Height Trends in the Chinese Population

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Abstract

In recent years, China's economic development and improved living standards have contributed to the growth in the average height of its population. Studying height trends and their influencing factors is crucial for understanding health conditions and formulating policies. Through data analysis and model predictions, strategies can be proposed to improve nutrition, physical exercise, and healthcare.

For Problem 1, the study analyzed growth trends and factors influencing the average height of the Chinese population. An exponential model showed good performance, revealing that height growth rate slows over time, with potential nearing saturation. Key factors like exercise duration, GDP per capita, and energy intake were significantly correlated with height. The findings provide a basis for height prediction and policy-making.

For Problem 2, a height prediction and growth factor analysis model was established by transforming the nonlinear equation into a linear form. Combining multiple regression and time series analysis, the study explored key factors influencing height and future trends. The results showed that factors such as energy intake have a significant impact on height, with the model demonstrating high fitting accuracy and good predictive performance. This research provides theoretical support for analyzing height trends and formulating related policies.

For Problem 3, strategies to promote healthy height development in the Chinese population were proposed based on key factors such as exercise, economic growth, sleep, protein intake, and energy intake. Measures include improving physical activity, optimizing diets, and enhancing sleep environments. Collaboration among governments, schools, families, and society is emphasized to implement these policies effectively.

Keywords

Exponential Model, Time Series Prediction, Spearman Correlation

Introduction

Background

In recent years, China's rapid economic development and significant improvement in people's living standards have led to a yearly increase in the average height of the Chinese population. This trend not only reflects improvements in nutritional status but may also be influenced by various factors such as genetics and the environment. Studying the changes in height among the Chinese population is crucial for understanding national health status and formulating relevant policies, involving multiple aspects such as nutritional intake and changes in lifestyle. By collecting and analyzing height data of Chinese individuals from different age groups and genders, mathematical models can be established to analyze height change trends, predict future trends, and propose strategies to promote national health, including improving diet, enhancing physical exercise, and raising medical standards.

Question Restatement

Question1：This problem requires researching the trend of average height changes in the Chinese population over the past few decades. This involves collecting height data of the Chinese population, including different age groups such as children, adolescents, and adults, as well as different genders. Subsequently, a mathematical model needs to be developed to analyze these data, revealing the speed and acceleration of height growth and identifying key factors influencing height changes.

Question2：This problem calls for optimizing the previously developed. mathematical model to more accurately describe and predict future trends in the height of the Chinese population. The optimized model should consider various potential influencing factors, including nutritional intake and changes in lifestyle. The goal is to enhance the model's predictive capability, enabling it to more effectively predict future changes in the height of the Chinese population and provide a scientific basis for promoting national health.

Question3：This problem requires us to propose specific policy recommendations based on the model analysis and prediction results to promote the healthy development and height growth of the Chinese population. This involves ensuring that all population groups have access to necessary health resources and equitable development opportunities through comprehensive measures such as improving dietary structures, enhancing physical exercise, and elevating medical standards. It is through these comprehensive measures that positive changes in the height of the Chinese population can be promoted.

Assumption and Justification

Assumption 1: Availability and Reliability of Historical Anthropometric Data

Content: It is assumed that accurate and reliable historical anthropometric data on average height, stratified by age groups (such as children, adolescents, adults) and genders, are available for the Chinese population over the past few decades.

Justification: Data is the cornerstone of any mathematical model. Without accurate historical data, the model cannot be constructed or validated. Assuming these data are sourced from authoritative institutions such as national statistical bureaus, health surveys, or relevant research institutions ensures their authority and reliability.

Assumption 2: Quantifiability of Factors Influencing Height Growth

Content: It is assumed that the factors influencing height growth in the Chinese population, such as nutritional intake and lifestyle changes, can be quantified and incorporated into the mathematical model.

Justification: The effectiveness of a mathematical model depends on the accurate description of influencing factors. Through research in nutrition, public health, and social sciences, we can quantify the impact of these factors on height growth and incorporate them into the model for prediction.

Assumption 3: Continuity and Smoothness of Height Growth Trends

Content: It is assumed that the trends in average height growth among the Chinese population are continuous and smooth, without sudden jumps or discontinuities.

Justification: Although there may be short-term fluctuations in reality (such as natural disasters, economic recessions), in the long run, height growth generally follows a relatively stable trend. Assuming continuity in trends simplifies the model and enhances prediction accuracy.

Assumption 4: Predictability of Future Changes in Influencing Factors

Content: It is assumed that the factors influencing height growth (such as nutritional intake, lifestyle, etc.) will continue to change in the future according to current trends or can be reasonably predicted based on existing data.

Justification: To optimize the model for predicting future trends, we need to make assumptions about the future changes of influencing factors. Although these factors may be influenced by multiple uncertainties, by considering historical data, socio-economic development trends, and policy changes, we can make reasonable predictions.

Assumption 5: Feasibility and Effectiveness of Policy Suggestions

Content: It is assumed that the proposed policy suggestions (such as improving dietary structure, strengthening physical exercise, enhancing medical standards, etc.) are feasible and can promote the health and height development of the Chinese population to some extent.

Justification: Policy suggestions are based on the analysis results of the model and aim to address real-world issues. To ensure their effectiveness, we assume that these suggestions can be implemented in practice and have a positive impact on the target population. Additionally, these suggestions align with current national health policies and public health goals.

Description of the symbol

Due to the large number of variables, the symbols of the variables will be defined below, and only the representative symbols of the variables that are frequently used and whose variable names are too long are given here.

Symbols	**Description**
AMH	Average Male Height
AFH	Average Female Height
AED	Average Exercise Duration
$GDPC$	GDP per Capita
ASD	Average Sleep Duration
$ADPIP$	Average Daily Protein Intake per Person

ADEIC	Average Daily Energy Intake per Capita

Problem Analysis

For Problem 1

The problem necessitates the collection of average height data of the Chinese population over the past few decades, stratified by gender and age groups. A mathematical model is required to analyze the trends in height changes among the Chinese population and identify the key factors influencing these changes. We must commence by examining the causes underlying human height and establish a model that aligns with biological principles. Ideally, human height is genetically determined; for individuals within a specific region, this genetically predetermined height is nearly uniform. However, in real life, due to variations in nutrition intake, lifestyle, physical exercise, and hygiene levels, the final manifestation of height, as a trait, is influenced by external factors and exhibits variations. We can translate the aforementioned analysis into equations and use them to fit the collected average height data. By deriving the equations, we can obtain the velocity and acceleration, and determine the degree of height change based on the magnitude of the velocity. This will, in turn, allow us to ascertain the key factors influencing height changes.

