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ORIGINAL ARTICLE

Bullying as a Risk Factor for Eating Disorder Behaviors Among Students: Secondary Analysis for a Cluster Randomized Controlled Trial

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Abstract
This study aimed to examine whether being a victim of bullying predicted body dissatisfaction and eating disorder behavior (EDB). In this study, we performed secondary analysis from a cluster randomized controlled trial among 5208 eight grade students from 73 public schools in three Brazilian cities. Data were collected in 2019 through an anonymous self-report questionnaire on bullying, body dissatisfaction, and EDB. We used factor analysis, multivariate linear regression, and multinomial logistic regression to verify whether being a victim of bullying during the baseline results in body dissatisfaction and EDB at the nine months follow-up for the control and intervention groups. Our results showed that being female (OR 1.41, 95% CI 1.22–1.63) is a risk factor for dissatisfaction by overweight. Bullying was not a predictor of body dissatisfaction; however, being a victim of bullying (β 0.40, 95% CI 0.35–0.46) is a predictor of having more EDB, independent of the exposure to the program. Therefore, bullying deserves attention in the school environment.

Keywords Bullying · Eating disorder · Adolescents · Prevention

Introduction

Bullying is an aggressive behavior characterized by repeated exposure to negative actions and power imbalance [1]. It has serious consequences on the development of adolescents and is influenced by personal and social factors—age, school, involvement in sports activities, and moral detachment [2]. According to the United Nations, bullying is a global issue and about 50% of adolescents reported having been victims of it, which may cause severe psychological damage and affect their mental health, with lifelong consequences [3–5].

Adolescents are more vulnerable to the effects of bullying, probably because they are in a stage of human development characterized by intense biopsychosocial changes, including those related body image [6]. Experiencing bullying during adolescence seems to be strongly connected with body dissatisfaction and feelings of being overweight, among both male and female students [7]. Furthermore, those misperceiving their body image and those dissatisfied with their weight are more likely to screen positive for mental disorders [8].

According to the review by Hosseini and Padhy (2020), body image misperception is common in the general population and is also a core component of several serious disorders, including body dysmorphic disorder and eating disorders (EDs) which are complex mental conditions that can cause considerable impairment [9, 10].

Previous studies show that body dissatisfaction is associated with unhealthy weight monitoring behaviors [11] and that bullying is associated with various mental disorders during adolescence [12], especially EDs [13–16]. However, the vast majority of literature on this topic is cross-sectional [13]. There is still a lack of longitudinal studies to better understand the relationship between body dissatisfaction, EDs, and bullying. Considering that the first eating disorder behaviors (EDBs) emerge during adolescence, it is important to understand the consequences of bullying in this stage of development and the disruptions it can bring to social

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relationships. It is also important to understand risk factors involved in the development of EDs [17, 18].

Studies indicate a recent change in the distribution of ED rates worldwide [19], with a stabilization in their frequency in North America and Western Europe. An increase in the number of these disorders was seen in some regions, such as Asia, Arab and Hispanic countries, and those inhabited by black North American minority groups [20, 21]. In Latin America, these disorders have clinical features similar to the ones mentioned in international literature [22], with a lower prevalence rate of anorexia nervosa and a higher rate of bulimia nervosa, when compared with Western Europe or the United States. Some facets of Latin American culture, such as a specific ideal body image, might be the reason for the development of anorexia nervosa and increase in the risk of bulimia nervosa and binge-eating disorder [23].

The hypothesis we want to test is that teenagers who suffer bullying are at greater risk of feeling dissatisfied with their body image and of exhibiting EDBs. Given that very few longitudinal studies have attempted to establish a temporal precedence between bullying, body dissatisfaction, and EDs [13] and that almost all of the literature on this topic was produced in high income countries, more studies must be conducted to investigate this temporal relationship. Hence, there is a wide knowledge gap with regard to adolescents in Latin America, a region with important cultural influences on appreciation of the body [22, 24]. This could contribute to the occurrence of EDs [25, 26] and affect its association with bullying. Therefore, allocating bullying victimization as a predictor for the two outcomes is a differential of this study, the objective of which was to verify whether being a victim of bullying at the beginning of the school year results in body dissatisfaction and EDB in Brazilian adolescents in the finish of the school year.

