

The association between adolescent height and feelings is sex-specific

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Abstract

Background Previous studies have shown associations between human growth and socioeconomic conditions. As these conditions are often associated with feelings of well-being and mental health, these feelings may in turn be associated with body height. The present study was conducted to determine the contribution of specific feelings to the growth of young adolescents.

Methods The study surveyed a total of 240 early pubertal boys (aged 12–13 years) and 98 early pubertal girls (aged 11 years). The study included height and data on mental and emotional well-being across various areas of life obtained from questionnaires of the KiGGS Wave 2, a comprehensive study conducted by the Robert Koch Institute (RKI) on the health of children and adolescents living in Germany.

Results Early pubertal boys and girls differ in their patterns of associations between feelings and body height. In contrast to expectation, taller height in girls is associated with negative feelings, shorter height is associated with the feeling “energy”. Shorter height in boys was mildly associated with a higher level of “worries”.

Conclusion The present study provides new insights into the relationships between feelings and height during early pubertal age. The findings suggest that gender-specific roles influence physical growth. It is speculated that tradwife effects and aspects of mate selection exhibit effects on height in young adolescents.

Take-home message for students Emotional processes and feelings during adolescence are influenced by social factors and linked to growth. The present pilot suggests a sex-specific link between feelings and height and that this association depends on gender role.

Introduction

Human growth and development are determined by continuous changes in body size, proportions, and maturation processes. The analysis of human growth patterns is central in anthropology and human biology (Batty et al., 2009). The growth and development of children and adolescents are highly complex phenomena that have long been at the centre of interdisciplinary scientific investigation (Best & Ban, 2021). Previous studies have shown that height is influenced by various factors, including genetic predisposition, socio-economic conditions (Case and Paxson 2008), health status, and nutrition (Grasgruber et al. 2014; Turchin et al. 2012; Gudbjartsson et al. 2008). Yet, more recent findings suggest that the relevance of these factors may be overestimated (Hermanussen and Wit 2017; German et al. 2020; Hermanussen et al. 2022). It is increasingly recognised that human growth is also shaped by a variety of emotional factors that can both promote and inhibit growth (Bogin 2021). This has become particularly evident in migrants (Scheffler et al. 2021; Fritsch and Scheffler 2025). Yet, the impact of emotions and feelings on growth has not yet been explored.

The definition of feelings presents a complex challenge, as no generally accepted and unified theoretical definition exists to date (Scherer 2005; Russell 1991). Feelings are often categorised as positive or negative and are understood as signals for the subjective experience of situations (Frenzel et al. 2009). Feelings such as joy, anger, or boredom shape the daily life and influence learning, performance, and psychological well-being (Valiente et al. 2012; Zang et al. 2025). Especially during adolescence, a period often described as a phase of storm and stress, emotional processes increasingly come to the forefront

(Casey et al. 2010). At the same time, interest and participation in social, economic, and sexual activities intensify during adolescence (Bogin et al. 2018). Continuous brain development and reorganisation are accompanied by changes in language use, risk-taking behaviour, and other cognitive abilities (Bogin et al. 2018). In no other stage of life do people experience feelings as intensely as during the transition from childhood to adulthood (Larson et al. 2002). While profound hormonal and neural adjustments take place internally, they are simultaneously faced with the task of shaping social integration and personal identity (Abreu and Kaiser 2016; Main et al. 2025). These processes are particularly reflected in the changing relationship with parents and peers (Abreu and Kaiser 2016; Guyer et al. 2016). The pursuit of belonging, autonomy, and recognition decisively shapes emotional experiences and often leads to tensions between individuation and social environment (Abreu and Kaiser 2016; Guyer et al. 2016; Paus et al. 2008; Steinberg 2005). Adolescence is an independent developmental stage lasting approximately five to eight years (Bogin et al. 2018). An early indicator of the transition into adolescence is the reversal of growth velocity in girls and boys (Naulé et al. 2021). Slowed growth shifts into an accelerated adolescent growth spurt, which typically begins in girls at about 10 to 11 years of age and in boys between 12 and 14 years (Bogin et al. 2018). During this developmental phase, physical growth is particularly influenced by the “community effect” (Aßmann and Hermanussen 2013; Hermanussen et al. 2025). This effect refers to the phenomenon that growth is regulated within social groups (Hermanussen et al. 2015). According to the underlying hypothesis, the height of an adolescent is oriented toward the average height of the immediate social environment (Hermanussen and Scheffler 2024).

