Relationship of mid-parental height, Calcium intake, and intensity of physical activity with body height growth of high school students in Malang

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ABSTRACT
Stunting is one of Indonesia’s problems, as portrayed in RISKESDAS 2018. This means the growth of Indonesian children was not optimal. Some factors that might affect body height growth were genetic factors, represented by mid-parental height, nutritional factors, especially calcium, and physical activity, which could activate pathways to stimulate growth. These factors were known to have a huge role in body height growth, especially if these factors were optimized in adolescence, as in high school students. This research aimed to explain the relationship between body height growth and the factors that might affect it: mid-parental height, calcium intake, and the intensity of physical activity. This research was observational analytic, using purposive sampling as the sampling method and collecting data using a cross-sectional questionnaire. Statistical analysis between variables shows that mid-parental height was positively related (p<0.05, r: 0.356), while calcium supplementation was not associated (p<0.05, r: -0.165), and intensity of physical activity was not related (p=0.059, r: 0.089) with the body height growth of the students. In conclusion, among the factors that were analyzed, mid-parental height was the only one that had a relationship with body height growth.
INTRODUCTION

Stunting was one of the problems in Indonesia portrayed in RISKESDAS 2018. It shows that 4.5% of teenagers (16-18 years old) were still very short, and 22.4% of the population was classified as short. This problem means that the growth of Indonesian children was not optimal (Riskesdas Jatim, 2018). Mid-parental height is a tool that is used in clinical practices to determine the potential final height that could be attained by a child based on the height of the parents (IDAI, 2017). This measurement represents genetic factors, in a very simple way, which have a huge role in a child’s growth (Garza et al., 2013). The nutritional factor was also known to have critical roles in the growth process. Without sufficient nutrition, the growth could be stunted (Gat-Yablonski & Phillip, 2015). One of the most important nutrients in body height growth is calcium, whereas this nutrition is one of the main components of bone (Sherwood, 2016). Besides those factors, physical activity was also publicly known to affect body height growth. This happened because physical activity could activate pathways by increasing the hormones and growth factors that stimulate growth (Bajer et al., 2015). The growth process itself mainly happens in adolescence, around the age of 16-18 years old, depending on the gender of the child (Guyton & Hall, 2019), and in Indonesia, children this age attend high school. It was publicly known that optimization of the factors described above in this phase was vital to achieving optimal final adult height. This research aimed to explain the relationship between mid-parental height, calcium intake, and intensity of physical activity with the growth of high school students.

METHODS

This research was cross-sectional observational analytics research. The data was collected using a questionnaire with two data collection instruments: SQ-FFQ (Semi Quantitative-Food Frequency Questionnaire) to collect calcium intake data of the students, and GPAQ (Global Physical Activity Questionnaire) to assess the intensity of physical activity of the students. The population of this research was students of 10 state and private high schools in Malang that agreed to participate in the study. Based on the calculation, the minimum number of samples was 116, and purposive sampling was used as the sampling method. The relationship of every variable was analyzed using the Spearman correlation test. This research was approved by the Health Research Ethic Committee of University of Muhammadiyah Malang through ethical approval No.E.5.a/020/KEPK-UUM/I/2022.

RESULTS

This research involves 152 students as the samples. The profile of the samples containing minimal, maximal, and average values of age, body height percentile, mid-parental height percentile, calcium intake, and intensity of physical activity is shown in table 1.

The data from every variable is then classified into categories. In the “body height” variable, 19 students, or 12% of the total sample, was classified as “very short”. While 41 students or 27% of students, was “short”. 88 students or 58% have “normal” body height. 4 students or 3% of the total sample was “tall”, and none of them were classified as “very tall”. The result was also shown in Figure 1.
Tidak ada data pasti tentang kejadian diabetes insipidus pada pasien dengan cedera otak traumatis. Juta orang mengalami cedera otak berat di Amerika Serikat. Terdapat lebih dari 50.000 kematian.

**ABSTRAK**

Diabetes insipidus, brain injury, and treatment of diabetes insipidus. Diabetes insipidus occurs in the first 2 weeks after the injury. One complication that patients with traumatic severe brain injury of Indonesia experience is diabetes insipidus. Adequate hypovolemic, polyuric and hypernatremia, although the immediate administration of desmopressin, the patients' clinical and hemodynamic were not shown any improvements. The patient passed away in the Intensive Care Unit (ICU). The main treatments for diabetes insipidus in traumatic severe brain injury are appropriate rehydration and administration of desmopressin. After surgery, the signs of diabetes insipidus were presented by polyuria of 300cc/hour urine production and 149mmol/L sodium.

The data from every variable were analyzed by the teachers and researchers. The result was also shown in Figure 3. The intensive care unit (ICU) was five days of treatment of the patient. The result of the implementation of diabetes insipidus in cases of traumatic severe brain injury requires complicated treatment. Therefore, definitive data on the incidence of diabetes insipidus in cases of traumatic severe brain injury are inadequate.