Methods

Study Design

This study is a secondary analysis of a cluster randomized controlled trial (RCT) to evaluate drug prevention program in schools, based on the European program "Unplugged" [27], which has already been culturally adapted in Brazil and is known as #Tamojunto 2.0 [28]. This manuscript examined data from the wave conducted in February/March 2019 and November/December 2019.

The #Tamojunto 2.0 RCT was registered in the Brazilian official registry of clinical trials: Registro Brasileiro de Ensaios Clínicos (REBEC) under protocol number RBR-8cnkwq. The study was approved by the Ethics Committee of the Universidade (protocol 2.806.30).

Sampling

The sample consisted of eight grade students from public schools from the cities of São Paulo, Eusebio, and Fortaleza. The number of schools in each municipality was determined to be proportional to the capacity of the Ministry of Health (BMH) team to supervise intervention implementation in the schools. PASS 15.0 software was used to calculate sample sizes of the two intervention groups in a cluster RCT [29]; additional information about sample size and randomization process is available in Sanchez et al. [28, 30]. According to Sanchez et al. [28] 5371 students were present during the baseline data collection. However, excluding those who refused to participate, returned blank questionnaires, and responded positively to a fictional drug, there were 5,208 valid questionnaires of students who had answered at both time points.

Instruments and Variables

Data were collected through a self-report questionnaire answered anonymously, administered by researchers in the classroom, without the presence of the teacher. The questionnaire was adapted from an instrument developed and tested by the European Union Drug Abuse Prevention (EU-DAP) [31] and we used a version that had been translated and adapted for Brazilian Portuguese participants [32]. However, some questions were replaced by items from two questionnaires that have widely been used in various Brazilian studies to evaluate students, and other questionnaires were included. These details and the validation of this instrument can be seen in Galvão et al. [33].

We used two outcome variables collected during the nine-month follow-up assessment:

1. The data relating to EDBs were collected through the SCOFF (Sick/Control/One stone/Fat/Food) questionnaire, a screening tool developed by Morgan et al. [34] that includes five dichotomous questions about eating behavior addressing core features of anorexia and bulimia nervosa. Two "yes" answers indicate a risk of having an ED. However, in this study, we used this questionnaire to analyze EDB as a continuous latent dimension, that is, the higher the score (ranging from 0 to 5) the greater the amount of eating disorder behaviors.
2. Body satisfaction was analyzed using the Stunkard Silhouette Scale [35], which consists of nine female figures and nine male figures, numbered 1–9, ranging from very thin to very obese. Participants were asked to choose one figure that they thought represented their body currently and one that they felt represented the body they would

like to have. An ideal discrepancy score was calculated by differences between answers, generating a value varying from − 8 to + 8. Individuals were classified as: satisfied (if the result was equal to zero), dissatisfied for being thin (if the result was a negative value), and dissatisfied for being overweight (if the result was a positive value) [35] (Fig. 1).

The explanatory variables were collected at baseline, and could therefore be interpreted as predictors of the outcome variables.

1. "Bullying victimization" was assessed using the Olweus Questionnaire [36] which consists of seven dichotomous questions (yes or no). We also created a latent variable underlying the seven indicators where the more intense the bullying victimization, the higher would be the amount of latent trait. In this scale, students were asked about experiencing bullying repeatedly, in the last 30 days, addressing specific types of bullying, such as verbal, physical, and relational types.
2. Sociodemographic data including city, sex, age, and socioeconomic status were collected. Students' socioeconomic status was assessed using the scale of the Brazilian Association of Research Companies (Associação Brasileira de Empresas de Pesquisa—ABEP) [37], which considers the education level of the head of the household, and the goods and services used, with scores ranging from 1–100 or in categories from A–E. Higher scores indicate a better economic status, and socioeconomic classes are ranked from A (highest) to E (lowest). For sex, there was a dichotomous question with two options: male (1) and female (2). As for age, there was a question with space for each student to enter their age.

The conceptual model connecting the indicator and the latent variables for the structural equation model are presented in Figs. 2 and 3.

Statistical Analysis

To compute descriptive statistics, we used Stata 16 software where qualitative variables were summarized by number and percentages and quantitative variables by means and standard deviations.