This occurs on the one hand through emotional needs and social pressure, and on the other hand through competition for status within the group (Hermanussen and Scheffler 2016; Hermanussen et al. 2025). Among tall stature populations this social-biological feedback mechanism appears to stimulate growth and to result in tall individuals, while shorter individuals tend to grow up in communities with short average height (Hermanussen et al. 2015). Although research on this topic is still in its early stages, initial studies suggest that feelings, both positive and negative, may influence the growth of young people (Bogin 2020). Based on these assumptions and previous research, the following hypothesis is formulated, which forms the starting point of the present pilot study:

- In early-adolescent boys (aged 12–13 years) and girls (aged 11 years), positive feelings are positively correlated with height.

The study examines the association between feelings and physical growth in adolescents. The primary focus is on analysing the extent to which positive and negative feelings correlate with height. The objective is to develop a comprehensive understanding of the interactions between emotional experiences and physical development during adolescence and to identify potential starting points for future research.

Sample and methods

Sample

The KiGGS study (Studie zur Gesundheit von Kindern und Jugendlichen in Deutschland – Study on Health of Children and Adolescents in Germany) is a long-term health monitoring study conducted by the

Robert Koch Institute (RKI) since 2003 at regular intervals, with the aim of gaining a comprehensive picture of the health status, health behaviour, and living conditions of children and adolescents in Germany. It provides nationally representative health data and consists of three survey phases: the KiGGS baseline study (2003–2006), KiGGS Wave 1 (2009–2012), and KiGGS Wave 2 (2014–2017). To this end, information on physical, psychological, and social development, lifestyle, well-being, illnesses, risk behaviour, quality of life, and social conditions was collected from both the children and their parents. Data collection took place at 167 representative study sites reflecting Germany's population structure, with participation being voluntary. The study was reviewed and approved by the Ethics Committee of the Charité – Universitätsmedizin Berlin and the Federal Data Protection Commissioner. In KiGGS Wave 2, the surveys and examinations were repeated in a similarly in the baseline phase. Nationally representative samples were once again collected through both questionnaires and physical examinations (Dölle et al. 2007; Neuhauser et al.; Stahlmann et al. 2022; Kurth et al.). For the present pilot study, only data from KiGGS Wave 2 were used, as this wave provides self-reported information on feelings during adolescence. We focused on height in early pubertal children, and included data from a total of 1358 adolescents (656 boys, 702 girls, aged 11 to 13) who had participated in KiGGS Wave 2.

Used Variables

Not all data collected in the study were used to test the hypothesis. The analysis for this research included age, height, sex, and the information on emotional states collected through the health questionnaire. Since the present study relied exclusively

on self-reported data, only those participants who completed the health questionnaire themselves could be included in the analysis. According to the KiGGS Wave 2 dataset description, self-reports were provided only by participants aged 11 years and older. Consequently, the analysis was based on data from 11-year-old girls and 12- to 13-year-old boys, as these age groups are relevant to the adolescent growth spurt. The height of the children and adolescents was measured without shoes using a portable stadiometer (Holtain Ltd., UK). The survey included questions on a range of feelings as well as on aspects of quality of life. Seventeen items were included that were classified as subjectively perceived feelings and categorized as: *energy, fears, feeling bad, feeling good, fun, being in a good mood, happy, like life, lonely, loner, nervous, restless, feeling sad, satisfied with oneself, tantrums, unhappy and worries*. Items that explicitly addressed dominance or subordination within the peer group were not provided in the questionnaires. Each feeling was represented by a standardised question in the health questionnaire and rated by the participants on a five-point scale: 1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always (Table 1). Only cases with complete information on height and feelings were included. Cases with missing values in these variables were excluded. We also excluded participants with a migration background to minimise potential cultural influences as emotions and also emotional expressivity are culture-specific (Rychłowska et al. 2015).

After data cleaning, the records of 98 girls aged 11 years as well as 240 boys aged 12 to 13 years remained in the analysis.

