

Title: Association of bullying victimization with overweight and obesity among adolescents from 41 low- and middle-income countries

Running title: Bullying victimization and obesity

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Abbreviations

BMI	Body mass index
CI	Confidence interval
GSHS	Global School-based Student Health Survey
LMIC	Low- and middle-income country
OR	Odds ratio

ABSTRACT

Background: Data on the association between overweight/obesity and bullying victimization among adolescents are scarce from low- and middle-income countries.

Objectives: We assessed the associations between overweight/obesity and bullying victimization in 41 low- and middle-income countries.

Methods: Cross-sectional data from the Global School-based Student Health Survey were analyzed. Data on past-30 day bullying victimization (including type) and body mass index based on measured weight and height were collected. The 2007 WHO Child Growth reference was used to define overweight and obesity. Multivariable logistic regression (multinomial and binary) and meta-analyses based on country-wise estimates were conducted. Data on 114 240 adolescents aged 12-15 years were analyzed [mean age (SD) 13.8 (1.0) years; 48.8% girls].

Results: Among girls, compared to normal weight, overweight (OR=1.08; 95%CI=1.02-1.16; between-country heterogeneity $I^2=0.0\%$) and obesity (OR=1.20; 95%CI=1.07-1.34; $I^2=0.0\%$) were associated with significantly higher odds for any bullying victimization but no significant association was observed among boys. However, overweight and obesity were both associated with significantly increased odds for bullying by being made fun of because of physical appearance among both sexes [obesity (vs. normal weight): girls OR=3.42 (95%CI=2.49-4.71); boys OR=2.38 (95%CI=1.67-3.37)].

Conclusions: Effective strategies to reduce bullying of children with overweight/obesity are needed in low- and middle-income countries.

Key words: obesity, overweight, adolescents, bullying victimization, epidemiology

INTRODUCTION

Bullying victimization in adolescence is highly prevalent worldwide with its prevalence based on a meta-analysis being approximately 36% (1). Bullying can be defined as repeated undesired aggressive behaviors perpetrated by a peer or a group of peers that involve a power imbalance favoring the perpetrator (2), and can take verbal (e.g., name calling), relational (e.g., social exclusion), or physical (e.g., hitting) forms (3). Bullying victimization in adolescence has been associated with adverse health outcomes such as mental disorders (including suicidal behavior) and physical health problems in adolescence and adulthood (4). Thus, the identification of risk factors for bullying victimization is important to establish effective prevention strategies.

Recently, there has been growing evidence that children and adolescents with obesity (or overweight) are more likely to be bullied (5). Adolescents with overweight/obesity may be more likely to be bullied for their physical appearance especially that obesity is often considered a sign of lack of self-discipline, incompetence, laziness, and sloppiness (6). Studying the specific association between overweight or obesity and bullying victimization is important as weight-based victimization has been associated with increased risk for depression, anxiety, poor body image, social isolation, suicidality, maladaptive eating behaviors, and avoidance of physical activity (7).

A recent meta-analysis by van Geel and colleagues that included 16 studies with more than 50 000 children and adolescents mainly from high-income countries (exception China) found that compared with normal weight, overweight and obesity were associated with 1.19 (95%CI=1.10-1.29) and 1.51 (95%CI=1.32-1.71) times higher odds for bullying victimization, respectively (5). More recently, a multi-country study including data on adolescents from 39 North American and European countries found that overweight and

obesity were associated with 1.40 (95% CI=1.32-1.49) and 1.91 (95% CI=1.71-2.14) times higher odds for chronic bullying victimization, respectively (8).

However, the vast majority of these studies were conducted in high-income countries and data from low- and middle-income countries (LMICs) are scarce. Studies on bullying victimization from LMICs are important because there is relatively little research on bullying from this setting, despite the fact that almost 90% of the world's adolescents live in this setting (9). Furthermore, childhood overweight and obesity are increasing rapidly in this setting due to changing lifestyles (e.g., poor diet and lack of physical activity). Indeed, the relative increase in obesity among children between 1990 and 2010 has been greater in developing countries (+65%) than in developed countries (+48%), while the vast majority of children with overweight and obesity live in developing countries (10). Studies from diverse settings are also necessary, as overweight/obesity may not be equally stigmatizing across all settings. For example, obesity is viewed as a sign of wealth, prosperity, and beauty in some non-Western settings (11). In addition, sex-differences in this association have also been understudied, and there are limited data on the association between overweight/obesity and specific types of bullying (e.g., physical, verbal).