Since the data relating to bullying victimization, EDB, and satisfaction with body image were not sufficient, as students had left many responses blank, we used the multiple imputation method through a sequential imputation approach. Multiple Imputations (MI) were performed using Bayes estimation of an unrestricted variance–covariance model, to impute the missing values [38]. The following variables were used in the non-restricted model: group (interventionXcontrol), school, sex, age, and ABEP score. Fifty imputed data sets were generated using these variables.

We used structural equation modeling in the two-model approach to address the aim of the study. We performed univariate and multivariate regression [39], linear and logistic according to each model, with the exploratory variables (latent dimension of bullying victimization, ABEP score, sex, and age) affecting the outcome measure (latent dimension of EDB and satisfaction with body image) controlled by the group variables and the baseline outcomes, considering school as a cluster. All inferential analyses were performed in Mplus version 7.4 using the maximum likelihood with

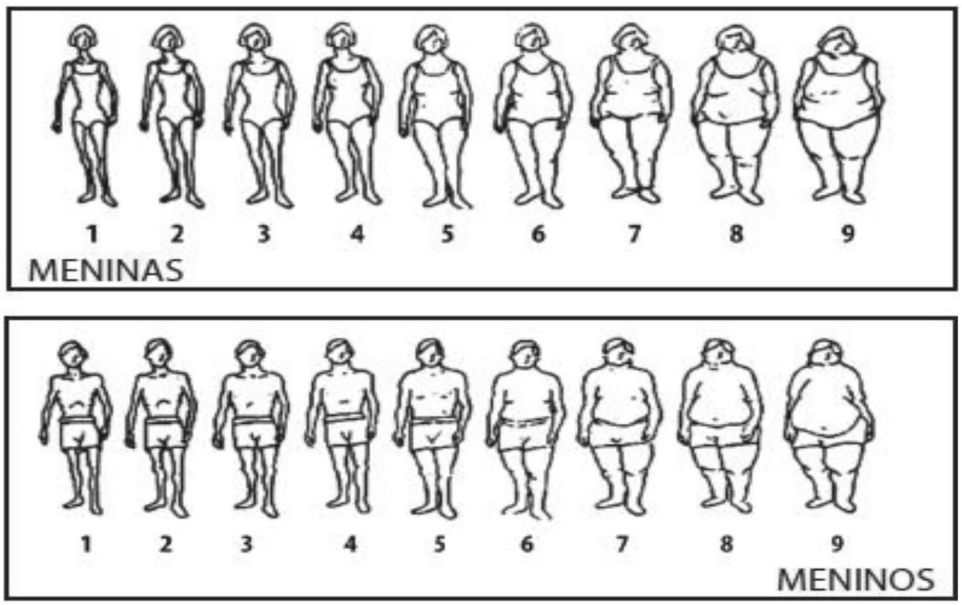

Fig. 1 Stunkard Silhouette Scale

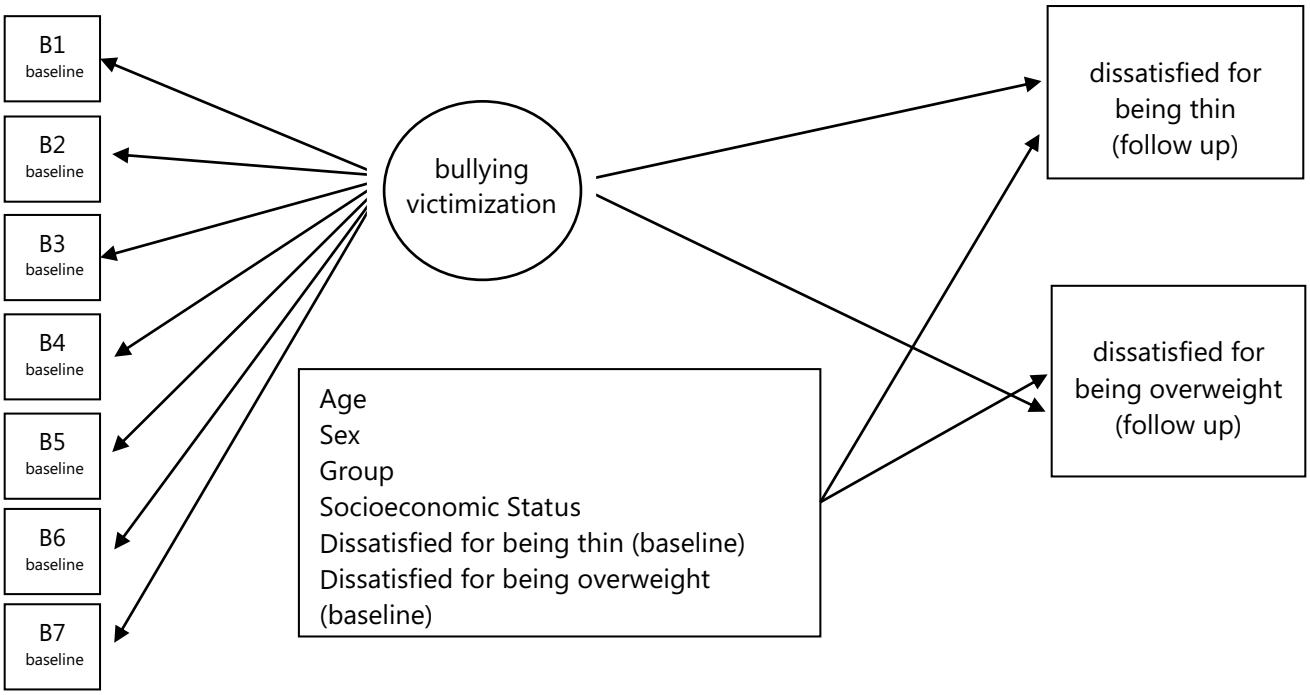

Fig. 2 Conceptual Model about being a victim of bullying predicting body dissatisfaction. B1 = Some students left me out of activities on purpose, deleted me from their friend group, or completely ignored me. B2 = Some students beat me, kicked me, pushed me or locked me alone inside a room. B3 = Some students told lies about me or spread false rumors trying to make others dislike me. B4 = Some students stole money or other things from me or damaged them on purpose. B5 = Some students threatened me or forced me to do things I didn't want to do. B6 = Some students have insulted me or made offensive comments about my race or skin color. B7 = I received aggressive or humiliating messages on social networking sites or WhatsApp from some students