Statistical analysis

For data processing, analysis, and visualisation, R 4.3.3 (RStudio, Boston, USA)

was used exclusively. The collected data were analysed using statistical methods (Groth 2024; Groth 2025), including Principal Component Analysis (PCA), Spearman correlation, and St. Nicolas House Analysis (snha) (Chen et al. 2024; Hermanussen et al. 2021). Snha is an exploratory approach that visualises relationships between variables as a network by identifying stable, local connections based on association chains. Snha was used to analyse and illustrate the relationships between emotional factors and height. Data analysis was conducted using the R packages snha (Groth 2023), ggplot2 (Wickham 2016), and reshape2 (Wickham 2007). This enabled a comprehensive representation and interpretation of complex relationships between emotional well-being, social environment, and physical growth factors. A significance threshold of $p < 0.05$ was applied for all statistical analyses. To ensure the suitability of the data for PCA, the Kaiser-Meyer-Olkin criterion (KMO) was applied. The PCA is unrotated.

Results

PCA of girls and boys

First, we described component loadings in the principal components (Table 2) to identify those emotional variables (feelings) that explain substantial proportions of variance in the dataset and their association with height. Due to their high variances, the Eigenvalues of the questions were comparably low. We decided that feelings to be used in the subsequent analysis, needed to reach a minimum loading of ≥ 0.20 in at least one principal component for both girls and boys. This decision was somewhat arbitrary, but we treated the study as a pilot and aimed to strike a reasonable balance

between retaining as much information as possible and excluding variables of limited relevance.

According to this criterion, 11 variables remained: *restless, tantrum, loner, worries, nervous, fears, feeling good, energy, like life, satisfied, and happy*. As we considered the variable feeling bad to be also relevant for characterizing peer group situations, we did not exclude feeling bad though it exceeded the threshold of ≥ 0.20 only in boys (Table 2). The variables unhappy, sad, lonely, good mood, and fun were excluded. Thus, 12 feelings remained for analysis. The KMO value was 0.784 for girls and 0.821 for boys, which, according to Kaiser (Kaiser 1974), can be considered “good”.

tantrum, loner, worries, nervous, fears, feeling good, energy, like life, satisfied, happy, and feeling bad) in girls illustrates figure 1. The figure shows a significant positive correlation between feeling bad (item: When you think about the last week, did you feel sad?) and height ($r = 0.258, p < 0.01$, Table 3) as well as a significant negative correlation between energy (item: If you think about the last week, have you been full of energy?) and height ($r = -0.321, p < 0.001$). Association chains existed within the network for: *tantrum, nervous, and restless* with *feeling bad*. Since *feeling bad* is associated with height, the analysis suggested an indirect link between this sequence of variables and height.

Network structure of emotional variables and height in girls (snha)

The complex network of associations between height and 12 feelings (*restless,*

Network structure of emotional variables and height in boys (snha)

Analogous to the analysis of the girls, snha was also conducted for boys aged 12 to 13

Table 1 Emotional parameters and their corresponding original questions (17 emotional variables primarily considered for girls aged 11 years and boys aged 12–13 years from the KiGGS Wave 2 study)

Feelings	Question
Energy	If you think about the last week, have you been full of energy?
-Fears	I have many fears, I get scared easily.
Feeling bad	When you think about the last week, did you feel bad?
Feeling good	When you think about the last week, did you feel fit and well?
Fun	When you think about the last week, did you have fun?
Good mood	When you think about the last week, were you in a good mood?
Happy	When you think about the last week, were you happy at school?
Like life	When you think about the last week, did you enjoy your life?
Lonely	When you think about the last week, did you feel lonely?
Loner	I'm mostly on my own; I prefer to focus on myself.
Nervous	New situations make me nervous, and I easily lose my confidence.
Restless	I'm often restless; I can't sit still for long.
Sad	Thinking about the last week, did you feel sad?
Satisfied	Thinking about the last week, did you feel content with who you are?
Tantrum	I get angry easily; I often lose my temper.
Unhappy	I'm often unhappy or depressed; I often cry.
Worries	I often worry.

years. The analysis included the same 12 feelings (*restless, tantrum, loner, worries, nervous, fears, feeling good, energy, like life, satisfied, happy, and feeling bad*) as well as height. The results showed only one minor negative correlation that occurred between worries and height ($r = -0.136$, $p < 0.05$, Figure 2, Table 4).

