ISSN: 2998-8179

Columbia Journal of Health Sciences and Nursing

Research Article

UNDERSTANDING SELF-RATED HEALTH AMONG OVERWEIGHT AND OBESE ADOLESCENTS: A LIFESTYLE AND SOCIAL PERSPECTIVE

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Abstract

Childhood overweight and obesity present formidable global public health challenges, with far-reaching consequences for individuals and societies. These conditions are influenced by a complex interplay of genetic, non-genetic, and environmental factors. In developed nations, the prevalence of overweight among adolescents, aged 15-19, exceeds 20% for both girls and boys, with obesity affecting around 8% of this population segment. Notably, adolescents from lower socio-economic backgrounds face a higher risk of overweight and obesity compared to their peers in more affluent areas.

The consequences of childhood overweight and obesity are profound, leading to severe health issues and psychosocial complications during childhood and into adulthood. These challenges encompass behavioral and emotional difficulties, reduced socialization, stigmatization, and decreased educational attainment. Furthermore, obesity in early life can set the stage for a range of long-term health and social issues. Understanding the determinants and consequences of childhood obesity is of paramount importance for public health initiatives and interventions.

Keywords: Childhood Obesity, Adolescent Health, Socio-Economic Factors, Psychosocial Consequences, Public Health Challenges

Introduction

Starting already in childhood, overweight and obesity generate significant global public health challenges(Fleming et al., 2014; Güngör, 2014; World Health Organization, 2017).The determinants for obesity among adolescents are complex and multi factorial, as obesity is affected by both genetic and non-genetic factors in the individual, as well as environmental factors (Güngör, 2014; World Health Organization, 2017).In developed countries, the prevalence of overweight has been estimated to be over 20% among 15–19-year-old girls and boys(Fleming et al., 2014).The corresponding prevalence for obesity is about 8%. Adolescents in lower socio-economic groups are at greater risk for overweight and obesity compared to adolescents in higher socio-economic groups in high-income countries (Goisis, Sacker, & Kelly, 2016; World Health Organization, 2017).

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Childhood overweight and obesity may lead to serious health consequences(Kelsey, Zaepfel, Bjornstad, & Nadeau, 2014)and psychosocial complications, both during childhood (Svensson, Bornehag, & Janson, 2011)and later in life(Bygdell et al., 2017; Güngör, 2014; World Health Organization, 2017).Moreover, obesity early in life is correlated to behavioural and emotional difficulties(Griffiths, Dezateux, & Hill, 2011)It can also lead to poor socialization, stigmatization and reduced educational attainment(Miller, Lee, & Lumeng, 2015; Pizzi & Vroman, 2013; Rankin et al.).

Previous studies show that overweight or obese adolescents of both genders more often rate their health as poor compared to adolescents with normal weight status (Bauldry, Shanahan, Boardman, Miech, & Macmillan, 2012; Herman, Sabiston, Tremblay, & Paradis, 2014; Heshmat et al., 2015; Krause & Lampert, 2015).Self-rated health captures aspects of both mental and physical health (Breidablik, Meland, & Lydersen, 2009; Singh-Manoux et al., 2006).Moreover, among adolescents, it is related to the self-concept of health (Breidablik et al., 2009).

It is well known that lifestyle factors, such as sleeping pattern, eating habits and sedentary behaviour influence health and weight status(World Health Organization, 2017). However, studies investigating lifestyle and social factors among overweight and obese adolescents are scarce (Vaezghasemi, Lindkvist, Ivarsson, & Eurenius, 2012).

The purpose of this school-based study in a Swedish county is to investigate if self-rated health varies among adolescents by their self-reported weight status (ISO-BMI), while considering lifestyle and social vulnerability factors that influence the adolescents' life.