robust standard errors (MLR) estimator, which accounts for the non-independence of the observation (i.e., adolescents nested in schools). Subsequently, the standard error was computed, considering the multi-level structure by command in Mplus called (TYPE = Complex) [40].

Results

Table 1 presents the socio-demographic characteristics of students who participated in the study (N = 5208). A balance between male and female students can be seen, with most students aged between 12 and 14 years, belonging to the middle socioeconomic class. Moreover, 43.71% of the students reported having suffered at least one type of bullying victimization at either time of the study (baseline or nine-month follow-up). A higher percentage of adolescents were dissatisfied with their body image due to the perception of being overweight. In addition, 45.96% of adolescents reported two or more EDB during the baseline study and 44.46% at the nine-month follow-up.

Table 2 shows that the percentage of males satisfied with their body image (33.21%) was higher than that of females (28.49%). There was a higher percentage of dissatisfied females with excess weight (44.41%) than males (30.82%). In addition, it can be seen that females and adolescents who were victims of bullying showed more EDB (mean 1.69 and 1.76, respectively).

Tables 3 and 4 show the magnitude (coefficient) and statistical significance (p-value) of the exploratory variables (latent dimension of bullying victimization, sex, age, and socioeconomic status) affecting the outcome variables (corporal satisfaction and latent dimension of EDB) through univariate and multivariate linear regression. Table 3 shows that only being a female student (OR 1.41; 95% CI 1.22–1.63) influences dissatisfaction with overweight when compared to male students. Table 4 shows that being a female student ($\beta = 0.67$, 95% CI 0.56; 0.75) as well as a victim of bullying ($\beta = 0.40$, 95% CI 0.35; 0.46) is a predictor of having more EDBs, independent of program exposure.