Discussion

Genetics and adequate nutrition are indispensable prerequisites for normal growth, but their role as true regulators of growth has been questioned. Recent research emphasised the significance of social, economic, political, and emotional (SEPE)

factors in the regulation of human growth (Bogin 2020; Bogin 2021; Hermanussen et al. 2022; Fritsch and Scheffler 2025; Scheffler and Hermanussen 2025). They describe a network composed of the general living conditions such as the political background, economic prosperity, social class, and level of education, and the more personal circumstances such as emotional security, social integration, and personal feelings. It has been estimated that SEPE factors may contribute to approximately 50% of the variance in height when considering body height over long periods (Hermanussen et al. 2025).

The present pilot study was undertaken to further illustrate the relation between body height in pubertal adolescents aged between 11 and 13 years and personal feel-

Table 2 Component loadings (PCA) of 17 feelings and height of for girls aged 11 years and boys aged 12–13 years from the KiGGS Wave 2 study. Percent explained variance share is given in brackets. Variables with a component loading of ≥ 0.20 are printed in bold. The variables *unhappy, sad, lonely, good mood, and fun* were excluded from further analysis

Variables	Girls			Boys		
	PC1 (25.64 %)	PC2 (16.48 %)	PC3 (9.80 %)	PC1 (24.29 %)	PC2 (11.67 %)	PC3 (10.93 %)
Restless	0.251	0.656	-0.256	-0.31	-0.32	0.687
Tantrum	0.307	0.096	-0.438	-0.365	-0.171	0.336
Loner	0.25	-0.223	-0.075	-0.186	0.243	-0.198
Worries	0.426	-0.315	0.308	-0.353	0.544	0.103
Nervous	0.445	0.136	-0.293	-0.391	0.314	0.019
Fears	0.255	-0.563	-0.292	-0.18	0.343	-0.019
Feeling good	-0.111	-0.059	-0.245	0.274	0.243	0.194
Energy	-0.124	-0.13	-0.268	0.178	0.204	0.246
Like life	-0.167	-0.062	-0.205	0.204	0.187	0.284
Satisfied	-0.17	-0.05	-0.26	0.224	0.169	0.2
Happy	-0.204	-0.058	-0.259	0.232	0.251	0.059
Unhappy	0.314	-0.078	0.017	-0.171	0.117	-0.052
Sad	0.176	0.03	-0.006	-0.202	-0.029	-0.162
Lonely	0.073	0.018	0.096	-0.153	0.022	-0.089
Good mood	-0.14	-0.101	-0.139	0.147	0.16	0.203
Fun	-0.161	-0.078	-0.149	0.129	0.131	0.211
Feeling bad	0.16	0.045	0.171	-0.207	0.002	-0.066
Height	0.064	0.144	0.29	-0.004	-0.112	-0.125

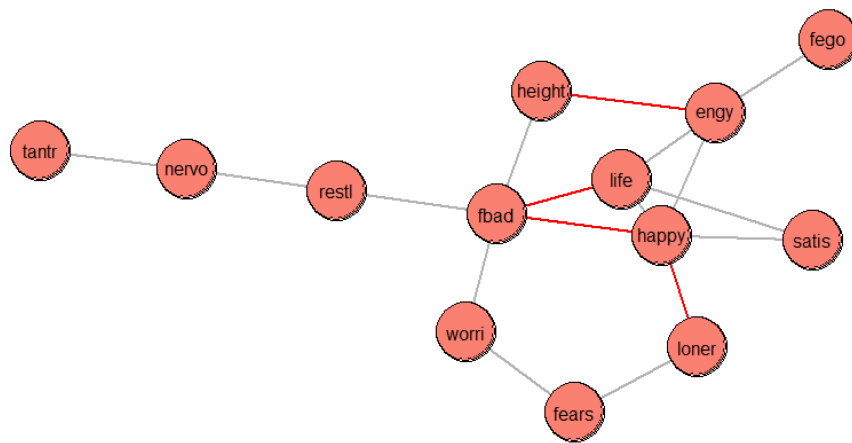


Figure 1 St. Nicolas House Analysis of feelings and height in girls aged 11 years (KiGGS study Wave 2) – Displayed are the most stable network connections between 12 feelings (restl = *restless*, tantr = *tantrum*, loner = *loner*, worri = *worries*, nervo = *nervous*, fears = *fears*, fego = *feeling good*, engy = *energy*, life = *like life*, satis = *satisfied*, happy = *happy*, fbad = *feeling bad*) and height. Positive correlations are represented by grey lines, negative correlations by red lines. A linear association chain can be observed from *tantrum*, *nervous*, *restless* to *feeling bad*.