For Problem 2

The problem requires us to consider potential influencing factors and predict future trends in the height of the Chinese population. We established a prediction framework based on a nonlinear model to analyze the various factors affecting the average height of males and females. By transforming the original nonlinear model into a multiple linear regression form and combining it with actual data for modeling and iterative optimization, we developed height prediction models specifically for males and females, resulting in models with strong explanatory power for the target variables.

Subsequently, we used time series analysis to forecast the trends of key influencing factors over the next five years and substituted them into the prediction models, obtaining the growth trends in average height for males and females over the next five years.

For Problem 3

The question requires us to draw upon the analytical results from the previous two inquiries in order to identify areas where measures can be implemented to further promote the healthy development of body height among the Chinese population. Based on the factors with high correlation identified through Spearman's rank correlation analysis in the first question, and the factors ultimately selected by the multiple stepwise regression equation in the second question, we conduct a comprehensive analysis on how to implement measures that can further enhance the healthy growth of body height among the Chinese population.

Height Growth Prediction and Analysis Model

Model Establishment

Taking male children as an example, under conditions where other factors such as nutrition intake, lifestyle, physical exercise, and hygiene levels are adequate and sufficient, the final average height is solely determined by genetics (in the absence of external negative influences, we refer to this as the "ideal height"). However, in real life, due to the absence or inadequacy of certain factors that affect height, the final height may be lower than the ideal height. Therefore, we can establish a model where the ideal height is denoted as max external negative impacts are denoted as ni (negative impact), and the final average height is denoted as h. Based on the characteristic that as ni decreases, h approaches max, we can write the following equation:

$$h = max - ae^{b \cdot ni}$$

Where a and b are coefficients, both greater than zero.

Noting that conditions in China have improved significantly in various aspects in recent years, and as the $year$ increases, ni decreases, we can simply substitute $year$ for ni, considering them linearly negatively correlated. That is:

$$h = max - ae^{-b \cdot (year - c)}$$

We can use the above formula for fitting to solve for a, b, and c.

Data Selection

We categorize the height of the Chinese population into two genders for discussion: male and female. For each gender, we further categorize them into three age groups for analysis: children (age $\leqslant$ 13), teens (14 $\leqslant$ age $\leqslant$ 18), and adults (age $\geqslant$ 18).

We will first conduct Descriptive Statistics on the collected data.

Descriptive Statistics

	Male children	**Male teen**	**Male adult**	**Female children**	**Female teen**	**Female adult**
N	6	6	6	6	6	6
Minimum	131.97	154.16	167.90	128.84	151.12	157.60
Maximum	138.72	171.58	172.60	141.72	160.26	160.60
Mean	135.5517	164.7311	170.6000	136.5195	156.4222	158.9833
Deviation	2.62212	7.45931	1.71348	5.44043	3.69073	1.11609
Skewness	-.232	-.678	-.661	-.543	-.382	.353
Kurtosis	-1.684	-1.743	-.230	-1.856	-1.776	-.920

Based on the data presented in the aforementioned table, it is observable that the height of female children is the lowest, whereas the height of male adults is the highest. Among them, the standard deviation of the male teen data in recent years is the greatest, signifying that the data fluctuates more. The standard deviation of the female adult data in recent years is the smallest, suggesting that the data fluctuates less and is more stable in terms of the data volume. Regarding skewness, the skewness value of male teen is the smallest and less than 0, indicating that the data distribution is relatively shifted towards the right. Additionally, the kurtosis of all the data is less than 0, suggesting that the data is more dispersed.

Parameter Estimation Method

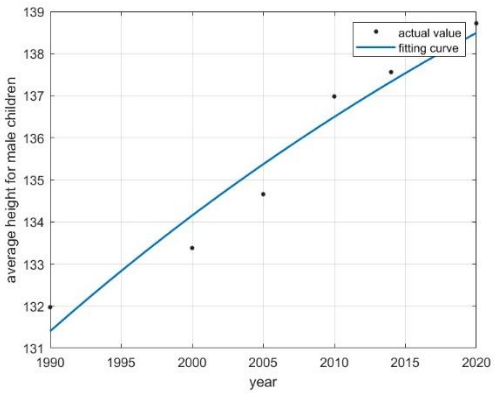
Utilizing MATLAB programming, we employ the fit function to perform fitting. For all groups, we select c = 1990 (as our collected data begins from 1990). For the children group, we set max = 150; for the teen group, we set max = 190; and for the adult group, we set max = 200.

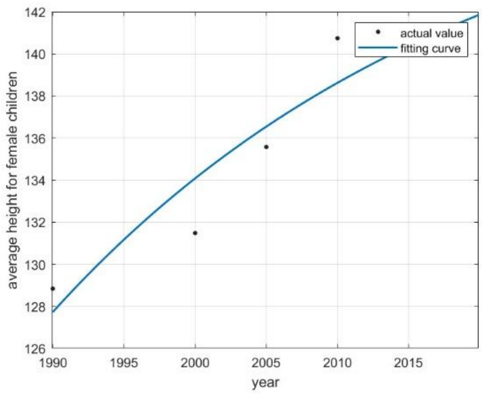
Final Estimated Coefficients are Presented in the Following Table:

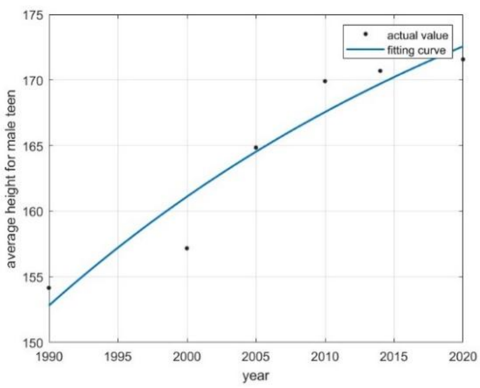
Coefficients of fitting curves

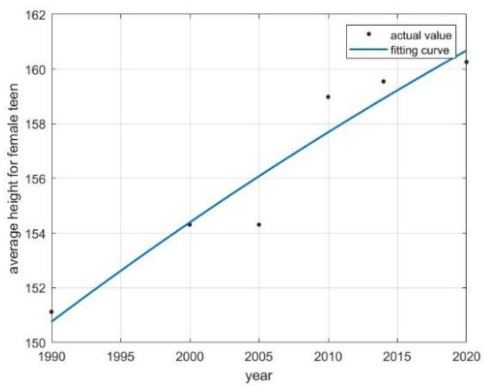
	Male children	Male teen	Male adult	Female children	Female teen	Female adult
max	150	190	200	150	190	200
a	18.6	37.19	32.09	22.27	39.24	49.21
b	0.016	0.02526	0.005399	0.03359	0.009719	0.007524
c	1990	1990	1990	1990	1990	1990

