

## **Missing breakfast is associated with overweight and obesity in Bangladeshi adolescents**

Childhood obesity has increased by 59% in developing countries over the past three decades (1) and it is a major global public health problem given its established links with adverse health conditions such as type II diabetes and cardiovascular disease. Understanding the modifiable behaviours associated with energy intake and expenditure is an important part of combating the global obesity epidemic.

Eating breakfast regularly is a key component of a healthy diet. Missing breakfast has been positively associated with metabolic changes, overweight and obesity in paediatric studies primarily conducted in high-income countries (2). In the Asian and Pacific region, missing breakfast is common among children and adolescents with 32% regularly missing breakfast in Malaysia (3) and 41% in Fiji (4). However, no studies have looked at missing breakfast or its association with weight status of adolescents in Bangladesh. This is of particular importance given the increase in childhood overweight and obesity in the country, with a pooled prevalence of 13.4% during 1998-2003 and 16.9% during 2010-2015 (5). This study aimed to assess the association between missing breakfast and weight status in adolescents in Bangladesh.

A self-administered questionnaire survey was conducted from 2012-2013 with students aged 12-17 years from eight secondary schools in Dhaka, the capital of Bangladesh. Students were asked how many days they had eaten breakfast in the last week: 5-7 days/week was categorised as “regular breakfast” and 0-4 days/week as “missing breakfast”, consistent with previous research (3). Physical activity was assessed using the 3-Day Physical Activity Recall log, and recreational screen-time was assessed using the Adolescent Sedentary Activity Questionnaire. Students provided socio-demographic information including age, gender, mother and father’s education, and other activity behaviours such as involvement in team and non-team sports at school, and walking to school.

Parents provided information on family income. The study was approved by The University of Queensland Ethics Committee, Australia.

Students' height and weight were measured by the research team to compute body mass index (BMI). Z-scores for BMI-for-age were determined using WHO AnthroPlus with categories of underweight ( $Z \leq -2SD$ ), healthy weight ( $-2SD < Z \leq +1SD$ ), overweight ( $1SD < Z \leq +2SD$ ), and obese ( $Z > +2SD$ ). To examine whether missing breakfast was associated with weight status, we used multinomial logistic regression with "healthy weight" as the reference.

Of the 1476 surveys distributed, 898 students responded, and 793 completed the breakfast item and formed the analytic sample. The study sample (49.7% female) had an average age of  $14.23 \pm 1.15$  years. Two-thirds (67.3%) had healthy weight, 8.8% were underweight, 16.7% were overweight and 7.2% were obese. Among participants, 59% reported having breakfast everyday and 11% missed breakfast everyday. About a quarter (23%) reported missing breakfast regularly (ate breakfast  $\leq 4$  days/week).

The univariate crude associations between missing breakfast and weight status are presented in Table 1. Multivariable analysis showed that participants who missed breakfast had 2.6 times higher odds of being obese than those who regularly had breakfast (OR 2.62; 95% CI 1.35 – 5.08;  $p=0.005$ ), after adjusting for gender, age, walking to school, involvement in non-team sports at school, and family income. Missing breakfast was significantly associated with being overweight (OR 1.77; 95% CI 1.11 – 2.83;  $p=0.016$ ), after adjusting for the same set of confounders. However, missing breakfast was not significantly associated with being underweight ( $p=0.17$ ). The estimated associations were not influenced by physical activity, screentime or family income.

This study found that 23% of adolescents missed breakfast regularly, which is lower than the 32% reported in a study of Malaysian adolescents (3). The analysis showed that adolescents who missed breakfast had higher odds of being overweight or obese than those who regularly had breakfast, which is consistent with other research (2,3). Missing breakfast can be an indicator of other unhealthy eating and low energy expenditure behaviours that contribute to weight gain (2).

Participants were a non-random sample recruited from a limited number of schools in a metropolitan area, which can result in selection bias. Results, therefore, may not be generalisable to all adolescents, in particular those in regional areas. Missing breakfast was measured using a single self-report item, which has not been validated and may be subject to social desirability and recall bias. No definition was provided for “eating breakfast”, and a different categorisation for missing breakfast data may have produced different results.

These study results extend the evidence base on missing breakfast and body weight to provide new data from a non-Western low-middle-income country. Results provide a rationale for more work to understand factors contributing to missing breakfast, the prospective relationship between missing breakfast and weight status, and interventions to reduce missing breakfast among adolescents in Bangladesh.

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#### **Competing interests**

None declared.

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