ings. This information was obtained from the questionnaires of the second wave of a long-term Study on Health of Children

and Adolescents in Germany (KiGGS). KiGGS documents a comprehensive picture of the health status, health behaviour,

Table 3 Spearman correlation coefficients (R), coefficients of determination (R^2), levels of significance (p), and confidence interval (CI) between twelve emotional variables and height in girls aged 11 years (KiGGS Wave 2)

Variable (feeling)	R-value	R^2 -value	p-value	95% CI
Restless	0.148	0.022	0.145	[-0.052, 0.337]
Tantrum	0.029	0.001	0.774	[-0.17, 0.226]
Loner	-0.042	0.002	0.678	[-0.239, 0.157]
Worries	0.086	0.007	0.398	[-0.114, 0.28]
Nervous	0.013	0.0	0.899	[-0.186, 0.211]
Fears	-0.142	0.02	0.162	[-0.331, 0.058]
Feeling good	-0.191	0.036	0.059	[-0.376, 0.007]
Energy	-0.321	0.103	<0.001*	[-0.488, -0.131]
Like life	-0.131	0.017	0.199	[-0.321, 0.069]
Satisfied	-0.167	0.028	0.1	[-0.354, 0.033]
Happy	-0.148	0.022	0.146	[-0.337, 0.052]
Feeling bad	0.258	0.067	<0.01*	[0.063, 0.434]

* significant $p < 0.05$

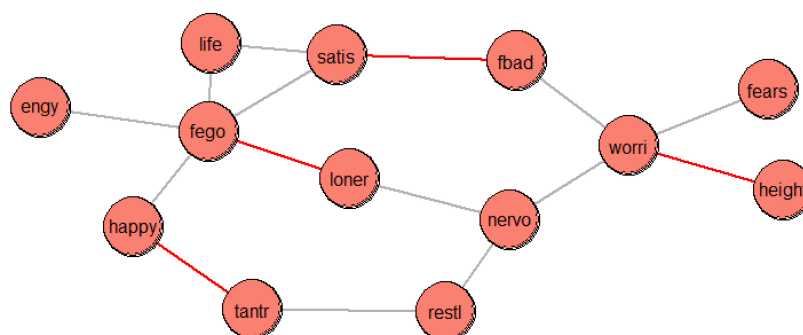


Figure 2 St. Nicolas House Analysis of feelings and height in boys aged 12–13 years (KiGGS Study Wave 2) – Displayed are the most stable network connections between the twelve emotional variables (restl = *restless*, tantr = *tantrum*, loner = *loner*, worri = *worries*, nervo = *nervous*, fears = *fears*, fego = *feeling good*, engy = *energy*, life = *like life*, satis = *satisfied*, happy = *happy*, fbad = *feeling bad*) and height. Positive correlations are indicated by grey lines, negative correlations by red lines.

and living conditions of children and adolescents in Germany at regular intervals since 2003 (Dölle et al. 2007; Neuhauser et al; Stahlmann et al. 2022; Kurth et al.). The KiGGS questionnaires contain a large

number of questions on personal feelings of which 12 items were finally selected: *restless, tantrum, loner, worries, nervous, fears, feeling good, energy, like life, satisfied, happy, and feeling bad*. Items that specifi-

Table 4 Spearman correlation coefficients (R), coefficients of determination (R²), levels of significance (p), and confidence interval (CI) between twelve emotional variables and height in boys aged 12 to 13 years (KiGGS Wave 2)

