

## The association of sugar-sweetened beverage consumption and inadequate physical activity with overweight and obesity in school-going children and adolescents in Pakistan

Obesity in children tracks into adulthood and is associated with premature cardiovascular disease, type II diabetes and premature death.<sup>1</sup> Although the prevalence of childhood obesity is escalating in developing countries including Pakistan,<sup>2</sup> the factors fuelling this trend have not been well studied. We conducted a survey on 339 randomly selected children and adolescents aged 11–17 years from four private schools in Karachi, Pakistan to determine the factors associated with overweight and obesity.

Approval to conduct the survey was obtained from the Ethics Review Committee of the Aga Khan University. From each school, a list of all the children in the specified classes was obtained. A random selection of children aged 11–17 years was conducted for enrolment in the study. Consent from the parent and assent from the child were

**Table 1** Factors associated with overweight and obesity in school-going children

	n (%)	Odds ratio (95% CI) for overweight and obesity in school children	
		Unadjusted*	Fully adjusted†
School-based factors‡			
Canteen sugar-sweetened carbonated beverage consumption			
No	98 (28.9)	1	1
Yes	241 (71.1)	3.10 (1.41 to 6.80)	3.59 (1.18 to 10.87)
Canteen juice consumption			
No	271 (79.9)	1	1
Yes	68 (20.1)	3.92 (2.14 to 7.20)	4.41 (1.89 to 10.29)
Canteen calorie-rich snack consumption§			
No	89 (26.3)	1	1
Yes	250 (73.7)	3.81 (1.58 to 9.20)	5.46 (1.78 to 16.75)
PE duration of activity per class			
>30 min/class	202 (59.6)	1	1
≤30 min/class	137 (40.4)	4.98 (2.70 to 9.20)	4.72 (2.08 to 10.71)
Unscheduled physical activity at school¶			
≥20 min/day	114 (33.6)	1	1
<20 min/day	225 (66.4)	0.78 (0.44 to 1.39)	NS#

Continued

**Table 1** Continued

	n (%)	Odds ratio (95% CI) for overweight and obesity in school children	
		Unadjusted*	Fully adjusted†
Out of school activity**			
Outside school physical activity††			
≥20 min/day	85 (25.1)	1	
<20 min/day	254 (74.9)	1.26 (0.64 to 2.46)	NS#
Participation in sedentary activities‡‡			
≤60 min/day	198 (58.4)	1	1
>60 min/day	141 (41.6)	9.05 (4.50 to 18.23)	8.06 (3.37 to 19.27)
Dietary habits§§			
Fast food visits			
≤2 times/week	266 (78.5)	1	1
>2 times/week	73 (21.5)	3.44 (1.89 to 6.26)	2.95 (1.23 to 7.05)
Snacking while watching television/leisure reading			
≤2 times/week	285 (84.1)	1	1
>2 times/week	54 (15.9)	9.51 (4.95 to 18.24)	9.92 (3.85 to 25.58)
Sociodemographic factors			
School			
School 1 – boys only	85 (25.07)	1	1
School 2 – girls only	80 (23.59)	0.82 (0.41 to 1.64)	1.74 (0.34 to 8.74)
School 3 – mixed	95 (28.02)	0.81 (0.40 to 1.64)	0.59 (0.18 to 1.92)
School 4 – mixed	79 (23.30)	0.77 (0.21 to 2.85)	1.13 (0.18 to 7.21)
Gender			
Male	181 (53.4)	1	1
Female	158 (46.6)	0.72 (0.41 to 1.27)	0.49 (0.13 to 1.93)
Age (years)			
>13–17	180 (53.1)	1	
11–13	159 (46.9)	0.79 (0.45 to 1.39)	1.74 (0.76 to 3.97)
Qualification of mother			
Primary school or less	14 (4.1)	1	
Secondary school, graduation or postgraduation	325 (95.8)	0.52 (0.16 to 1.72)	NS#
Family structure			
Extended	154 (45.4)	1	
Nuclear	185 (54.6)	0.58 (0.33 to 1.01)	NS#
Ethnicity			
Non-Urdu speaking	62 (18.3)	1	
Urdu speaking	277 (81.7)	1.33 (0.62 to 2.87)	NS#
Family history of obesity			
No	234 (69.0)	1	
Yes	105 (31.0)	1.14 (0.63 to 2.07)	NS#

\*Unadjusted OR at univariate level.

†Fully adjusted OR.

#NS, not significant.

|| PE, physical education (PE class frequency = 2 days/week).

§Canteen calorie-rich snack (any one of following items: burger, fries, chips, biscuits, pizza, patties, samosa (deeply fried traditional food item), chocolates, sweets, toffee, icecream cake, brownie, pastry and doughnut).

¶Unscheduled physical activity: daily duration of activity at school other than that provided in the PE classes.

††Outside school physical activity: daily duration of active physical activity outside school (participation in games like football, cricket, badminton, rope skipping, jumping, swimming, to the extent that participant would get out of breath).

‡‡Sedentary activity: daily duration of television watching and/or using the internet and/or playing video games.

‡School-based factors:

Canteen sugar-sweetened carbonated beverages (colas); canteen juice (packed fruit juice) and §canteen calorie-rich snack consumption; duration of activity per PE class; ¶ unscheduled physical activity at school (physical activity other than that provided in the PE classes).

\*\*Out of school activity:

Duration of participation in ‡‡sedentary activity; ††active physical activity outside the school.

§§Dietary habits:

Frequency of visits to fast food places; frequency of snacking while watching television, leisure reading or doing homework.

||| Sociodemographic factors:

Subset of school, age, gender, qualification of mother, family structure and family history of obesity.

obtained prior to recruitment. Dietary patterns were assessed through a food frequency questionnaire focusing on canteen and home-based snacks and sugar-sweetened beverages, and fast foods. Physical activity was assessed using the International Physical Activity Questionnaire *modified* for children.<sup>2</sup> Anthropometric measurements were obtained. Multivariable models were built and logistic regression was performed for the primary outcome of overweight and obesity, as defined by the International Obesity Task

Force Criteria.<sup>3</sup> The final model accounted for clustering effect by the school.

Of the total of 400 children approached, 339 consented to enrol. The prevalence of overweight and obesity in the study population was 17.7% (n=60): 19.9% boys and 15.2% girls (p=0.25). As shown in table 1, the (OR (95% CI) for overweight and obesity was greater in children who did versus did not consume calorie-rich snacks (5.46 (1.78 to 16.75)), sugar-sweetened beverages, including carbonated colas (3.59 (1.18, 10.87)),

and fruit juice (4.41 (1.89 to 10.29)) from the canteen, visited fast food restaurants more versus less than twice weekly (2.95 (1.23 to 7.05)), and performed less versus greater than 30 min of activity per physical education class (4.72 (2.08 to 10.71)), engaged in sedentary activities for more versus less than 1 h/day (8.06 (3.37 to 19.27)), or snacked more versus less than twice per week during television watching (9.92 (3.85 to 25.58)).

Our results indicate that unhealthy food, especially sugar-sweetened beverage

consumption and insufficient physical activity at school, are associated with overweight and obesity in children in Pakistan. These data suggest that the schools are well spotted to initiate public health measures to prevent the obesity epidemic in children in developing countries like Pakistan. Our findings call for proactive nutrition education coupled with regulations on sale of sugar-sweetened beverages in schools, which clearly should begin now, especially for products without nutritional value. Efforts are also required to educate children and their families about other potentially modifiable high-risk behaviours including engaging in physical activity at the school and home, so that the onset of the obesity epidemic could be restrained.

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