Thus, using data on adolescents aged 12-15 years from 41 LMICs, the aims of the current study were: (a) to examine sex-specific associations between obesity and bullying victimization (including type); and (b) to assess between-country heterogeneity in this association. Given that the effectiveness of bullying interventions are inconclusive (12, 13), it is important to understand what type of children are more likely to be bullied so that targeted and effective interventions can be established.

METHODS

The survey

Publicly available data from the Global School-based Student Health Survey (GSHS) were analyzed. Details on this survey can be found at <http://www.who.int/chp/gshs> and <http://www.cdc.gov/gshs>. Briefly, the GSHS was jointly developed by the WHO and the US Centers for Disease Control and Prevention (CDC), and other UN allies. The core aim of this survey was to assess and quantify risk and protective factors of major non-communicable diseases. The survey draws content from the CDC Youth Risk Behavior Survey (YRBS) for which test-retest reliability has been established (14). The survey used a standardized two-stage probability sampling design for the selection process within each participating country. For the first stage, schools were selected with probability proportional to size sampling. The second stage involved the random selection of classrooms that included students aged 13-15 years within each selected school. All students in the selected classrooms were eligible to participate in the survey regardless of age. Data collection was performed during one regular class period. The questionnaire was translated into the local language in each country and consisted of multiple choice response options; students recorded their response on computer scannable sheets. All GSHS surveys were approved, in each country, by both a national government administration (most often the Ministry of Health or Education) and an institutional review board or ethics committee. Student privacy was protected through anonymous and voluntary participation, and informed consent was obtained as appropriate from the students, parents and/or school officials. Data were weighted for non-response and probability selection.

From all publicly available data, we selected all nationally representative datasets that included the variables pertaining to this analysis. High-income countries were excluded to focus on LMICs. We also excluded countries for which more than 20% of the data on body

mass index (BMI) or bullying were missing. If there were more than two datasets from the same country, we chose the most recent dataset. Thus, a total of 41 LMICs were included in the current study. The characteristics of each country or survey are provided in **Table 1**. For the included countries, the survey was conducted between 2003 and 2016, and consisted of 7 low-income, 22 lower middle-income, and 12 upper middle-income countries based on the World Bank classification at the time of the survey for the respective countries.

Bullying victimization

The students were first provided the following definition of bullying: “Bullying occurs when a student or group of students say or do bad and unpleasant things to another student. It is also bullying when a student is teased a lot in an unpleasant way or when a student is left out of things on purpose. It is not bullying when two students of about the same strength or power argue or fight or when teasing is done in a friendly and fun way.” Bullying victimization was assessed by the question “During the past 30 days, on how many days were you bullied?” with answer options 0, 1-2, 3-5, 6-9, 10-19, 20-29, and all 30 days. In line with previous publications using the same dataset (15, 16), this variable was used as a dichotomous variable (any bullying), which referred to being bullied on at least one day in the past 30 days (i.e., answering either 1-2, 3-5, 6-9, 10-19, 20-19, or all 30 days).

Another question asked about the predominant type of bullying “During the past 30 days, how were you bullied most often?” with eight answer options: “I was not bullied during the past 30 days”; “I was hit, kicked, pushed, shoved around, or locked indoors”; “I was made fun of because of my race, nationality, or color”; “I was made fun of because of my religion”; “I was made fun of with sexual jokes, comments, or gestures”; “I was left out of activities on purpose or completely ignored”; “I was made fun of because of how my body or

face looks”; “I was bullied in some other way”. This variable with its original eight answer options was also used in some analyses.

Overweight and obesity

Trained survey staff conducted measurement of weight and height. BMI was calculated as weight in kilograms divided by height in meters squared. Obesity and overweight were defined as >2 SDs and >1 SD above the median for age and sex based on the 2007 WHO Child Growth reference, respectively, and adolescents who were below -2 SDs were considered to be underweight (17). All other participants were considered to be normal weight.