Feelings	R-value	R ² -value	p-value	95% CI
Restless	-0.085	0.007	0.215	[-0.216, 0.049]
Tantrum	0.066	0.004	0.336	[-0.068, 0.198]
Loner	0.116	0.013	0.088	[-0.017, 0.246]
Worries	-0.136	0.018	0.046*	[-0.265, -0.003]
Nervous	-0.017	0.0	0.806	[-0.15, 0.117]
Fears	-0.117	0.014	0.085	[-0.247, 0.016]
Feeling good	-0.117	0.014	0.088	[-0.246, 0.017]
Energy	-0.008	0.0	0.906	[-0.141, 0.126]
Like life	-0.122	0.015	0.073	[-0.252, 0.011]
Satisfied	-0.1	0.01	0.142	[-0.231, 0.034]
Happy	-0.029	0.001	0.674	[-0.162, 0.105]
Feeling bad	0.068	0.005	0.32	[-0.066, 0.2]

* significant $p < 0.05$

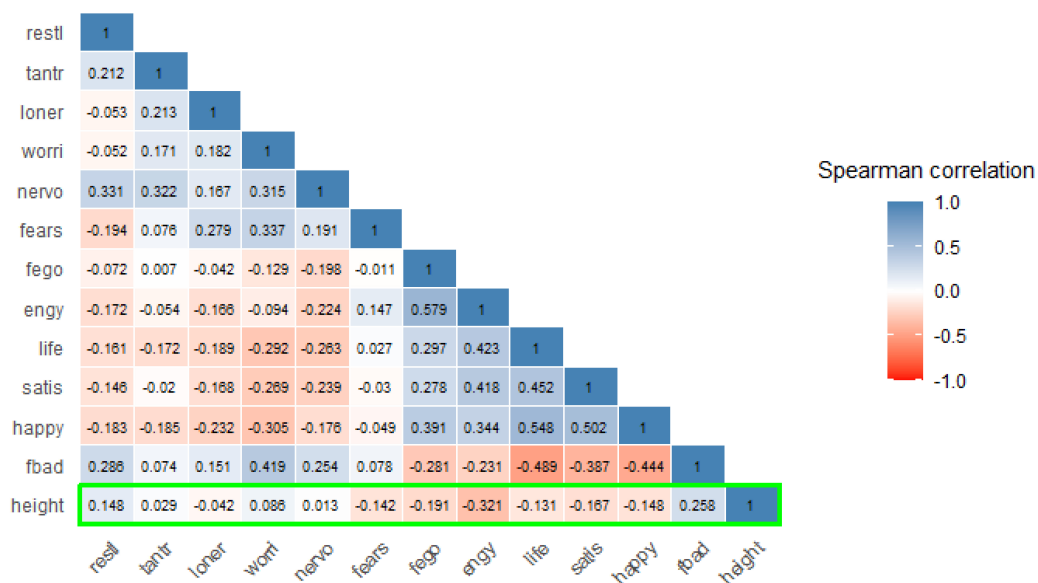


Figure 3 Spearman correlation matrix of 12 feelings (restl = *restless*, tantr = *tantrum*, loner = *loner*, worri = *worries*, nervo = *nervous*, fears = *fears*, fego = *feeling good*, engy = *energy*, life = *like life*, satis = *satisfied*, happy = *happy*, fbad = *feeling bad*) and height in girls aged 11 years (KiGGS Wave 2). Positive associations are coded in blue and negative associations in red; the intensity of the colour corresponds to the strength of the correlation.

cally addressed group behaviour were not provided in these questionnaires.

Based on the public notion that happy and healthy individuals tend to grow well, we hypothesised that positive feelings in young adolescents such as *feeling good*, *energy*, *like life*, *satisfied*, and *happy* were positively correlated with height, while negative feelings such as *restless*, *tantrum*, *loner*, *worries*, *nervous*, *fears*, and *feeling good* were negatively related with height. Yet, the data indicate that this interaction is more complex than initially assumed. In general, single feelings are not well or even inversely related to height. Height of girls showed significant negative correlations with the “positive” item *If you think about the last week, have you been full of energy?* and significant positive correlations with the “negative” item *When you think about the last week, did you feel bad?*. Most other

correlations between height and feelings remained insignificant. As the probability of randomly detecting two highly significant variables among 12 is below 1%, we rejected our hypothesis for girls and, quite in contrast to our notion, concluded that taller height is associated with negative feelings in girls.

The pattern differed in boys. Consistent with our hypothesis, shorter boys reported *worries* significantly more often. If worrying is interpreted as a potential indicator of submissiveness, this finding may support the idea that dominance is linked to growth in male adolescents. However, because worries were the only emotional factor associated with height, we concluded that the relationship between growth and socio-emotional factors is more complex than can be adequately explained by isolated measures of feelings.