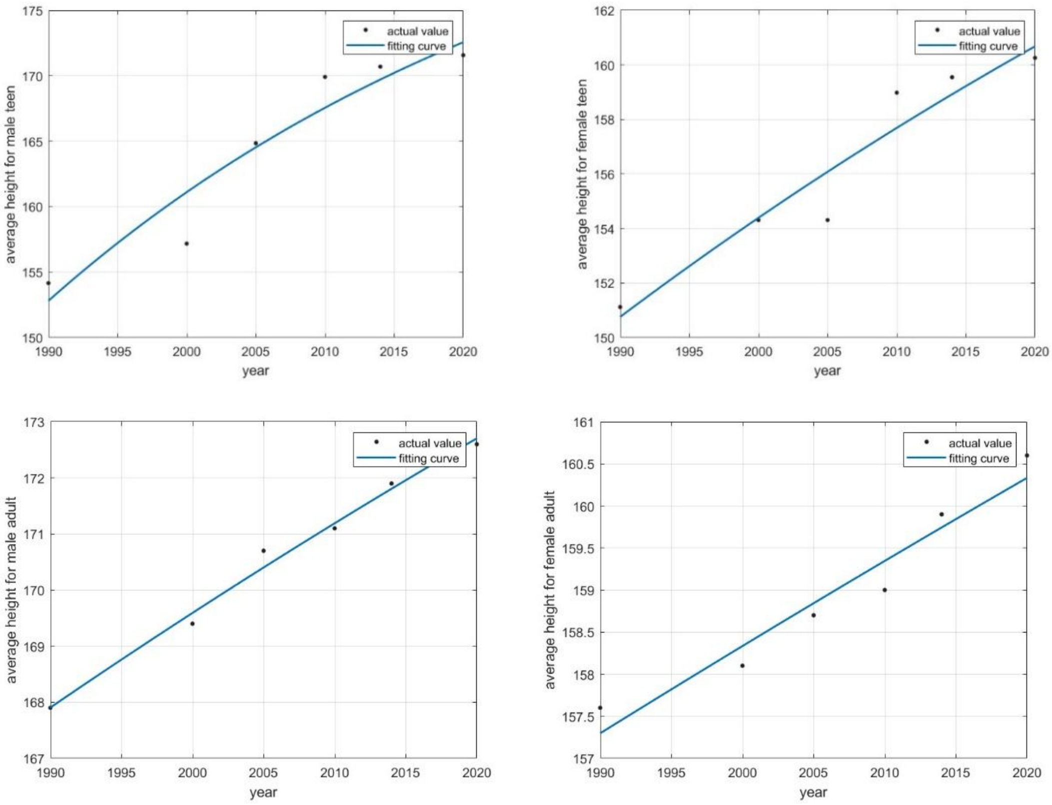
By substituting the aforementioned coefficients into the equations and plotting the graphs, we proceed to evaluate the fitting performance.











We calculate the R-squared (R^2) and Root Mean Squared Error (RMSE) for each fit, with the specific values detailed in the following table.

Fitting test statistics

	Male children	Male teen	Male adult	Female children	Female teen	Female adult
R^2	0.9486	0.9106	0.9895	0.9059	0.9189	0.9386
$RMSE$	0.6652	2.4938	0.1960	1.8665	1.1748	0.3092

It is evident that for each fit, the R^2 values exceed 0.9 and the RMSE values remain below 3, indicating a satisfactory fitting effect.

Problem Solving

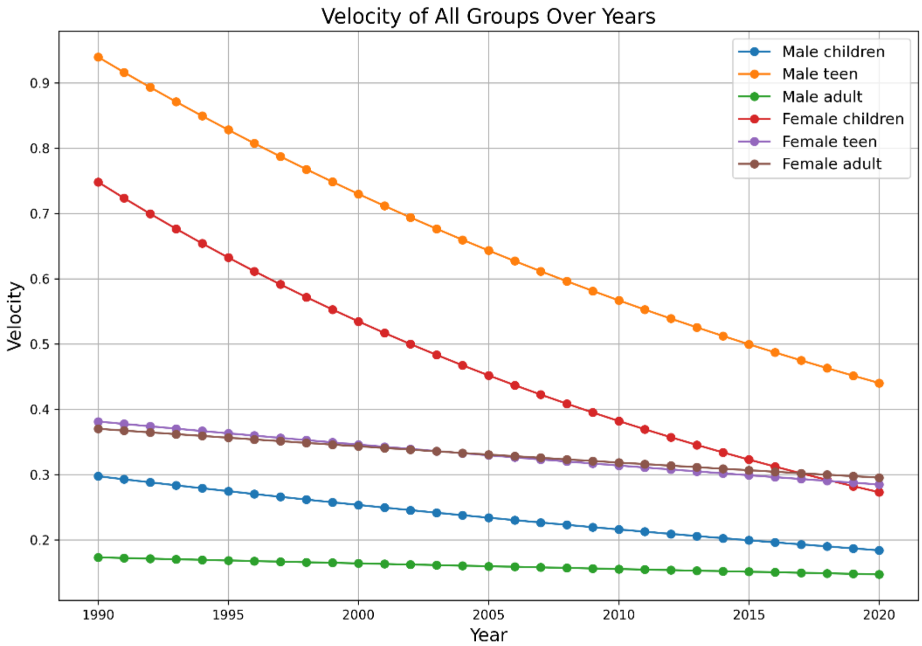
Subsequently, to determine the velocity of height growth (v) and acceleration (f), we differentiate the height (h) with respect to year to obtain v:

