Analysis of Energy Intake at Breakfast and Physical Activity in College Students
Yields the Ideal Breakfast Size

Sae Sasabe, Tomoya Tsumori, Sakura Makio, Honoka Yamamoto
Shukutoku University, Faculty of Nursing and Nutrition, Department of Nutrition, Chuo-ku, Nitona 673, Chiba, Japan

Abstract

Background and Objective: Skipping breakfast in young adults is a growing nutritional problem in Japan that results in lower energy expenditure in the morning. Here, we examined the relationship between energy intake at breakfast and physical activity to determine the ideal breakfast size (in kcal).

Study Design: Cross-sectional.
Participants: Twenty healthy undergraduate student volunteers (5 males and 15 females), recruited from Shukutoku University, Japan.

Measurable Outcome/Analysis: We assessed dietary intake over the course of seven consecutive days using the dietary recall method. We calculated energy/nutrition intake using standard tables of food composition in Japan. After excluding days of self-reported unusual dietary consumption, the remaining 133 days were analyzed. Intensity of physical activity and step counts were measured with a Polar V800 accelerometer. When recorded activity was 2.0 METs (standing intensity) or higher, it was regarded as “active time.”

Results: Active time and step counts were significantly lower on days when breakfast was skipped (n = 38/133) than when it was not (active time: 187.6 ± 267.1 min/day, p < 0.005; step count: 6,275 vs. 9,458 steps/day, p = 0.0005). Linear regression showed a significant positive correlation between energy intake at breakfast and active time. An inverted U-shaped quadratic curve was a better fit than a straight line. The resulting regression formula indicated that an energy intake of 526 kcal would yield the longest active time.

Conclusions: Our study suggests that too little breakfast, as well as too much breakfast, can lead college students to be less physically active. The breakfast energy intake that resulted in the longest active time in this study was 526 kcal, which is the longest, was 34%.

Table 1. Characteristics of participants

<table>
<thead>
<tr>
<th></th>
<th>(Average ± SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>21.5 ± 0.6</td>
</tr>
<tr>
<td>Sex</td>
<td>Male (n) 5, Female (n) 15</td>
</tr>
<tr>
<td>BMI</td>
<td>20.9 ± 0.5</td>
</tr>
<tr>
<td>Physical activity</td>
<td>Active time (min/day)</td>
</tr>
<tr>
<td></td>
<td>Step count (steps/day)</td>
</tr>
<tr>
<td>Diet intake</td>
<td>Total energy intake (kcal/day)</td>
</tr>
<tr>
<td></td>
<td>Breakfast energy intake (kcal)</td>
</tr>
<tr>
<td></td>
<td>Breakfast energy intake (%)</td>
</tr>
</tbody>
</table>

Discussion and Conclusion

- Breakfast skipping has been a long-standing nutritional problem among young people in Japan, and little improvement has been seen in more than a decade.
- It is unlikely to be feasible to recommend an ideal balanced breakfast to those who habitually miss breakfast.
- To provide nutritional education for those who do not consume any energy at all for breakfast, it is necessary to indicate how much (in kcal) they need to aim for the first step to maintain their health, but there is little evidence to define a meaningful breakfast in terms of quantity.
- In order to determine the minimum breakfast energy intake required for a healthy lifestyle, we conducted a cross-sectional study on the relationship between physical activity and breakfast energy intake (Fig. 1).

Figure 1. How much (kcal) is enough to make breakfast worthwhile?

Figure 2. “Definition of active time”

Figure 3. Comparison of physical activity between breakfast eating day and skipping day

Figure 4. Relationship between energy intake from breakfast and active time

Method

Participants: Twenty healthy undergraduate student volunteers (5 males and 15 females) recruited at Shukutoku University, Japan.

Data collection: Dietary intake over the course of seven consecutive days using the dietary recall method. In this study, a breakfast-skipping day was defined as no-energy intake before 10:00 am.

Energy/nutrition intake calculated using standard tables of food composition in Japan 2015 (seventh revised version).

Intensity of physical activity and step counts were measured using a Polar V800 3D accelerometer and H10 heart rate monitor. Participants were the device 24 hours a day including during sleep, except when bathing. When recorded activity was 2.0 METs (standing intensity) or higher, it was regarded as “active time.”

Data analyses and ethics: Seven days were excluded because of self-reported unusual dietary consumption (e.g., only one meal per day or a day of drinking and eating too much). The remaining 133 days were analyzed.

All statistical analyses were performed using JMP PRO version 15.0 (SAS Institute Inc., Cary, NC, USA). Data were analyzed using unpaired t-tests and regression analyses. P-values < 0.05 using two-tailed tests were considered statistically significant.

This research was approved by the Ethics Committee of Shukutoku University (approval number IR19-01).

Future Research

- We will conduct an intervention study to direct breakfast energy intake and examine the minimum breakfast energy intake that can be expected to increase physical activity.
- To increase physical activity, it may be helpful to increase breakfast energy intake to approximately 1/3 of the daily energy intake.
- To nutritionally educate the habitual breakfast skipper, the minimum size of breakfast to improve physical activity should be determined.

Acknowledgment

This work was supported by JSPS KAKENHI, Grant Number 19K20190.

Contact

Please e-mail Sae Sasabe (sae.sasabe@ocn.shukutoku.ac.jp) with questions or suggestions.