Methods

Study design and setting

A cross-sectional study design was used with data from a tri-annual, school-based survey, *Life and Health in Youth*, conducted by the Department of Sustainable Development in collaboration with the Centre for Clinical Research at county council of Sörmland, Sweden. The survey targets all schools in the county of Sörmland, an area socioeconomically representative of Sweden. In the beginning of 2017,the county of Sörmland had a total population of 288,097(Statistiska Centralbyrån. Statistikdatabasen [Statistics Sweden. Statistical database], 2020).The percentage of adolescents (15–19-years-old) was about the same as in Sweden as a whole (6%). However, the proportion of adolescents with foreign origin was somewhat higher in the county of Sörmland compared to Sweden as whole (23% versus 18%). The questionnaire was distributed to adolescents attending 9th grade (15–16years old) and the second year of upper secondary school (17–18-years-old), with the latter being attended by 93% of all 17–18-year-olds in Sweden.

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Data collection

Data was collected during February–March2017. School employees handed out, collected and returned the questionnaires to the Centre for Clinical Research, Sörmland. However, students and parents were informed beforehand in writing that participation was voluntary. Therefore, a completed questionnaire was regarded as the student's informed consent. No parental approval is needed for participants above the age of 15 in Sweden(Sveriges Riksdag. Lag (2003:460) om etikprövning av forskning som avser människor [Swedish Parliament. Ethical Review Act], 2003). The study was approved by the Regional Ethical Review Board, Stockholm (Dnr2017/ 709-32).

Study population

In all, 5,015 students in the county of Sörmland filled in the questionnaire. The response rate was 84% in the 9th grade and 82% in second year of upper secondary school. Of these, 167 students were excluded due to missing data regarding gender (55 students) or for not identifying themselves as girl or boy (112 students). Furthermore, 1,263students were excluded due to incomplete or missing data, mainly due to lack of information on height or weight (540), self-rated health (33), eating breakfast (100), ethnicity (72), support by mother (76), close person with substance abuse (102), and physical abuse by an adult (84).In total, the remaining 71%, consisting of 1,759 girls and 1,826 boys (N=3,585 students), were included in the study.

The questionnaire

The questionnaire included 78 questions for 9th grade and 82 questions for the second year of upper secondary school regarding various aspects of the adolescents' life, e.g., gender, lifestyle, health, social network, family relations and child abuse. The corresponding questions were identical in the two questionnaires (Sörmland County Cuncil. Liv & Hälsa ung enkäter och publikationer, 2020).The Life and Health in Youth surveys have previously been used in other research projects regarding students' health (Annerbäck, Sahlqvist, & Wingren, 2014; Annerbäck, Svedin, & Dahlström, 2018; Annerbäck, Wingren, Svedin, & Gustafsson, 2010; Kvist, Dahllöf, Svedin, & Annerbäck, 2020; Nylander, Fernell, & Tindberg, 2015; Nylander, Seidel, & Tindberg, 2014).

Measurements and definitions

The exposure in the present study was the students' ISO-BMI,(Cole, Bellizzi, Flegal, & Dietz, 2000)calculated by dividing the self-reported weight (kg) by height (in meters squared) and categorized into normal weight (ISO-BMI <25), overweight (ISO-BMI 25.0 - <30)or obesity (ISO-BMI ≥30),according to sex and estimated age as measured by the school year (Table 1).

Table1. BMI cut-off values for ISO-BMI among students by school year.

	Girls	Girls	Boys	Boys

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School year (estimated age in years)	ISO-BMI 25 (overweight)	ISO BMI 30 (obesity)	ISO-BMI 25 (overweight)	ISO BMI 30 obesity
9th grade (15.5)	24.17	29.29	23.60	28.60
Second year upper secondary school (17.5)	24.85	29.84	24.73	29.70

The outcome self-rated health was measured by the question "*How do you feel generally*?" and categorized according to the five response options into either good ("very good" or "good") or less than good self-rated health ("neither good or bad", "bad" or "very bad").Gender ("girl" or "boy") and school year ("9th grade" or "second year of upper secondary school"), being used as a proxy for age, were used as background factors.