Control variables

These included age and food insecurity (proxy of socioeconomic status). As in a previous GSHS study, food insecurity was used as a proxy for socioeconomic status as there were no variables on socioeconomic status in the GSHS (18). Specifically, this was assessed by the question “During the past 30 days, how often did you go hungry because there was not enough food in your home?” Answer options were categorized as ‘never’, ‘rarely/sometimes’, and ‘most of the time/always’ (19).

Statistical analysis

Statistical analyses were performed with Stata 14.1 (Stata Corp LP, College station, Texas). The analysis was restricted to those aged 12-15 years as most students were within this age range and the exact age outside of this age range was not provided. Using the overall sex-stratified samples, we conducted multivariable multinomial logistic regression analysis with the predominant type of bullying as the outcome and overweight or obesity as the exposure

variable while adjusting for age, socioeconomic status (food insecurity), and country. We conducted sex-stratified analyses as previous studies have shown that the association between bullying victimization and overweight or obesity may differ by sex (20). Adjustment for country was conducted by including dummy variables for each country in the model as in previous GSHS publications (19, 21).

We also conducted country-wise analyses to assess whether there is between-country heterogeneity in the association between any bullying victimization and overweight or obesity using binary logistic regression analysis while adjusting for age and socioeconomic status (food insecurity). The dichotomized bullying victimization variable was used for this analysis to obtain stable estimates, as the sample size in each country was small. We also calculated the Higgins's I^2 which represents the degree of heterogeneity that is not explained by sampling error with a value of <40% often considered as negligible and 40-60% as moderate heterogeneity (22). A pooled estimate was obtained by combining the estimates for each country into a fixed effect meta-analysis.

For all regression analyses, as in previous studies on this topic (5), those who were underweight (n=8504) were excluded as the objective was to assess whether being overweight or obese is associated with increased odds for bullying victimization compared to normal weight, and because underweight has previously been associated with increased risk for bullying victimization (23). All variables were included in the regression analysis as categorical variables with the exception of age (continuous variable). Sampling weights and the clustered sampling design of the surveys were taken into account to obtain nationally representative estimates. Results from the logistic regression analyses are presented as odds ratios (ORs) with 95% confidence intervals (CIs). The level of statistical significance was set at $p < 0.05$.

RESULTS

A total of 114 240 adolescents aged 12-15 years were included in the analysis [mean age (SD) 13.8 (1.0) years; 48.8% girls]. The overall prevalence of any bullying victimization, overweight, and obesity were 35.1% (girls 32.6%; boys 37.3%), 11.1% (girls 11.4%; boys 10.9%), and 3.9% (girls 3.4%; boys 4.4%), respectively. There was a wide variation in these prevalence estimates by country (Table 1) including those by sex (**Table S1** of the Appendix). For example, the prevalence of obesity ranged from 0.4% in Cambodia and Malawi to 21.9% in Tonga, while that of any bullying victimization ranged from 9.8% (Macedonia) to 70.1% (Egypt). The prevalence of the predominant type of bullying is illustrated in **Table S2** (Appendix). Physical bullying was more common among boys while being made fun of because of physical appearance was more common among girls. The prevalence of overweight and obesity was particularly high among those who were made fun of because of physical appearance (**Figure 1**). Based on multivariable analyses, compared to normal weight, overweight and obesity were both associated with higher odds for being made fun of because of physical appearance among both sexes with this association being particularly pronounced for obesity among girls (OR=3.42; 95%CI=2.49-4.71) (**Table 2**). Among boys, overweight and obesity were also associated with significantly higher odds for being made fun of because of religion, while girls with overweight and boys with obesity had significantly higher odds for being made fun of with sexual jokes, comments, or gestures. The country-wise association between obesity (vs. normal weight) and any form of bullying victimization is shown in **Figure 2** (girls) and **Figure 3** (boys). The overall OR (95%CI; I^2) based on a meta-analysis for girls and boys were 1.20 (1.07-1.34; 0.0%) and 1.02 (0.93-1.13; 37.3%), respectively, and a significant association was only observed among girls. The results for overweight were similar with the corresponding figures being 1.08 (1.02-1.16;

0.0%) for girls (**Figure S1** of the Appendix) and 1.02 (0.94-1.10; 9.2%) for boys (**Figure S2** of the Appendix).