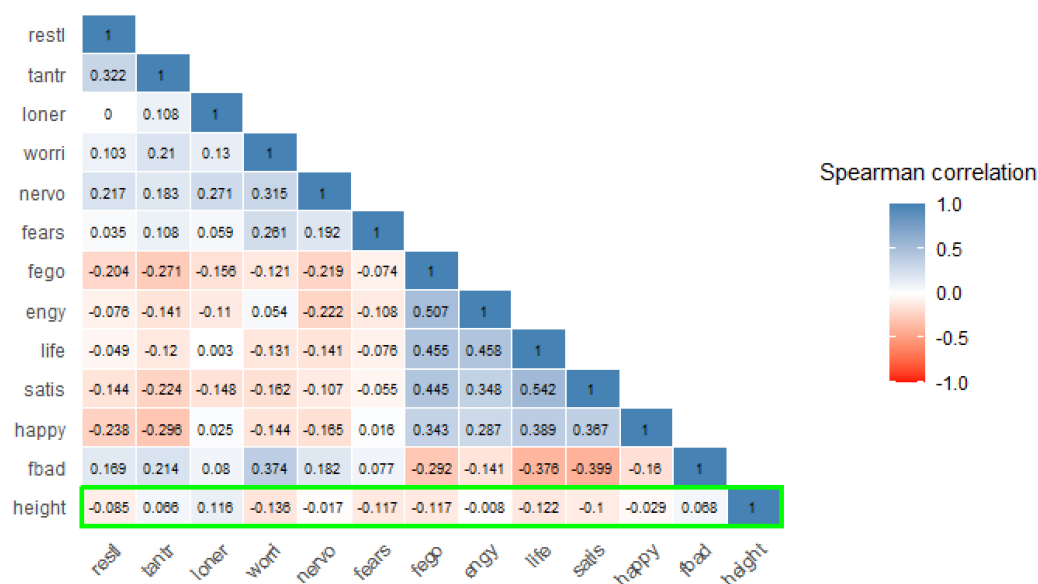


Figure 4 Spearman correlation matrix of 12 feelings (restl = *restless*, tantr = *tantrum*, loner = *loner*, worri = *worries*, nervo = *nervous*, fears = *fears*, fego = *feeling good*, engy = *energy*, life = *like life*, satis = *satisfied*, happy = *happy*, fbad = *feeling bad*) and height in boys aged 12 to 13 years (KiGGS Wave 2). Positive associations are coded in blue and negative associations in red; the intensity of the colour corresponds to the strength of the correlation.

Feelings not only affect individuals but also play a role in the social transmission of norms (Ahmed 2004). Feelings act as an outside-in model in which individuals are immersed into the emotional climate of their group and eventually adopt them as their own. The perception of one's social status not only influences the emotional balance, but in turn appears to also affect the endocrine regulation of growth (Hermanussen et al. 2022; Scheffler and Hermanussen 2025).

Limitations

The present study is based on the questionnaires of the KiGGS Wave 2 study that was not specifically designed to assess dominance and social integration among members of social groups, but focused on the individual, its physical and its health

status including a variety of feelings that occurred during “the last week”. Data on pubertal development was also not available. The selection of emotional variables was partly based on subjective criteria. Initially, we selected 17 questions that appeared relevant to the aims of this study, but subsequently reduced this number to 12 after finding that 5 questions showed no apparent association with body height. As full information was only available in a small proportion of the participants, the sample size was small which may limit the explanatory power and generalisability of the results.

The present study focused on adolescent growth before and near peak height velocity. As the KiGGS study had grouped their participants into two-year age categories (10+11 years, 12+13 years, etc.), with data

on feelings being available not before age 11, the group of girls was comparably small.

