-plot ANOVA instead of a matching approach. The rationale for this decision lies in the fact that a split-plot ANOVA permits the investigation of both between-subject and within-subject factors concurrently, thus enabling the analysis of differences between groups (control vs. treatment), as well as over time. However, this approach may be impacted by uncontrolled confounding variables. Overall, the study's strict inclusion criteria, analysis of covariates, and use of standardized z-scores ensured high accuracy in our findings. Nevertheless, the results should be interpreted with caution, and patients should be treated according to current guidelines.

In conclusion, our data indicate a general potential tendency towards lower z-scores of body weight and body height in ADHD drug users compared to the general pediatric population. We observed an individual decrease in z-scores of body height and body weight after three years of ADHD drug intake in a longitudinal pediatric cohort study. Our findings support the importance of closely monitoring pediatric patients taking ADHD medication for undesired alterations, particularly in body weight.

Competing Interests: Astrid Bertsche reports grants from UCB Pharma GmbH and honoraria for speaking engagements from Biogen GmbH, Desitin Arzneimittel GmbH, Eisai GmbH, GW Pharma GmbH, Neuraxpharm GmbH, Shire/Takeda GmbH, UCB Pharma GmbH, and ViroPharma GmbH. The other authors declare they have no conflicts of interest.

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Ethics approval: The LIFE Child study was designed in accordance with the Declaration of Helsinki and has been approved by the Ethics Committee at the Medical Faculty of Leipzig University (Reg. no 264-10-19042010; Approval date: 19 April 2010).

Informed consent: Informed consent was obtained from all individual participants included in the study.

Data availability: The datasets presented in this article are not readily available because data cannot be shared publicly because there exist ethical restrictions. The LIFE Child study is a study collecting potentially sensitive information. Publishing data sets is not covered by the informed consent provided by the study participants. Furthermore, the data protection concept of LIFE requests that all (external as well as internal) researchers interested in accessing data sign a project agreement. Researchers that are interested in accessing and analyzing data collected in the LIFE Child study may contact the data use and access committee (dm@life.uni-leipzig.de). Requests to access the datasets should be directed to dm@life.uni-leipzig.de.

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Supplementary Information

Potential effects of attention deficit hyperactivity disorder medication on body height and body weight in a longitudinal pediatric cohort study, the LIFE Child study

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Supplementary Table 1: Children and adolescents taking at least one of the following active ingredients were excluded from the analysis due to potential effects on body height or weight. Some active ingredients are listed more than once owing to different ATC codes for different administration routes.

ATC code	Name of active ingredient / class	Frequency of intake
A03	Drugs for functional gastrointestinal disorders	31
A04A	Antiemetics and antinauseants	43
A07DA03	Loperamide	4
A07EA02	Hydrocortisone	1
A07EC02	Mesalazine	12
A09AA04	Tilactase	21
A10A	Insulins and analogues	50
C01AA05	Digoxin	4
C01AA08	Metildigoxin	8
C02CA04	Doxazosin	1
C07AB02	Metoprolol	3
C07AB07	Bisoprolol	2
C08CA01	Amlodipine	7
C09AA01	Captopril	11
C09AA02	Enalapril	9
C09AA05	Ramipril	6
C09BA25	Ramipril and hydrochlorothiazide	2
C09CA01	Losartan	1
C10AA03	Pravastatin	1
C10AX09	Ezetimibe	2
G02BB01	Vaginal ring with progestogens and oestrogens	3
G02CB01	Bromocriptine	1
G03	Sex hormones and modulators of the genital system	275
G04BD04	Oxybutynin	4
H01AC01	Somatropin	17
H01BA02	Desmopressin	8
H01CA04	Leuprorelin	1
H02AA02	Fludrocortisone	2
H02AB09	Hydrocortisone	4
H03AA	Thyroid hormones	152
H03CA	Iodine therapy	7
L01XE01	Imatinib	3
L01XE06	Dasatinib	1
L02AE02	Leuprorelin	1
L04AB01	Etanercept	5
L04AB02	Infliximab	1
L04AB04	Adalimumab	5
L04AC07	Tocilizumab	2
L04AX01	Azathioprine	9
N03AD01	Ethosuximide	1
N03AF02	Oxcarbazepine	22
N03AG01	Valproic acid	9
N03AX11	Topiramate	3
N03AX14	Levetiracetam	9
N03AX15	Zonisamide	1
N05AD05	Pipamperone	4
N05AH03	Olanzapine	2
N05AH04	Quetiapine	2
N05AX08	Risperidone	7
N05AX12	Aripiprazole	3
N05CH01	Melatonin	2
N05CM22	Promethazine	3
N06AB03	Fluoxetine	4
N06AB04	Citalopram	1
P01BF01	Artemether and lumefantrine	2
P02	Anthelmintics	6
P03A	Ectoparasiticides, including scabicides	11
R01AD01	Beclomethasone	2
R01AD04	Flunisolide	1
R01AD05	Budesonide	7
R01AD09	Mometasone	40
R01AD11	Triamcinolone	2
R01AD12	Fluticasone furoate	1

R01AD58	Fluticasone, combinations	1
R03AC02	Salbutamol	238
R03AC13	Formoterol	2
R03AK06	Salmeterol and fluticasone	138
R03AK07	Formoterol and budesonide	14
R03AK08	Formoterol and beclomethasone	6
R03AK11	Formoterol and fluticasone	2
R03AL01	Fenoterol and ipratropium bromide	1
R03BA	Glucocorticoids	150
R03BB01	Ipratropium bromide	4
R03CC02	Salbutamol	1
R03CC63	Clenbuterol and ambroxol	1
R03DC03	Montelukast	63
R06	Antihistamines for systemic use	289
R07AX	Other respiratory system products	1