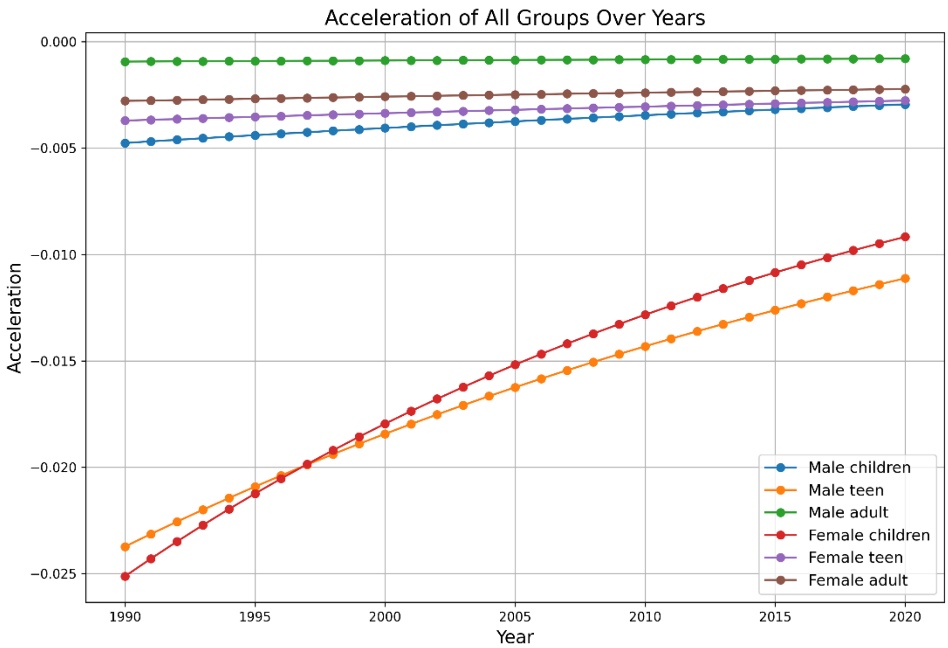
$$v = a \cdot b \cdot e^{-b(year-c)}$$

Further differentiating v with respect to year yields f:

$$f = -a \cdot b^2 \cdot e^{-b(year-c)}$$

We have plotted the line charts of speed and acceleration for different groups, shown as follows:





From the figure, it can be observed that the growth rate of average height decreases over the years, indicating that the increment in average height is gradually slowing down, and the growth potential of each group is approaching saturation. The average height growth rate is the highest for male youth and female children, suggesting that these two groups are most influenced by improved societal conditions.

The acceleration of average height growth is consistently negative, indicating that the growth rate of average height is slowing down year by year. The acceleration (absolute value) is the largest for male youth and female children, suggesting that the slowdown in growth rate is most significant for these two groups. For the adult group, the acceleration is close to zero with minimal variation, indicating that the change in the average height growth rate for adults is relatively stable.

Overall, the average height of Chinese people steadily increased from 1990 to 2020, but the growth rate gradually slowed down.

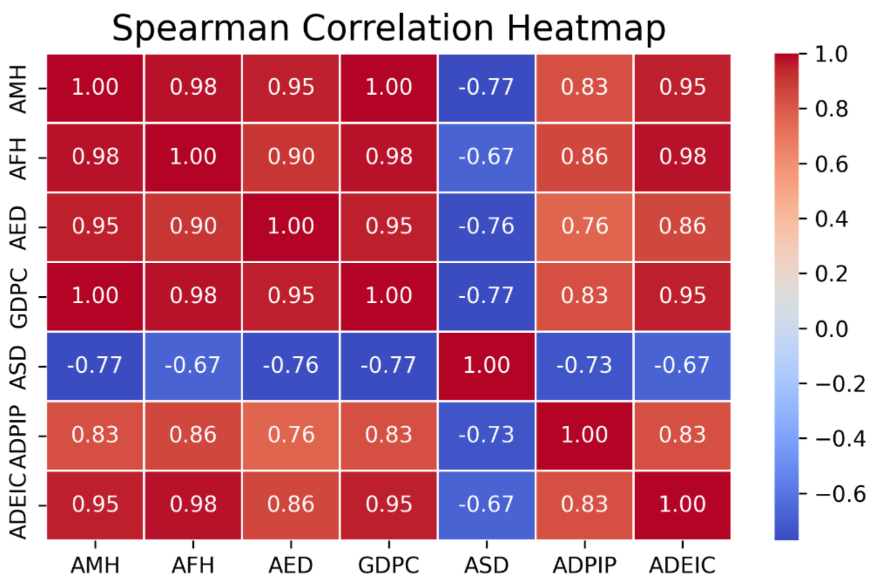
Analysis of Relevant Factors

We collected data on Average Male Height (AMH), Average Female Height (AFH), Average Exercise Duration (AED), GDP per Capita (GDPC), Average Sleep Duration (ASD), Average Daily Protein Intake per Person (ADPIP), and Average Daily Energy Intake per Capita (ADEIC), which are considered to have potential relationships with height.

Considering that our model uses an exponential form for modeling, we selected Spearman correlation analysis to analyze the relevant factors. Spearman's correlation coefficient is a non-parametric statistical method used to measure the monotonic relationship between two variables. It calculates the correlation by comparing the ranks of variables and is suitable for nonlinear monotonic relationships. The calculation formula is：

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$$

Here, d_i represents the difference in ranks between two variables for the i-th sample, and n is the sample size. The heatmap is shown as follows:



The average height level shows a strong positive correlation with AED, GDPC, and ADEIC, indicating that moderate exercise, improved economic conditions, and sufficient energy intake can increase average height. However, it shows a negative correlation with ASD, possibly because insufficient sleep in this dataset did not significantly impact height.

Height Prediction and Growth Factor Analysis Model

Model Establishment

The original equation we established in the first question is as follows：

$$h = max - ae^{b \cdot ni}$$

The ideal height is represented by max, and the external negative impact is denoted as ni (negative impact), with the final average height represented as h.

To facilitate multiple linear regression, we transformed the equation as follows:

$$\ln (max - h) = lna \cdot b \cdot ni$$

Furthermore, we define the coefficient α = ln(a) · b, and decompose ni into multiple variables as follows:

$$\ln(max - h) = \alpha_1 x_1 + \alpha_2 x_2 + \cdots + \alpha_k x_k$$

Here, x_1, x_2, ..., x_k represent the variables related to negative impacts, and α_1, α_2, ..., α_k are the corresponding regression coefficients.

Through this transformation, we converted the original nonlinear model into a linear form, allowing for direct estimation of parameters using multiple linear regression. This approach not only preserves the model's sensitivity to negative impacts but also facilitates further statistical analysis and prediction.