DISCUSSION

In our study on adolescents from 41 LMICs, we found that compared with normal weight, overweight (OR=1.08) and obesity (OR=1.20) were associated with significantly higher odds for any form of bullying victimization only among girls. Among boys, these associations were not significant overall but there was a near moderate level of between-country heterogeneity for the association between any form of bullying victimization and obesity ($I^2=37.3\%$). When accounting for the predominant form of bullying, overweight and obesity were both associated with significantly elevated odds for being made fun of because of physical appearance among both sexes. This highlights the importance of taking the type of bullying into consideration when attempting to elucidate the association between body composition and peer victimization. Some other predominant forms of bullying were also more common among adolescents with overweight or obesity but they were all verbal forms and no significant associations were observed for physical and relational forms of bullying. Strengths of the study include the large sample size, data from diverse settings, and use of data that are nationally representative of adolescents attending school. To the best of our knowledge, this is the first multi-continent study on this topic from LMICs.

It has been hypothesized that adolescents with overweight/obesity may be more likely to be bullied due to the negative stereotypes associated with obesity (e.g., laziness, incompetence). It is even possible that some children with overweight or obesity may internalize these negative beliefs and behave in a manner that elicits these beliefs (24). Alternatively, a weak sense of self-esteem can increase risk for peer victimization for being perceived as being vulnerable or submissive (25). Indeed, a recent study showed that the

association between higher BMI and peer victimization among adolescents was mediated by self-concept (26). Weight-based victimization and lower self-esteem may create a vicious cycle where bullying victimization leads to lower self-esteem, resulting in increased vulnerability for further bullying.

However, the strength of the association between overweight/obesity and any bullying victimization found in our study was weaker than that reported in the meta-analysis by van Geel and colleagues, especially for boys. Specifically, the latter study found that children and adolescents with overweight and obesity were at 1.19 (95%CI=1.10-1.29) and 1.51 (95%CI=1.32-1.71) times higher odds for bullying victimization (compared with normal weight), respectively, with no significant interaction by sex (5). Although this difference may be attributable to methodological factors, it may also be related to differences in contextual factors since the vast majority of studies included in the meta-analysis by van Geel and colleagues were from Western high-income countries. The prevalence of childhood obesity is lower in LMICs than in high-income countries and it is possible that obesity may not cause prejudice and victimization when its prevalence is low and not appreciably visible in the society (27). For example, one study found that the prevalence of obesity and weight-based discrimination both increased in parallel over time in the U.S.A. (28). Conversely, in some developing countries, there is still a preference for obesity over thinness owing to the fact that obesity reflects greater wealth and better access to food (29). Thus, it is possible that obesity may not be equally as stigmatizing in LMICs as in high-income countries.

The finding that any type of bullying was associated with greater body size only among girls but not boys aligns with one study from China (30) but contradicts findings from the meta-analysis by van Geel and colleagues which found no interaction by sex (5). Our findings regarding sex-differences may be related to the fact that overweight/obesity may be a sign of physical strength that is valued among boys but that among girls, there may be little

advantage in being physically superior (31). In contrast, a slim figure is often considered an ideal body composition for girls (32). This may be reflected in our findings where obesity was significantly protective against any bullying victimization in some countries only among boys (i.e., Afghanistan, Yemen, Kiribati, Tonga) but not girls in our study. However, it is worth noting that there was a near moderate level of between-country heterogeneity in the association between any form of bullying victimization and obesity among boys and that in countries such as Swaziland, Macedonia, Namibia, and Peru, obesity was positively and strongly associated with bullying victimization (i.e., $OR > 2$) although statistical significance was only reached in Peru. This suggests that in some countries, boys with obesity may actually be more likely to be bullied, and this may mean that the level of stigma associated with obesity may not be equal across all settings especially for boys.

In terms of the predominant type of bullying, our study results suggest that adolescents with overweight/obesity are more likely to be exposed to verbal bullying than physical or relational bullying. This is in line with previous studies which found that overweight or obesity is only associated with verbal but not other forms of bullying in youth (23, 33). In particular, being made fun of due to physical appearance was particularly strongly associated with obesity in our study, an observation that has previously been made in China (33). However, other studies have found that relational and/or physical bullying is also associated with overweight/obesity (20, 24, 34). Thus, further research is necessary to understand why the type of bullying that children with overweight/obesity experience differs between studies.