Lifestyle factors

Eating habits were measured separately for breakfast, lunch and dinner by the questions *"How often do you have breakfast/lunch/dinner?"*And categorized as having this meal every day per week or more seldom ("4–6 days per week", "1-3 days per week" or "never"). **Sedentary behaviour** was measured by the question *"How long do you stay still after a day at school*?" and categorized into 3 hours or less ("2–3 hours" or "less than 2 hours") or4 hours or more ("4–5 hours", "6-7 hours" or "more than 7 hours"). **Sleep duration** was measured by the question *"How many hours do you usually sleep per night during weekdays?"* and was categorized into 6 hours or less ("5–6 hours" or "less than 5 hours") or 7 hours or more ("7–8 hours", "9–10 hours" or "more than 10 hours").

Social vulnerability

Ethnicity was categorized as Swedish (born in Sweden and having at least one Swedish parent) or non-Swedish (born outside of Sweden or having both parents who were born outside of Sweden).

Since family income was not assessed, the question *"Are you worried about your family's economy?"* was used as a proxy for **socio-economic stress** and categorized into yes ("yes, quite worried" or "yes, very worried") or no ("not especially worried" or "not worried at all").

Regarding **lack of social support,** two questions were used. The **support by the mother**was measured by the question *"Can you talk to your mother about things that you worry about?"* and was categorized into yes or no. The **support by a close friend** was measured by the question*"Do you have a close friend that you can talk to about everything?"* and categorized into yes ("yes, one" or "yes, several close friends") or no.

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In order to measure the stress of **having a close person with drug-related or psychiatric problems,** the adolescents were asked if they knew of a close person who had *1) substance abuse* or *2) a psychiatric disorder during the last two years* (yes or no).

Regarding different types of **child abuse, online abuse** was measured by the question *"Have you been exposed to any harassments or violations via mobile, tablet or computer during the last 12 months?"* (yes or no). **Sexual abuse** was measured by the question *"Have you been touched or been forced to touch someone else in a sexual way?"*and categorized into yes("yes, once", "yes, a few times" or "yes, many times") or no. **Physical abuse** by an adult was measured by the question "*Have you been slapped or hit by an adult?*" and categorized as yes ("yes", once "or "yes, several times") or no.

Statistical methods

Logistic regression was used to estimate the odds ratios (OR) in adjusted models with 95%confidence intervals (CI). The results were considered statistically significant for p-values<0.05 in two tailed analyses. Statistical analyses were carried out using SPSS 22.0 for Windows (SPSS Inc., Chicago, IL). The data was stratified by gender.

A *first model* was created to examine the relation between overweight/obesity and less than good self-rated health, adjusting for school year (Table 2). *The second model* was adjusted for lifestyle factors and social vulnerability, respectively (steps 1 and 2) and together (step 3). We also estimated the interaction term between lifestyle factors and social vulnerability, in order to examine multiplicative effects.

For our *third model*, two indexes were calculated, one for unhealthy lifestyle and one for social vulnerability (Table 4). This was used to assess whether the number of unhealthy lifestyle and social vulnerability factors affected the association between overweight/obesity and less than good self-rated health.

Results

Overall, overweight/obesity (ISO-BMI ≥25) was more common among boys (24%) than girls (15%).While less than good self-rated health was more often reported among girls (36%*versus* 19%) (Table 2). Almost half of the students reported not having breakfast every day. More students had lunch and dinner every day, but the proportions were lower for girls. Nearly half of the students reported sedentary behaviour for four hours or more per day, while four out of ten reported sleeping six hours or less per night. One out of ten students were worried about their family's economy, and one out of seven was either born outside of Sweden or had both parents who were born overseas. Four out of ten adolescents could not talk closely to their mother, and one in seven did not have a friend for close talks. Having a close person with psychiatric illness was common among both girls and boys (30% *versus*17%). Also, substance abuse in a close person was commonly reported, but to a lower extent.

Girls reported more online abuse and sexual abuse than boys, who in turn reported more physical abuse by an adult.