Data Preprocessing

Firstly, descriptive statistical analysis was conducted on Average Male Height (AMH), Average Female Height (AFH), Average Exercise Duration (AED), GDP per Capita (GDPC), Average Sleep Duration (ASD), Average Daily Protein Intake per Person (ADPIP), and Average Daily Energy Intake per Capita (ADEIC).

Descriptive Statistics

	AMH	AFH	AED	GDPC	ASD	ADPIP	ADEIC
N	8	8	8	8	8	8	8
Minimum	165.30	154.80	1.36	1663.00	7.20	60.40	2250.50
Maximum	173.80	161.00	2.52	89358.00	8.40	68.00	4871.00
Mean	168.15	156.74	1.84	43948.39	7.91	64.10	2950.51
Deviation	2.87	2.23	0.50	35355.77	0.49	2.57	909.73
Skewness	1.21	1.16	0.60	0.16	-0.59	0.22	1.59
Kurtosis	0.90	0.34	-2.03	-1.92	-1.92	-1.04	2.27

From the table, we can see that the variance of GDPC is relatively large, indicating significant data fluctuation. Both AMH and AFH have a large positive skewness, suggesting a right-skewed distribution, where most values are concentrated in the lower height range, with a few higher values pulling up the mean. ADEIC has the highest skewness, indicating that the energy intake data also exhibits a pronounced right-skewed distribution. The kurtosis of ADEIC is 2.27, significantly higher than that of other variables, suggesting that the energy intake data is more concentrated and may contain extreme values.

In our dataset, the variables have differences in scale and magnitude. Therefore, we applied Max-Min normalization to standardize the independent variables. The normalization formula is as follows:

$$x' = \frac{x - x_{min}}{x_{max} - x_{min}}$$

Model Solution

We used a multiple linear regression model to solve for the average height of females (AFH) and males (AMH). Through multiple iterations to optimize the regression coefficients, we gradually determined the strength and direction of the impact of each variable on the target variable. The following shows the changes in regression coefficients during the iterations and their analysis.

Iteration of equation coefficients for average female height

The number of iterations	Regression coefficients					
	α_0	**α_1**	**α_2**	**α_3**	**α_4**	**α_5**
1	3.5859	-0.0698	0.01054	-0.02854	0.001666	-0.16323
2	3.58602	-0.0686	0.01026	-0.02826	-	-0.1624
3	3.579	-0.05395	-	-0.01949	-	-0.159
4	3.56	-0.04	-	-	-	-0.1536

From the data, it can be observed that the intercept term α_0 stabilizes between 3.56 and 3.586 across multiple iterations, indicating that the model's initial prediction for female average height is relatively stable. The coefficient α_1 is relatively small, suggesting that exercise duration has a weak impact on female height, with a negative direction, meaning that an increase in exercise duration may slightly promote height growth. Among all variables, α_5 has the largest value, indicating that energy intake is the most significant factor affecting female height, also with a negative direction, implying that an increase in energy intake may promote female height growth.

The coefficients α_2, α_3, and α_4 gradually decrease and are eliminated as iterations proceed, indicating that their impact on female height is not significant.

The final prediction model is as follows:

$$h = max - ae^{-0.04 \cdot x_1 - 0.1536 \cdot x_5}$$

Iteration of equation coefficients for average male height

The number of iterations	Regression coefficients					
	α_0	**α_1**	**α_2**	**α_3**	**α_4**	α_5

1	3.10219	0.108	-0.1214	0.0951	0.0449	-0.3397
2	3.1597	-	-0.0614	0.0267	0.0552	-0.36288
3	3.1879	-	-0.0676	-	0.045	-0.375
4	3.1953	-	-0.0527	-	-	-0.3521

From the data, it can be observed that the intercept term α_0 stabilizes between 3.10219 and 3.1953 across multiple iterations, indicating that the model's initial prediction for male average height is relatively stable. The coefficient α_2 is relatively small, suggesting that GDP has a weak impact on male height, with a negative direction, meaning that an increase in GDP may slightly promote height growth. This could be related to higher economic levels improving nutrition supply and medical conditions. Among all variables, α_5 has the largest value, indicating that energy intake is the most significant factor influencing male height and has a positive effect.

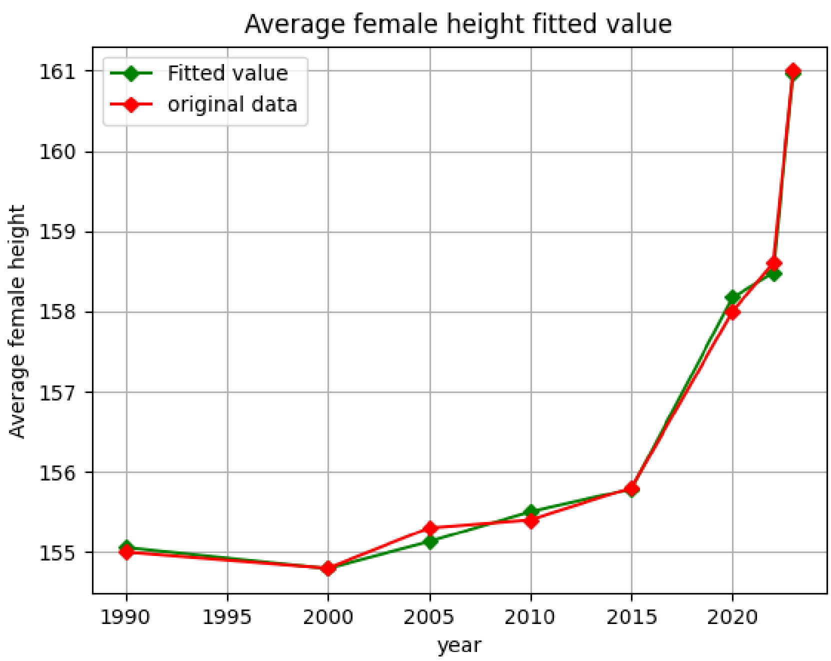
The coefficients α_1, α_3, and α_4 gradually decrease and are eliminated as iterations proceed, indicating that their impact on male height is not significant.