Speculative contextual factors

The present findings suggested that, in girls, positive feelings tend to be associated with shorter stature. This opposes our hypothesis and in the first place, appears amazing. Yet, it might refer to ideals of femininity associated with delicacy and the desire for protection, i.e., to the traditional gender roles that have recently experienced a notable renaissance, the so-called “tradwife effect” (Banet-Weiser and Reinis 2026). “Tradwives” emerged in the mid-2010s as a digital community and have since spread explosively across social media (Sykes and Hopner 2024). This novel lifestyle links female happiness to a return to traditional gender roles, that is, to subordination to the husband, motherhood, and ideals of a harmonious family (Elmhirst 2024). Femininity is physically staged and internalised through posture, clothing, and aesthetics (Sykes and Hopner 2024). This form of self-presentation leads to a conscious and emotional distancing from feminism (Herzner 2025; Stotzer and Nelson 2025). The tradwife concept supports persistent patriarchal structures in which heterosexual men form the dominant members of the social group (Herzner 2025). Social hierarchies influence growth. When the social status in the sense of achievement striving or competition is no longer desired and instead subordination is considered ideal, *energy* is not directed toward personal development but toward the cultivated embodiment of traditional femininity, such as being small, delicate, selfless, and domestic. Empirical studies to examine this theory are not yet available. Another explanatory approach may lie in evolutionary and social psychological factors related to partner choice. If shorter

girls receive positive feedback on perceived attractiveness, their emotional well-being may be strengthened and reduce pressure to invest energy in physical growth. Tradwife roles may trigger physical changes during adolescence as individuals adjust to shared social norms and expectations within their community. Social rank and expectations are linked to body height. Partner preferences may play an important role, with women more often preferring a taller partner, while men tend to choose a shorter partner (Dial and Brown 2025). Thus, girls who perceive themselves as tall may experience conflicts with traditional norms of femininity and body image as reflected in a reduced feeling of *energy* and increased *bad feeling*.

An opposite pattern emerged in the 12- to 13-year-old boys. Shorter boys tend to often experience *worries*. A theoretical explanatory approach lies in their gender-specific role expectations and associated social demands. In male development, height traditionally possesses a strong symbolic and status value (Schmidt and Talbot 2025). In many societies, height in young men is associated with strength, dominance, assertiveness, and social competence (Bogin 2020; Hermanussen and Scheffler 2024). Taller boys may therefore benefit from positive social resonance because they are more likely to be perceived as confident and attractive (Stulp et al. 2015; Bogin 2020; Schmidt and Talbot 2025). Thus, when many worries and stressors occur during adolescence, this may have an inhibiting influence on physical growth, especially if boys feel that they are not achieving their social rank within the peer group. In this context, the community effect becomes important again. In peer groups in which height functions as a relevant status criterion, taller boys can more easily achieve a stable social rank. Such a position within the group reduces the risk of experiences of social competition and

supports emotional relief, which in turn is associated with fewer *worries*. Conversely, shorter boys might tend to experience more *worries* due to greater sensitivity to stress and social comparison. In this way feelings could indirectly influence growth through hormonal processes, thus contributing to variation in height during adolescence. In summary, the 12- to 13-year-old boys show that the feeling *worries* in combination with the community effect may play a role in height during adolescence.

Implications and future research

Findings from modern developmental and epigenetic research show impressively that environmental conditions, in particular SEPE factors, can modulate gene expression to a considerable extent (Bogin 2021). These include especially emotional insecurities related to social and economic inequality, as well as existing health burdens such as stress. In addition, social performance pressure and a high psychosocial burden within the family environment can have negative effects on well-being and therefore indirectly on physical growth (Bogin 2020; Hosseinkhani et al. 2020). Despite this scientific progress, parts of research and the public still hold the view that human stature is predominantly genetically determined (Bicknell et al. 2025). Such statements and the continuous search for the missing heritability demonstrate the persistence of outdated concepts from past decades. Today it is known that growth, development and maturation occur within a wide spectrum and do not follow a rigid sequence. Rather, it is an extremely complex interaction of phylogenetic influences and SEPE influences, which occur particularly strongly during adolescence. Although there are some limitations – for example, the questionnaire may be inconsistent –, we can provide valuable insights

into height development during early adolescence. To the best of our knowledge, this association has not been demonstrated before.

Future results should focus on feelings related to group interactions, particularly those associated with dominance and/or subordination. In addition, future studies should focus on the cultural impact of emotions on growth.

Including children and adolescents with a migration background could improve the generalizability of the findings to contemporary populations.

Analysing data from the KiGGS baseline study (2003–2006) could provide insight into whether and how the association between feelings and height has changed over time. To generalise the results, an age-stratified sample and a more appropriate questionnaire would be required.

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