Table2. Characteristics of the study population

	Girls N (%)	Boys N (%)
	1759	1826
School year		
9th grade	938 (53%)	918 (50%)
Second year upper secondary school	821 (47%)	908 (50%)
ISO-BMI		
<25	1500 (85%)	1384 (76%)
≥25	259 (15%)	442 (24%)
Self-rated health		
Good	1135 (65%)	1473 (81%)
Less than good	624 (36%)	353 (19%)
Lifestyle factors		
Breakfast every day		
Yes	932 (53%)	1037 (57%)
No	827 (47%)	789 (43%)
Lunch every day		

Yes	1056 (60%)	1386 (76%)
No	703 (40%)	440 (24%)
Dinner every day		
Yes	1386 (79%)	1612 (88%)
No	373 (21%)	214 (12%)
Sedentary behaviour		
3 h or less/day	901 (51%)	873 848%)
4 h or more/day	858 (49%)	953 (52%)
Sleep duration		
6 h or less/day	675 (38%)	624 (34%)
7 h or more/day	1084 (62%)	1202 (66%)
Social vulnerability		
Ethnicity		
Swedish	1326 (75%)	1369 (75%)
Non-Swedish	433(24%)	457 (25%)
Economic stress		
Worries about family's economy		
No	1505 (86%)	1609 (88%)

Yes	254 (14%)	217 (12%)
Social support		
Can talk to mother		
Yes	927 (53%)	1000 (55%)
No	804 (46%)	764 (42%)
Has no mother	28 (2%)	62 (3%)
Close friend to talk to		
Yes	1537 (87%)	1549 (85%)
No	222 (13%)	277 (15%)
Illness in close person		
Substance abuse		
No	1446 (82%)	1575 (86%)
Yes	313 (18%)	251 (14%)
Psychiatric disorder		
No	1228 (70%)	1516 (83%)
Yes	531 (30%)	310 (17%)
Child abuse		
Online abuse		
No	1342 (76%)	1492 (82%)

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Yes	417 (24%)	334 (18%)
Sexual abuse		
No	1100 (63%)	1616 (89%)
Yes	659 (38%)	210 (12%)
Physical abuse by adult		
No	1543 (88%)	1525 (82%)
Yes	216 (12%)	301 (18%)

Models

In the *first model*, girls with overweight/obesity were more likely to report less than good self-rated health compared to their peers with normal weight (aOR 1.53[95% CI 1.17–1.99]) (Table 3). Also, older girls more often reported less than good self-rated health than those who were younger (aOR 1.30[95% CI 1.07–1.58]). Among boys, there was no significant effect on less than good self-rated health between those having and not having overweight/obesity (aOR0.95[95% CI 0.72–1.25]). The remaining analysis therefore focuses only on girls.

Table 3. Associations between less than good self-rated health among students by ISO-BMI and school year, per gender.

	Less than good self-rated health	
	Girls aOR (95% CI) *	Boys aOR (95% CI) *
ISO-BMI		
<25	1 (Ref.)	1 (Ref.)
≥25	1.53 (1.17–1.99)	0.95 (0.72–1.25)
School year		
9th grade	1 (Ref.)	1 (Ref.)

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Second year upper secondary school	1.30 (1.07–1.58)	1.42 (1.12–1.79)

*Adjusted for all variables in this step

In the first step of the *second model*(Table 4),with adjustments for measured lifestyle factors, girls with overweight/obesity were more likely to report less than good self-rated health compared to girls having normal weight (aOR1.36[95% CI 1.02–1.82]). In addition, all lifestyle factors were significantly related to self-reported health per se. When looking at regularity of eating habits, girls not having lunch and girls not having dinner, respectively, had an almost two-fold odds ratio for less than good self-rated health compared to girls having these meals every day (Table 3).A similar pattern was seen for sedentary behaviour for 4 hours or more after a schooldays, compared to girls being sedentary 3 hours or less per day. The strongest association was seen for sleeping habits, with an aOR of 2.11 (95% CI 1.70–2.63)for girls sleeping less than 6 hours a night compared to those sleeping 7 hours or more. School year was not included in the model because it was not significant in the relation between overweight/obesity and less than good self-rated health.