The study results should be interpreted in the light of several limitations. First, the study relied on self-reported data for bullying victimization. Thus, some degree of bias may exist (e.g., recall bias, social desirability bias). Second, it is possible that some countries included in our study do not have a proper translation for the word “bullying”. However, the

survey provided a clear definition of bullying prior to asking the questions on bullying. Thus, this is likely to have minimized misinterpretation. Third, our study only included adolescents who attend school, and the results may therefore not be generalizable to all adolescents in the respective countries especially in countries where school attendance rates are low. Fourth the variable on the different types of bullying was only based on the predominant form. Thus, it is possible that adolescents who were predominantly bullied for a certain form of bullying were also exposed to other types of bullying. Finally, due to the cross-sectional nature of the study, we cannot establish causality or temporal associations. For example, it is also possible that bullying victimization resulted in obesity via avoidance of physical activity, increased food consumption, and binge eating which have been reported to be more frequent among victims of weight-based bullying (7). However, the fact that the most consistent and strongest associations were observed for being made fun of because of physical appearance suggests that body weight is likely to be the cause of bullying. Furthermore, one prospective study found that bullying victimization at baseline did not predict increases in BMI in the subsequent 3 years among children (35).

In conclusion, our study results indicate that girls in LMICs with overweight and obesity are more likely than normal weight girls to experience bullying, with no such association observed for boys. However, when the predominant form of bullying is taken into account, boys with overweight/obesity are also exposed to higher risk for some specific forms of bullying. Adolescents with overweight/obesity are known to already be at higher risk for a variety of adverse physical and mental health outcomes (36), and bullying victimization may further compound this risk (4). Awareness that these adolescents are at increased risk for bullying victimization may help identify victims of bullying. Furthermore, school-based anti-bullying strategies may also consider addressing discrimination against adolescents with overweight/obesity. On a broader scale, efforts to address weight-related

stigma in LMICs on a societal level could reduce the burden of bullying victimization for adolescents with overweight/obesity. Finally, longitudinal studies are warranted to provide stronger evidence on causality and the direction of the associations.

CONFLICT OF INTEREST STATEMENT

No conflict of interest was declared.

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Table 1 Survey characteristics and prevalence of bullying, overweight, and obesity

Country-income	Country	Year	Response rate (%)	N ^a	Any bullying (%)	Overweight (%)	Obesity (%)
Low	Afghanistan	2014	79	1,493	43.8	13.6	2.2
	Benin	2016	78	717	48.4	12.8	2.4
	Cambodia	2013	85	1,812	22.1	3.4	0.4
	Malawi	2009	94	2,224	44.9	6.0	0.4
	Myanmar	2007	95	2,227	20.0	4.4	0.8
	Nepal	2015	69	4,616	50.3	6.7	0.5
	Uganda	2003	69	1,904	45.6	6.5	0.8
Lower middle	Bangladesh	2014	91	2,753	23.7	8.1	1.3
	Belize	2011	88	1,600	30.7	23.4	13.5
	Bolivia	2012	88	2,804	30.4	17.3	4.7
	East Timor	2015	79	1,631	31.3	4.7	1.2
	Egypt	2011	85	2,364	70.1	25.8	7.7
	El Salvador	2013	88	1,615	22.5	19.1	10.3
	Guatemala	2015	82	3,611	23.0	20.2	7.7
	Guyana	2010	76	1,973	38.4	11.1	4.1
	Honduras	2012	79	1,486	32.3	13.0	6.0
	Indonesia	2015	94	8,806	21.0	11.0	5.3
	Kiribati	2011	85	1,340	36.8	31.9	8.0
	Laos	2015	70	1,644	13.2	9.4	2.2
	Macedonia	2007	93	1,550	9.8	18.4	3.4
	Mongolia	2013	88	3,707	31.4	10.1	1.8
	Morocco	2010	92	2,405	18.5	12.1	2.8
	Pakistan	2009	76	4,998	41.1	5.4	1.0
	Philippines	2015	79	6,162	51.5	7.9	2.8
	Sri Lanka	2008	89	2,504	37.6	4.1	0.7
	Swaziland	2013	97	1,318	32.1	12.7	4.3
	Tonga	2010	80	1,946	50.6	37.3	21.9
	Vietnam	2013	96	1,743	26.1	5.5	0.6
	Yemen	2014	75	1,553	42.0	9.2	2.4
	Upper middle	Algeria	2011	98	3,484	51.0	10.7
Costa Rica		2009	72	2,265	19.1	18.9	8.9
Fiji		2016	79	1,537	30.0	19.4	8.2
Iraq		2012	88	1,533	28.3	17.4	7.9
Jamaica		2010	72	1,204	40.4	15.8	6.0
Libya		2007	98	1,891	35.4	17.6	8.3
Malaysia		2012	89	16,273	21.0	14.1	9.7
Mauritius		2011	82	2,074	35.2	15.3	6.2
Namibia		2013	89	1,936	45.9	5.7	1.9
Peru		2010	85	2,359	47.2	17.7	2.9
Suriname		2009	89	1,046	26.2	12.8	7.2
Thailand	2015	89	4,132	32.7	13.5	6.6	