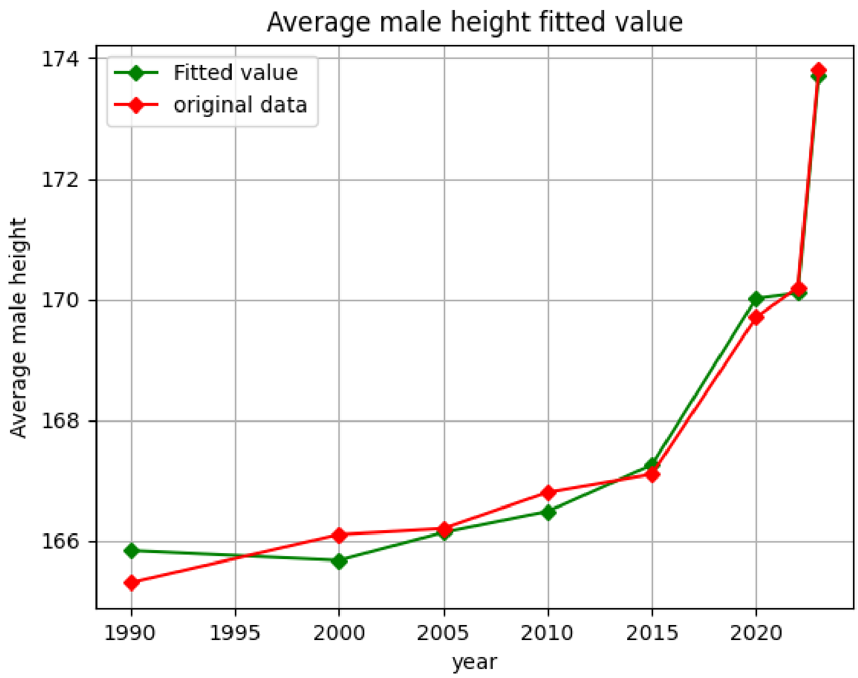
The final prediction model is as follows:

$$h = max - ae^{-0.0527 \cdot x_2 - 0.3521 \cdot x_5}$$

Model Evaluation

The predicted and actual values of male and female heights are compared in the following figure:





It can be observed that the fitting effect is good, with the predicted values being very close to the actual values.

To evaluate the performance and statistical significance of the male and female height prediction models, we analyzed and compared metrics such as R squared, P-value, F-value, and RMSE. R squared represents the explanatory power of the model for the target variable. P-value is used to test the overall significance of the model. F-value indicates the overall regression significance of the model; the larger the value, the stronger the explanatory power of the independent variables for the target variable. RMSE measures the prediction error of the model; the smaller the value, the higher the prediction accuracy of the model.

Statistical Metrics for AMH and AFH Prediction Models

Statistics	R squared	P	F	RMSE
AMH	0.99053	0.000008726	261.502	0.0163
AFH	0.9959	0.00000108	606.527	0.00524

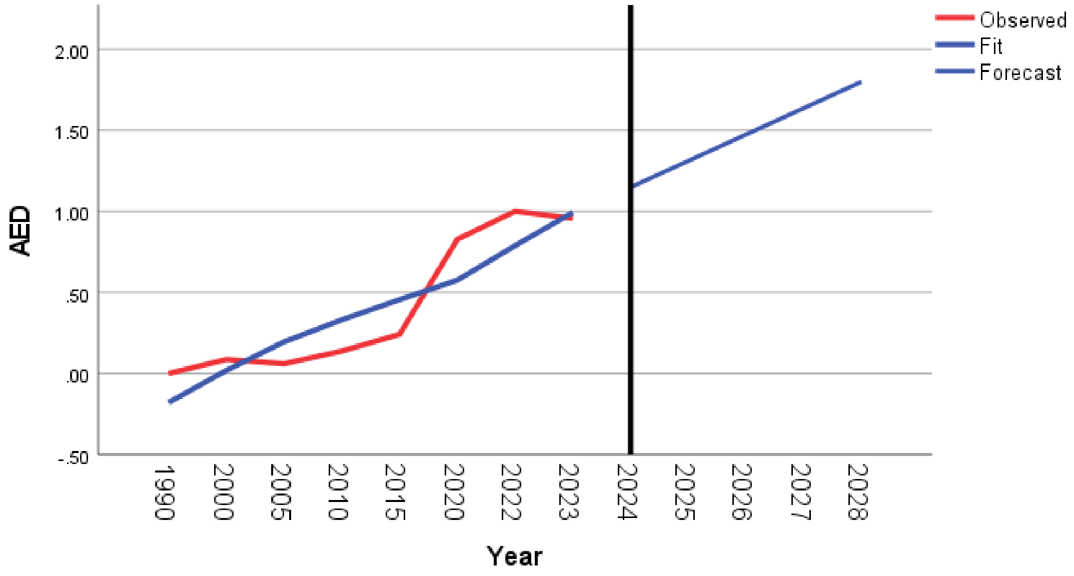
From the table, it can be seen that in the predictions for male and female heights, the R squared values are close to 1, indicating that the model has strong predictive power for height. The P-values are much smaller than 0.05, demonstrating the overall significance of the model. In both male and female height predictions, the F-values are large, and the significance of the female height model is better than that of the male height model. The RMSE values are small, and the average prediction error of the female height model is even smaller.