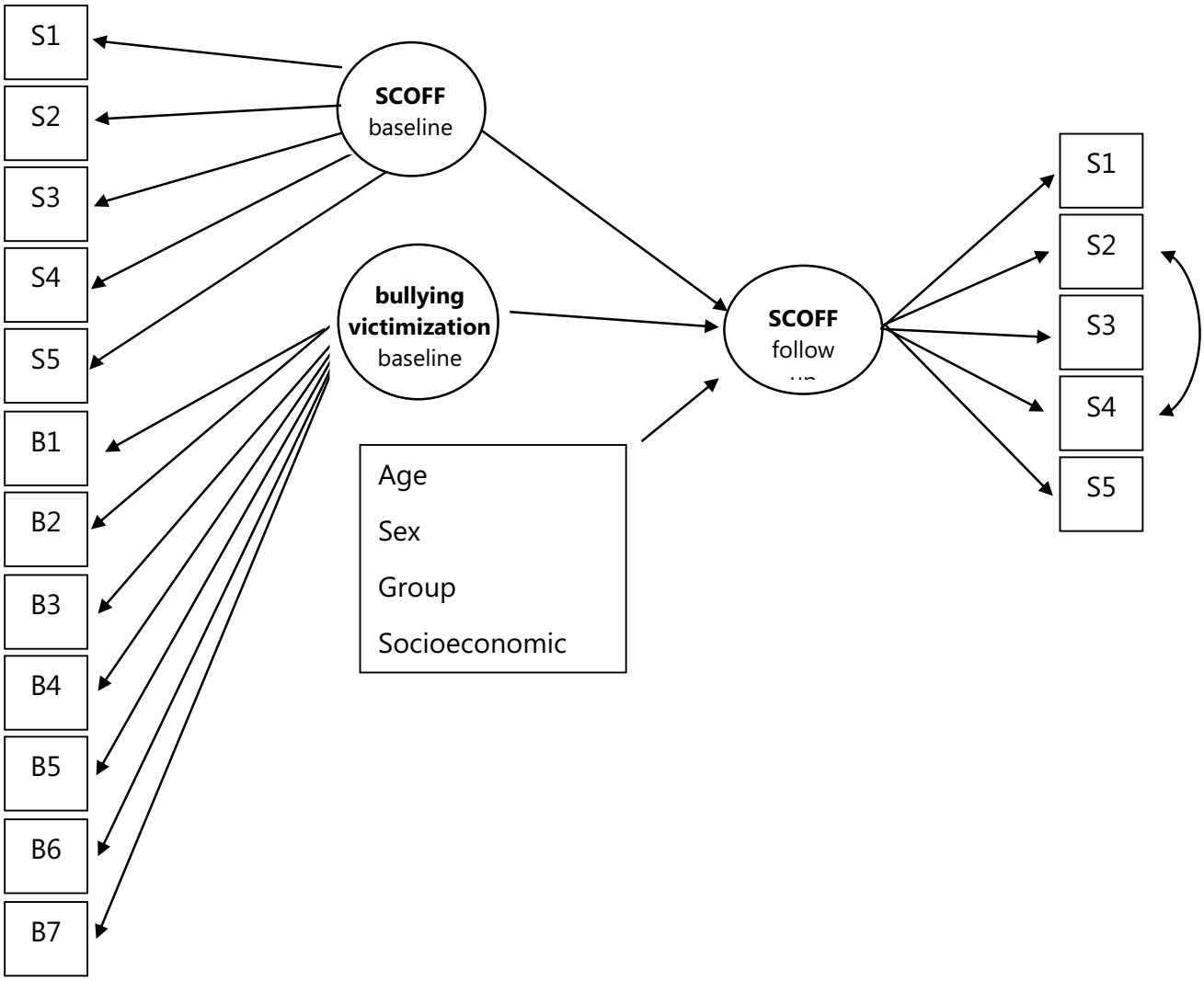

Fig. 3 Conceptual model for being a victim of bullying predicting more eating disorder behaviors. S1 = Do you make yourself **S**ick because your feel uncomfortably full? S2 = Do you worry that you have lost Control over how much you eat? S3 = Have you recently lost more than One stone in a 3-month period? S4 = Do you believe yourself to be Fat when others say you are too thin? S5 = Would you say that Food dominates your life? B1 = Some students left me out of activities on purpose, deleted me from their friend group, or completely ignored me. B2 = Some students beat me, kicked me, pushed me or locked me alone inside a room. B3 = Some students told lies about me or spread false rumors trying to make others dislike me. B4 = Some students stole money or other things from me or damaged them on purpose. B5 = Some students threatened me or forced me to do things I didn't want to do. B6 = Some students have insulted me or made offensive comments about my race or skin color. B7 = I received aggressive or humiliating messages on social networking sites or WhatsApp from some students

Discussion

The main findings of this study are that female students have more EDBs and are more dissatisfied with excessive weight than male students; further, although bullying is not a predictor of body dissatisfaction, it is a predictor of increased EDB. All results are independent of the randomized group. The strength of this study is that it involved a large-scale representative sample of adolescents in a developing country and the longitudinal investigation of the relationship between EDB, body dissatisfaction, and bullying in early adolescence.