In the second step (Table 4),with adjustments for reported social vulnerabilities, girls with overweight/obesity were again significantly more likely to report less than good self-rated health compared to girls having normal weight (aORof 1.35[95% CI 1.02–1.86]). All variables measuring social vulnerability were significantly associated with less than good self-rated health, except for ethnicity. The strongest associations were seen for lack of social support particularly for not having a friend for close talks. For girls having reported physical abuse by an adult, the odds ratio for less than good self-rated health was more than two-fold compared to girls not sharing such experience. Further, girls reporting having a close person with an illness were significantly more likely to report less than good self-rated health compared to their counterparts not reporting this, both for substance abuse and for psychiatric disorder. Girls worrying about their family´s economy also had an increased odds ratio for less than good self-rated health when compared to peers not reporting this (aOR of 1.53 [95% CI 1.14–2.06]).

In a third step (Table 4), all lifestyle factors and social vulnerability variables were included in the model. With these full adjustments, the relation between overweight/obesity and less than good self-rated health was no longer statically significant.

Table 4. Associations between less than good self-rated health and ISO-BMI, lifestyle, and social vulnerability factors among adolescent girls.

	Less than good self-rated health

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	Step 1	Step 2	Step3
Lifestyle	Social vulnerability	Lifestyle and aOR (95% CI) [a]	aOR (95% CI) [a]
	Social vulnerability		
aOR (95% CI) [a]			
ISO-BMI			
<25	1 (Ref.)	1 (Ref.)	1 (Ref.)
≥25	1.36 (1.02–1.82)	1.35 (1.02–1.82)	1.27 (0.95–1.77)
Lifestyle factors			
Breakfast every day			
Yes	1 (Ref.)	1 (Ref.)	No 1.42 (1.14–1.78) n.s.
Lunch every day			
Yes	1 (Ref.)	1 (Ref.)	
No	1.91 (1.54–2.38)	1.76 (1.40–2.21)	
Dinner every day			
Yes	1 (Ref.)	1 (Ref.)	
No	1.83 (1.42–2.36)	1.72 (1.32–2.26)	
Sedentary behaviour			
3	hours or less/day	1 (Ref.)	1 (Ref.)
4	hours or more /day	1.51 (1.23–1.87)	1.39 (1.08–1.72)
Sleep duration			
7 hours or more/day	1 (Ref.)	1 (Ref.)	
6 hours or less/day	2.11 (1.70–2.63)	1.84 (1.46–2.31)	
Social vulnerability			
Ethnicity			
Swedish	1 (Ref.)	1 (Ref.)	Non-Swedish n.s. n.s.
Economic stress			
Worries about family's economy			
No	1 (Ref.)	1 (Ref.)	
Yes	1.53 (1.14–2.06)	1.42 (1.05–1.93)	

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Social support		
Can talk to mother		
Yes	1 (Ref.)	1 (Ref.)
No	2.08 (1.69–2.56)	1,79 (1.45–2.22)
Close friend to talk to		
Yes	1 (Ref.)	1 (Ref.)
No	2.35 (1.72–3.21)	2.32 (1.64–3.20)
Illness in close person		
Substance abuse		
No	1 (Ref.)	1 (Ref.)
Yes	1.47 (1.10–1.97)	n.s.
Psychiatric disorder		
No	1 (Ref.)	1 (Ref.)
Yes	1.83 (1.44–2.33)	1.93 (1.52–2.45)
Child abuse		
Online abuse		
No	1 (Ref.)	1 (Ref.)
Yes	1.57 (1.21–2.03)	1.42 (1.09–1.86)
Sexual abuse		
No	1 (Ref.)	1 (Ref.)
Yes	1.52 (1.20–1.19)	1.45 (1.15–1.85)
Physical abuse by adult		
No	1 (Ref.)	1 (Ref.)
Yes	2.25 (1.62–3.14)	2.03 (1.45–2.86)