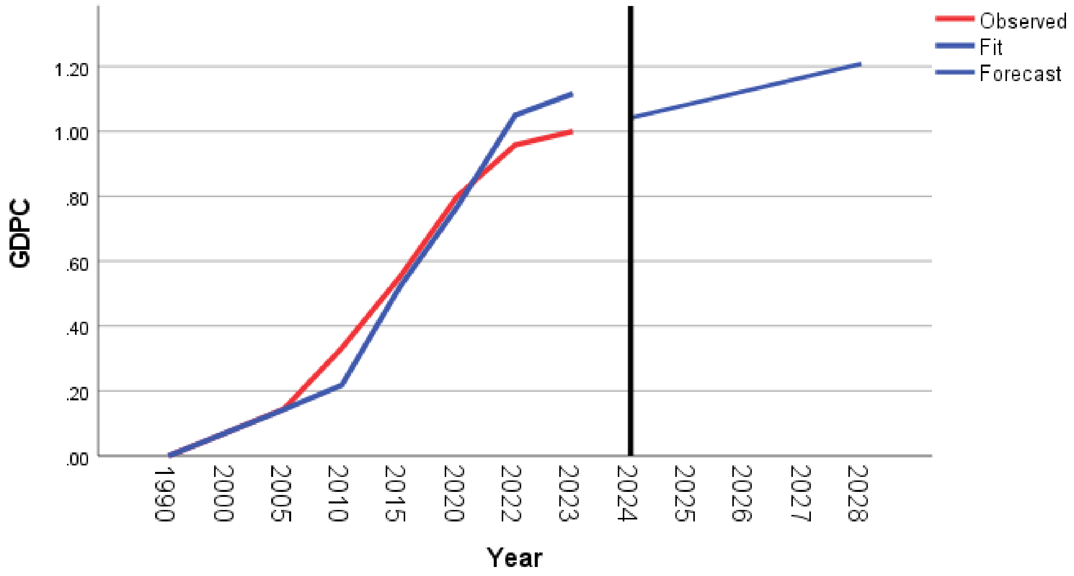
Prediction Based on the Model

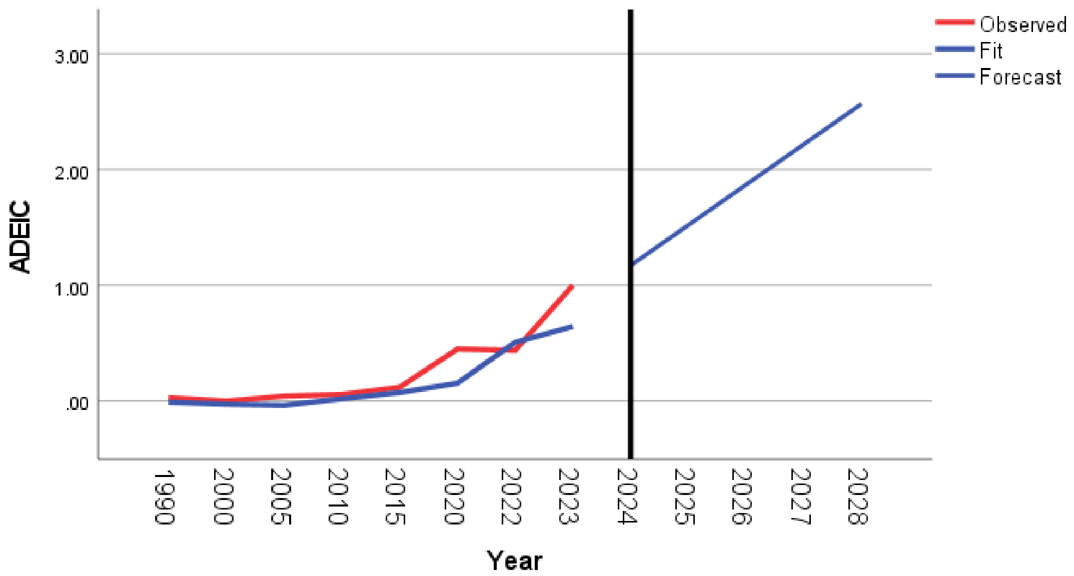
We first used time series analysis to predict the data for AED, GDPC, and ADEIC over the next five years. The prediction results are shown in the table below, along with a visualization of their trends:

Predicted Values of AED, GDPC, and ADEIC from 2024 to 2028

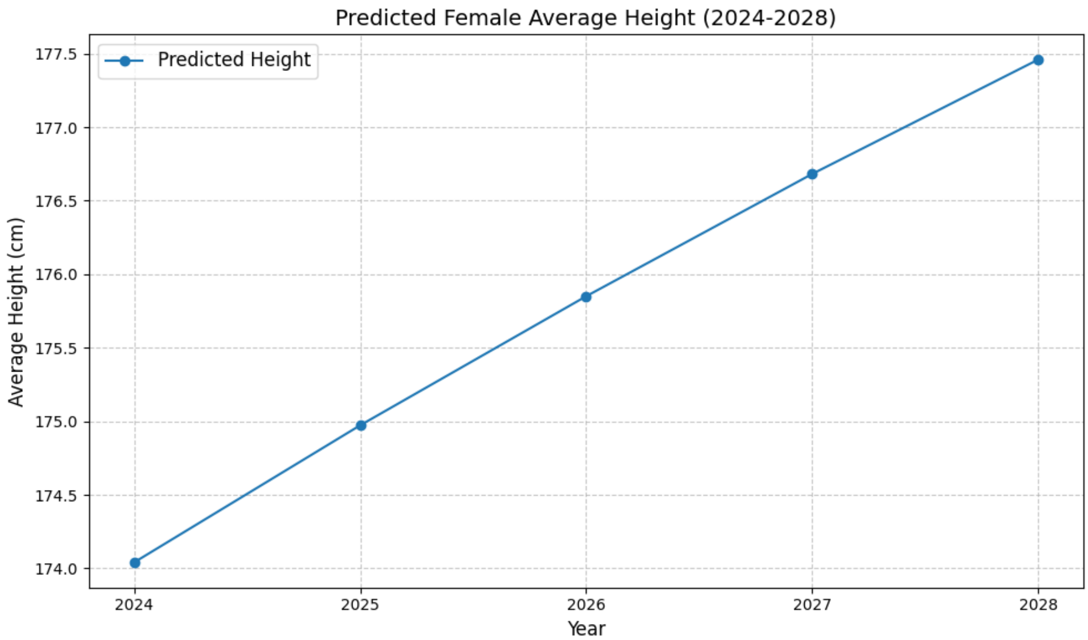
Year	AED	GDPC	ADEIC
2024	1.15	1.04	1.17
2025	1.31	1.08	1.52
2026	1.47	1.13	1.87
2027	1.64	1.17	2.22
2028	1.8	1.21	2.57