In this study, bullying was a risk factor for the development of EDB. This result corroborates the results of the systematic review by Day et al. (2021), which analyzed studies on the association between bullying and ED and concluded that, overall, intimidated adolescents are more likely to have

Table 1 Distribution of participants according to sociodemographic variables, drug use, bullying, and eating disorder behaviors (N = 5208)

	N	%	95% CI
Baseline			
Group			
Intervention	2840	54.53	[44.12; 46.82]
Control	2368	45.47	[53.18; 55.89]
City			
São Paulo	2373	45.57	[44.22; 46.92]
Fortaleza	2051	39.38	[38.06; 40.72]
Eusébio	784	15.05	[14.11; 16.05]
Sex			
Male	2576	50.06	[48.68; 51.42]
Female	2570	49.94	[48.58; 51.31]
Average age	13.23 ± 0.01		
Age (years)			
12–14	4645	91.44	[90.64; 92.18]
15–17	535	8.56	[7.82; 9.36]
ABEP score	24.75 ± 0.13		
A (45–100)	179	3.48	[3.01; 4.01]
B (29–44)	1279	24.84	[23.68; 26.04]
C (17–28)	2809	54.55	[53.19; 55.91]
D/E (1–16)	882	17.13	[16.12; 18.18]
Victim of bullying[a]			
Number of types reported (0–7)	0.91 ± 0.02		
Victim (at least one type)	2076	43.71	[42.31; 45.13]
Corporal satisfaction[b]			
Satisfied	1144	29.62	[28.20; 31.08]
Dissatisfied with low weight	1126	31.75	[20.30; 33.23]
Dissatisfied by overweight	1492	38.63	[37.11; 40.18]
Eating disorders behaviors[c]			
Number of positive behaviors (0–5)	1.51 ± 0.02		
With behaviors (from 2 yes)	2041	45.96	[44.50; 47.43]
9 months after baseline			
Corporal satisfaction[c]			
Satisfied	1038	30.93	[29.39; 32.52]
Dissatisfied with low weight	1059	31.56	[30.00; 33.15]
Dissatisfied by overweight	1259	37.51	[35.89; 39.17]
Eating disorders behaviors [c]			
Average yes answers (0–5)	1.44 ± 0.02		
With behaviors (from 2 yes)	1676	44.46	[42.88; 46.05]

ABEP Associação Brasileira de Empresas de Pesquisa, *CI* Confidence Interval

[a]Olweus Bully/Victim Questionnaire

[b] Escala de Stunkard

[c] SCOFF Questionnaire

EDs and a negative body image compared to non-victimized adolescents. However, in our study, we did not identify the same positive association for the outcome of body dissatisfaction; a possible explanation for this is that adolescents with a negative body image are more vulnerable to become victims of bullying and not the opposite [7]. In the case of EDB, a possible explanation is that victims of bullying feel very uncomfortable in the face of provocation and thus decide to practice inappropriate eating behaviors to control their weight and aspire to have their physical form idealized by the group to which they belong [41–43]. Being a victim of bullying is a stressful event and can lead to emotional problems, which in turn can increase the risk of EDs [44]. In addition, being a victim of bullying and presenting EDB might share the same etiology, such as low self-esteem and social dysfunction [7]. Thus, corroborating current literature [45, 46], our findings point to the importance of incorporating school-based interventions supporting adolescent's positive self-perceptions and providing them with life skills training to reduce bullying behaviors and EDs.

Developing skills to improve interpersonal relationships is highly relevant for improving adolescents' mental health outcomes and including these skills in multi outcome interventions, designed to promote mental health and prevent mental disorders and risk behaviors, is a valuable strategy [47]. According to the review and meta-analysis of Ttofi and Farrington. [48], the most essential components of anti-bullying programs in schools, that were associated with a decrease in bullying, were parental training, improved playground supervision, and classroom management strategies. There are several promising preventive interventions for ED risk factors, but whether this actually lower ED incidence is unclear [49]. However, prevention programs that focus on reducing bullying also decrease the frequency of EDs [50], given that the greater an adolescent's repertory of social skills, the greater their protection against the development of EDs [45].