**Table 1. Demographic profile of the sample**

<table>
<thead>
<tr>
<th>No</th>
<th>Characteristics</th>
<th>Minimal</th>
<th>Average</th>
<th>Maximal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age</td>
<td>15 years</td>
<td>11 years 5 months</td>
<td>20 years 6 month</td>
</tr>
<tr>
<td>2</td>
<td>Body Height Percentile</td>
<td>0(^{th})</td>
<td>27.8(^{th})</td>
<td>93.5(^{th})</td>
</tr>
<tr>
<td>3</td>
<td>Mid-Parental Height Percentile</td>
<td>0(^{th})</td>
<td>20.1(^{th})</td>
<td>81.4(^{th})</td>
</tr>
<tr>
<td>4</td>
<td>Calcium Intake</td>
<td>63 mg/day</td>
<td>755 mg/day</td>
<td>4237 mg/day</td>
</tr>
<tr>
<td>5</td>
<td>The intensity of Physical Activity</td>
<td>13 MET/day</td>
<td>1093 MET/day</td>
<td>8817 MET/day</td>
</tr>
</tbody>
</table>

**Figure 1. Classification of body height growth variable**

**Figure 2. Classification of mid-parental height variable**
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Figure 3. Classification of calcium intake variable

Figure 4. Classification of intensity of physical activity variable

Table 2. Results of statistical analysis between variables

<table>
<thead>
<tr>
<th>Variable 1</th>
<th>Variable 2</th>
<th>Sig. (P value)</th>
<th>r value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-Parental Height</td>
<td>Calcium Intake</td>
<td>0.000</td>
<td>0.356</td>
</tr>
<tr>
<td>Body Height</td>
<td>The intensity of Physical Activity</td>
<td>0.042</td>
<td>-0.165</td>
</tr>
</tbody>
</table>

Fulfill Daily Recommendation

Didn't Fulfill Daily Recommendation
In the “mid-parental height” variable, 19 students or 13% of the total sample, was classified as having “very short” MPH. 57 students or 37% of the students have “short”

In the “calcium intake” variable, 20 students or 13% of the total sample was fulfilled daily requirement of calcium, which is 1200 mg/day. While 132 students or 87% of the total sample was not fulfill daily recommendation of calcium intake. The result was also shown in Figure 3.

In the “intensity of physical activity” variable, 56 students, or 37% of total sample, have fulfilled daily recommendations for daily physical activity, which is 240 MET/day. In comparison, 96 students, or 63% of the total sample, didn’t fulfill the daily recommendation. The result is also shown in Figure 4.

The results of the statistical analysis between variables are shown in table 2. Statistical analysis between the student’s body height and mid-parental height results in P value of 0.000 and an r value of 0.356. This means that the student’s height was significantly related (p<0.05) to mid-parental height with moderate strength. While analysis between calcium intake and student’s body height results in P value of 0.042 and r value of -0.165, this means that calcium intake has significant relation (p<0.05) to the body height, but because the strength is too weak, it was considered to have no correlation. And the analysis of the intensity of physical activity with student’s body height results in a P value of 0.278 with an r-value of 0.089. This means that the intensity of physical activity was not related to the body height of the students.

**DISCUSSION**

The result of the statistical analysis means that mid-parental height was positively related to the growth of body height; this result was similar to previous research (Goyal et al., 2020). This relation might happen because parents inherit genes from their offspring; research has found that no less than 180 genes are related to body height growth (Lango Allen et al., 2010). These genes were also found to regulate biological pathways that have big roles in body height growth such as Hedgehog Signaling Pathway, which regulated by BMP2 and BMP6 (Yang et al., 2015), MAPK signaling pathway, which regulated by FGFR4 and GNA12, TGFb signaling pathway, which regulated by GDF5 and ID4 (Guasto & CORMIER-DAIRE, 2021), and Endothelin signaling pathway, which regulated by PRKG2 (Kristiano et al., 2017).

Statistical analysis of calcium intake and body height growth showed no relationship between calcium intake and body height growth. Previous researches have various results regarding this matter; some research found that increased calcium supplementation could support body height growth. One of those researches found that consuming calcium below a specific cutoff value could affect final body height, while increasing calcium intake above the cutoff value didn’t increase final body height but increased the body height’s growth rate. Some researchers also found that calcium intake didn’t correlate with body height (Maharsari, 2018; Winzenberg et al., 2007; Xu et al., 2021). This could happen because calcium has 40-60% absorption rate depending on some factors, like the concentration of calcium ions in the gastrointestinal (GIT) lumen, absorption time of the food in the GIT, and substances that could inhibit calcium absorption, such as phytate and oxalate (Shkembi & Huppertz, 2022).

The result of statistical analysis between body height growth and intensity of physical activity means that there was no relation between the two variables; previous research also found similar results (Jazbinšek & Kotnik, 2020; Kohl et al., 2013; Savitri et al., 2021). This might happen because every person has a difference in responding the physical activity, which
is the production of hormones and growth factors. The research found that the difference in testosterone concentration in blood before and after the exercise was related to body height, while the intensity of the activity itself was not associated with body height (Kowal et al., 2021).

The result of this research, in general, founds that calcium intake and intensity of physical activity didn’t have a correlation with the growth of body height. This might be happened because of the genetic factor that limits the maximum height that could be attained (Perkins et al., 2016). Environmental factors, including calcium intake and intensity of physical activity, support optimum growth.

The limitation of this research was the data collection method, a questionnaire. This method depends on the respondents’ memory, which could result in biased data. Another limitation was that this research didn’t consider other factors that could affect the calcium absorption rate. To give better understand the relationship of calcium intake and the intensity of physical activity with body height growth, the next research could use cohort method with periodic evaluation from childhood through adolescence, and adulthood to monitor the exact amount of calcium which consumed and the intensity of physical activity of the research samples.

**CONCLUSION**

Based on the results of this research, among factors that were analyzed, mid-parental height was the only variable that correlated with the growth of student’s body height, while calcium intake and intensity of physical activity was not related to the growth of student’s body height. The next research could investigate other growth parameters along with the factors that could affect them.

**REFERENCES**


Diabetes insipidus in patients with traumatic severe brain injury

ABSTRAK


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- Brain injury
- Desmopressin
- ICU

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