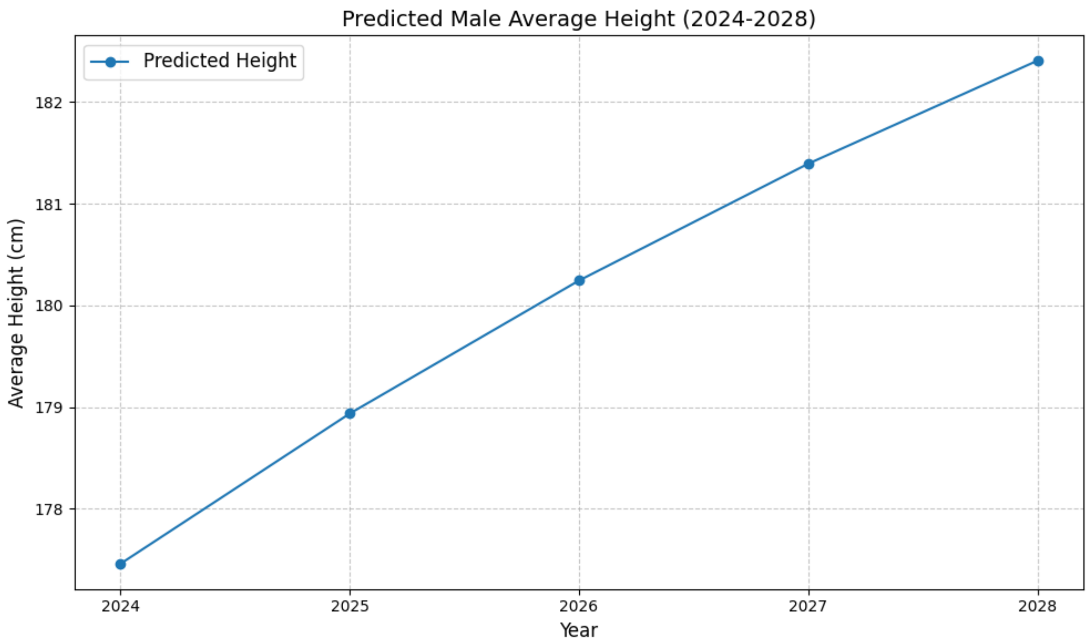






Next, we predicted the heights of males and females over the next five years. The results are as follows:





We estimate that by 2028, the average height of females will reach 177.46 cm, an increase of approximately 3.92 cm compared to 2024; the average height of males will reach 182.41 cm, an increase of approximately 4.16 cm compared to 2024.

Strategies for Enhancing Height Growth

From the first question, we identified five factors (Average Exercise Duration (AED), GDP per Capita (GDPC), Average Sleep Duration (ASD), Average Daily Protein Intake per Person (ADPIP), and Average Daily Energy Intake per Capita (ADEIC)) that have a significant correlation with the height of the Chinese population, with GDPC showing the highest correlation. In the second question, we selected ASD and ADEIC as variables for the regression equation.

Based on the above analysis, we will implement measures to promote the healthy development of body height among the Chinese population from the following five aspects:

Average Exercise Duration (AED)

Abstract: AED represents the average time individuals engage in daily physical exercise. Adequate physical activity stimulates bone growth, enhances muscle strength, and improves cardiopulmonary function, exerting a positive influence on stature development.

Measures:

a. Promotion of Physical Exercise:

Actively disseminate the importance of physical exercise in schools, communities, and media outlets to encourage both adolescents and adults to increase their exercise duration.

b. Improvement of Sports Facilities:

•Increase the construction and investment in sports facilities, such as public gyms, sports venues, and fitness equipment, to provide more opportunities for the public to exercise.

c. Organization of Sports Activities:

•Organize various sports events and competitions, including basketball, football, swimming, etc., to stimulate public interest and enthusiasm in sports participation.

GDP per Capita (GDPC)

Abstract: GDPC serves as a pivotal indicator for assessing the economic development level of a country or region. With economic growth, people's living standards improve, facilitating easier access to high-quality food, nutrients, and medical services, which collectively exert a positive influence on stature development.

Measures:

a. Promotion of Economic Growth:

•Foster economic growth by implementing reforms and innovations, promoting industrial upgrading, and enhancing overall economic development to elevate the per capita gross domestic product (GDPC).

b. Optimization of Resource Allocation:

•Allocate more resources towards sectors such as education, healthcare, and sports to elevate the quality of public services.

c. Enhancement of Residents' Income:

•Increase residents' disposable income by creating more employment opportunities and raising wage levels, thereby enabling them to purchase additional nutrients and medical services.

Average Sleep Duration (ASD)

Abstract: ASD serves as an indicator reflecting individuals' sleep quality. Adequate sleep is crucial for the secretion of growth hormone, which plays a vital role in stature development.

Measures:

a. Promotion of Healthy Sleep Knowledge:

•Disseminate the importance of healthy sleep in schools, communities, and media outlets to encourage individuals to maintain sufficient sleep duration.

b. Improvement of Sleep Environment:

•Optimize bedroom environments by reducing noise levels, adjusting lighting and temperature conditions, and other means to enhance sleep quality.

c. Reduction in Electronic Device Usage:

•Limit the time adolescents spend using electronic devices before bedtime to mitigate the disruptive effects of blue light on sleep patterns.

Average Daily Protein Intake per Person (ADPIP)

Abstract: ADPIP serves as a crucial indicator for assessing individuals' daily protein intake. Protein, as the fundamental substance comprising bones and muscles, plays a pivotal role in stature development.

Measures:

a. Promotion of High-Protein Foods:

•Increase the consumption of high-protein foods, such as meat, fish, beans, and eggs, in school cafeterias, restaurants, and family diets.

b. Improvement of Dietary Structure:

•Advocate for a balanced diet by enhancing the intake of vegetables, fruits, and whole grains to provide comprehensive nutritional support.

c. Provision of Nutritional Guidance:

•Offer personalized nutritional advice to the public through the guidance of nutritionists and physicians to ensure the rationality and scientific nature of protein intake.

Average Daily Energy Intake per Capita (ADEIC)

Abstract: ADEIC represents the average level of daily energy intake among individuals. Adequate energy intake is essential for maintaining normal physiological functions and supporting growth and development.

Measures:

a. Promotion of Healthy Eating Habits:

•Advocate for scientific dietary practices, avoiding overeating and excessive dieting, to ensure the rationality of energy intake.

b. Enhancement of Dietary Diversity:

•Provide a diverse range of food options to cater to the energy needs of different population groups.

c. Monitoring of Energy Intake:

•Assess the rationality of energy intake through regular monitoring of body weight and height, and make adjustments as necessary.

Conclusion

Collectively, the improvement of five indicators—AED, GDPC, ASD, ADPIP, and ADEIC—can further promote the healthy development of stature among the Chinese population. The implementation of these measures necessitates concerted efforts and collaboration among governments, schools, families, and all sectors of society.

References

Lu,G., Hu,Y., Yang,Z., et al. (2023). Geographic latitude and human height: Statistical analysis and case studies from China. *Economic&Human Biology*, 102180.

Wang, Y., Zhang,Z. ,Yang,Y., et al. (2023). Changes in adult height in China from 1985 to 2019: Stunting rates and mean height. *Chinese Journal of School Health, 44*(8), 1005-1008.

Zhang, J., Li, Y., Zhou, F., et al. (2023). Height development trends among 7-18-year-old school-age children in China during 2000-2019: A multi-center study. *Economic&Human Biology,* 102165.