Our study also shows that being a female student increases the odds of body dissatisfaction and EDBs; these findings are already well documented in previous literature, suggesting that women are more likely to have additional EDs than men [51–53]. This may be because women try harder to cultivate the desirable physical appearance disseminated by media because highly visible platforms are used by social media to discuss personal eating and exercise habits, weight issues, and ideal female bodies; further, comparisons with the "attractive" people are stimulated, making it difficult for women to accept their body image [54–56]. The results in this study highlight the need for special attention toward female students during ED prevention programs [56].

Table 2 Distribution of corporal satisfaction and eating disorder behaviors among participants in the follow-up according to sociodemographic variables and bullying victimization (N = 5,208)

	Corporal satisfaction							Eating disorder behaviors (score)		
	Satisfied		Dissatisfied by low weight		Dissatisfied by overweight					
	N	%	N	%	N	%	p*	mean	SD	p*
Group										
Control	454	30.7	470	31.78	555	37.53	0.957	1.42	1.23	0.590
Intervention	584	31.11	589	31.38	704	37.51		1.45	1.24	
Sex										
Male	554	33.21	600	35.97	514	30.82	< 0.001	1.18	1.16	< 0.001
Female	472	28.49	449	27.10	736	44.41		1.69	1.26	
Age										
12–14	959	30.71	980	31.38	1184	37.91	0.663	1.45	1.24	0.244
15–17	52	30.77	58	34.32	59	34.91		1.35	1.27	
SES										
A	30	28.30	32	30.19	44	41.51	0.014	1.68	1.27	0.312
B	288	33.49	238	27.67	334	38.84		1.41	1.22	
C	559	30.58	584	31.95	685	37.47		1.45	1.23	
D/E	149	28.27	198	37.57	180	34.16		1.38	1.24	
Bullying victimization										
No	588	32.81	563	31.42	641	35.77	0.005	1.22	1.14	< 0.001
Yes	362	27.72	419	32.08	525	40.20		1.76	1.29	

SD Standard deviation, *SES* socioeconomic status

*Chi-Square Test

We found that many students were absent from the classroom during the baseline collection, based on the number of students enrolled in each school. However, this loss of data due to follow-up (25%) is a common limitation of longitudinal studies [57–59]; to manage this, we used sophisticated statistical methods and estimated the values lost over the time. Furthermore, since it was an RCT, where the main objective was not to track EDs, we used a screening instrument to detect EDB. Hence, it was not possible to obtain better details of this disorder and differentiate anorexia, bulimia, and binge eating from one another, which means that important data were missed. In addition, this study involved students from only three cities in Brazil; therefore, it cannot be generalized across the country.

Specifically in Brazil, it is thought that having a slim, strong, and good-looking body is healthy. The "health

Table 3 Participant characteristics associated with corporal satisfaction (N = 5208)

	Univariate multinomial logistic regression						Multivariate multinomial logistic regression					
	Dissatisfied with low weight			Dissatisfied by overweight			Dissatisfied with low weight			Dissatisfied by overweight		
	Crude odds	95%CI	p	Crude odds	95%CI	p	Adjusted odds	95%CI	p	Adjusted odds	95%CI	p
Group												
Control	1			1			1			1		
Intervention	0.98	[0.85; 1.14]	0.828	1.00	[0.89; 1.14]	0.940	1.03	[0.87; 1.22]	0.719	0.97	[0.85; 1.11]	0.642
Sex												
Male	1			1			1			1		
Female	0.76	[0.66; 0.86]	<0.001	1.47	[1.31; 1.65]	<0.001	0.73	[0.62; 0.86]	<0.001	1.41	[1.22; 1.63]	<0.001
Age	1.00	[0.91; 1.07]	0.839	0.96	[0.90; 1.02]	0.255	0.94	[0.84; 1.05]	0.279	1.00	[0.91; 1.09]	0.947
SES	0.99	[0.99; 1.00]	0.012	1.00	[1.00; 1.01]	0.258	0.99	[0.98; 1.00]	0.067	1.00	[0.99; 1.01]	0.495
Bullying victimization	1.02	[0,96; 1.08]	0.657	1.05	[0.99; 1.10]	0.216	1.02	[0.94; 1.11]	0.573	1.02	[0.95; 1.10]	0.554
Corporal satisfaction (baseline)	8.24	[6.68; 10.16]	<0.001	3.69	[3.08; 4.43]	<0.001	8.27	[6.72; 10.18]	<0.001	3.7	[3.04; 4.39]	<0.001