^a Restricted to those aged 12-15 years.

Table 2 Association of overweight and obesity with predominant type of bullying victimization (outcome) estimated by multinomial logistic regression

Predominant type of bullying	Overweight vs. normal weight				Obesity vs. normal weight			
	Girls		Boys		Girls		Boys	
	OR [95%CI]	P-value	OR [95%CI]	P-value	OR [95%CI]	P-value	OR [95%CI]	P-value
No bullying (base category)								
Hit, kicked, pushed, shoved around, or locked indoors	0.99 [0.79 ,1.25]	0.951	1.13 [0.92 ,1.40]	0.236	1.03 [0.59 ,1.80]	0.907	0.83 [0.59 ,1.17]	0.289
Made fun of because of race, nationality, or color	0.90 [0.66 ,1.23]	0.508	0.94 [0.70 ,1.25]	0.660	0.61 [0.31 ,1.20]	0.148	1.01 [0.69 ,1.48]	0.972
Made fun of because of religion	0.55 [0.32 ,0.95]	0.033	1.45 [1.01 ,2.08]	0.043	1.55 [0.77 ,3.12]	0.222	2.04 [1.23 ,3.39]	0.006
Made fun of with sexual jokes, comments, or gestures	1.31 [1.02 ,1.68]	0.032	1.21 [0.97 ,1.51]	0.095	0.91 [0.53 ,1.57]	0.745	1.56 [1.14 ,2.14]	0.005
Left out of activities on purpose or completely ignored	0.75 [0.44 ,1.28]	0.290	1.16 [0.70 ,1.90]	0.565	0.72 [0.42 ,1.25]	0.243	0.85 [0.40 ,1.82]	0.670
Made fun of because of how body or face looks	1.48 [1.16 ,1.89]	0.002	1.39 [1.03 ,1.89]	0.034	3.42 [2.49 ,4.71]	<0.001	2.38 [1.67 ,3.37]	<0.001
Other	0.98 [0.84 ,1.14]	0.825	1.04 [0.83 ,1.31]	0.721	0.88 [0.62 ,1.24]	0.469	0.93 [0.70 ,1.24]	0.637

Abbreviation: OR Odds ratio; CI Confidence interval

Models are adjusted for age, socioeconomic status (food insecurity), and country.

Figure legends

Figure 1 Prevalence of overweight and obesity by type of predominant form of bullying among (a) girls and (b) boys

Figure 2 Country-wise association between any form of bullying victimization and obesity (vs. normal weight) among girls estimated by multivariable logistic regression

Abbreviation: OR Odds ratio; CI Confidence interval

Models are adjusted for age and socioeconomic status (food insecurity)

Overall estimate was based on meta-analysis with fixed effects.

Estimates from Macedonia, Myanmar, and Vietnam could not be calculated due to the very low prevalence of obesity among girls in these countries.

Figure 3 Country-wise association between any form of bullying victimization and obesity (vs. normal weight) among boys estimated by multivariable logistic regression

Abbreviation: OR Odds ratio; CI Confidence interval

Models are adjusted for age and socioeconomic status (food insecurity)

Overall estimate was based on meta-analysis with fixed effects.

Estimates from Benin, Malawi, and Sri Lanka could not be calculated due to the very low prevalence of obesity among boys in these countries.