CI confidence interval, *SES* socioeconomic status

discourse" is used as an excuse to perpetuate unhealthy methods in the pursuit of reaching that standard of beauty, which can mask possible cases of EDs [45, 60]. Therefore, further studies with the Latin American population are needed to better understand the cultural influences on the idealization of the body.

It is important to highlight that the findings of this study are similar to those from Western Europe or the United States, showing that bullying as a risk factor for EDBs in adolescents seems to be independent of cultural elements. Although the ideal body image differs between Latin Americans and other ethnicities (i.e., the former idealizes a "curvier" shape and higher weight than in Western countries, which might be a protective factor in adolescence), other etiological factors, genetic variations, emotion dysregulation, and the increase of childhood obesity might also play a vital part in the differences in the prevalence of EDs, when comparing Latin America to Western Europe or the United States [23].

In conclusion, our study suggests that bullying is a risk factor for developing EDBs. Interventions targeting bullying victimization could decrease the frequency of EDs. Moreover, further studies, with specific diagnoses of EDs, should be carried out to help understand the causal relationship between these clinical conditions and bullying.

Summary

The objective of this study was to investigate whether being a victim of bullying predicts body dissatisfaction and the eating disorders behaviors (EDBs among Brazilian adolescents. A cluster randomized controlled trial was used to evaluate the effectiveness of the program #Tamojunto 2.0 implemented among 5208 8th grade students selected from 73 public schools in three Brazilian cities. Data were collected in the year 2019, through an anonymous self-report questionnaire and completed at two time points (baseline and nine-month follow-up). We used factor analysis, multivariate linear regression, and multinomial logistic regression to verify whether being a victim of bullying during the baseline resulted in body dissatisfaction and EDB at the nine-month follow-up for the groups (control and intervention). Being a female student (OR 1.41; 95% CI 1.22–1.63) is a risk factor for dissatisfaction due to excessive weight when compared to male students. Being a female student ($\beta = 0.67$, 95% CI 0.56; 0.75) and being a victim of bullying ($\beta = 0.40$, 95% CI 0.35; 0.46) are predictors of having more EDB, independent of the exposure to the program. Bullying was not a predictor of body dissatisfaction. Our study suggests that bullying can act as one of a risk factor for the development of EDBs. Hence, bullying deserves attention in the school environment.

Table 4 Predictors of eating disorder behaviors among the participants (N = 5.208). All exploratory variables were collected at baseline

	Eating disorder behaviors					
	Univariate linear regression			Multivariate linear regression		
	β	95%CI	p	β	95%CI	p
Group						
Control	ref			ref		
Intervention	0.05	[− 0.04; 0.14]	0.365	0.06	[− 0.02; 0,15]	0.197
Sex						
Male	ref			ref		
Female	0.68	[0.58;0.77]	< 0.001	0.67	[0.56;0.75]	< 0.001
Age	0.01	[− 0.05;0.05]	0.943	0.03	[− 0.02;0.07]	0.364
SES	0.01	[− 0.04;0.05]	0.827	0.04	[− 0.01;0.08]	0.134
Bullying victimization	0.47	[0.41;0.52]	< 0.001	0.40	[0.35;0.46]	< 0.001
Eating disorder behaviors (Baseline)	1.22	[1.12; 1.31]	< 0.001	1.15	[1.06; 1.24]	< 0.001

CI confidence interval, *SES* socioeconomic status

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Author Contributions All authors contributed to the study conception, design, and analysis. They read and approved the final manuscript.

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Data Availability Data are available on request.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Consent to Participate Consent to participate was obtained from the schools' directors, students, and parents.

Consent for Publication The authors provide their consent to Springer to publish this work.

Ethical Approval This study was approved by the Ethics in Research Committee at the Universidade Federal de São Paulo (Protocol 2.806.30).

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