[a] adjusted for all other variables in the Step. In Step 3, only statistically significant variables are included in the model.

n.s.= non-significant

Indexes on unhealthy lifestyle and social vulnerability

In our *third model* (Table 5), indexes by number of unhealthy lifestyle factors (step 1) and number of social vulnerability variables (step 2) were analyzed, respectively. In both steps, girls with overweight/obesity had significantly elevated odds ratios for less than good self-rated health of the same magnitude (aOR1.37–1.39) compared to girls with normal weight. The odds ratio increased by number of factors in the unhealthy lifestyle

index, from 2.03 (95% CI 1.36–2.96) for one factor to 10.15 (95% CI 6.77–15.23) for four-five factors. The odds ratio increased in a similar fashion for the social vulnerability index, thus ranging from 2.08 to 19.03 (Table 5). In the third step (Table 5), with full adjustments for both indexes, the association between overweight/obesity and less than good self-rated health was no longer statistically significant. With full adjustments for the social vulnerability index, the association between unhealthy lifestyle index (all levels) and less than good self-rated health decreased. Correspondingly, the strong association between a high social vulnerability index (6–7 factors) and less than good self-rated health decreased when adjusted for both ISO-BMI and the unhealthy lifestyle index. The interaction term between unhealthy lifestyle and social vulnerability was statistically significant, indicating that there are multiplicative effects of these on less than good self-rated health among girls.

Table 5. Associations between less than good self-rated health by ISO-BMI and different indexes, among adolescent girls.

	Less than good self-rated health aOR (95% CI) a		
	Step 1 Index	Step 2 Index	Step 3 Index
Unhealthy lifestyle*		Social vulnerability**	Unhealthy lifestyle and Social vulnerability***
ISO-BMI			
<25	1 (Ref.)	1 (Ref.)	1 (Ref.)
≥25	1.37 (1.02–1.82)	1.39(1.04–1.87)	1.28 (0.94–1.74)
Unhealthy lifestyle			
0	1 (Ref.)	1 (Ref.)	
1	2.03 (1.36–2.96)	1.83 (1.22–2.75)	
2	2.72 (1.85–4.00)	2.36(1.49–3.36)	
3	6.84 (4.65–10.05)	4.60 (3.07–6.91)	
4–5	10.15 (6.77–15.23)	6.07 (3.95–9.34)	
Social vulnerability			
0	1 (Ref.)	1 (Ref.)	
1	2.08 (1.96–4.06)	2.56 (1.76–3.76)	
2	4.17 (2.88–6.04)	3.46 (2.37–5.07)	
3	7.32 (4.96–10.82)	5.24 (3.05–7.86)	
4–5	19.03 (12.39–29.30)	12.47 (8.00–19.44)	
6–7	28.32(10.97–73.12)	16.98 (6.32–45.65)	

[a] adjusted for all other variables in the Step

*Not having breakfast, lunch or dinner daily, sleep duration <6 hours per night and sedentary behaviour >4 hours per day after a day at school.

** Worries about the family's economy, cannot talk to mother, cannot talk to a close friend, psychiatric disorder in related person, online abuse, sexual abuse or physical abuse by adult.

Analysis on missing data showed that girls were less likely to report length and weight than boys(Pearson's Chisquare=0.00). This difference between genders was not evident for the question about self-rated health. Even though the relation between ISO-BMI ≥25 and less than good self-rated health was not significant among boys, the results from *models 1–3*among boys followed a similar pattern as that among girls.

Discussion

The present study shows that there is an association between overweight/obesity in adolescent girls and less than good self-rated health, in accordance with other studies (Krause & Lampert, 2015). Secondly, it shows that self reported unhealthy lifestyle and social vulnerability influence the relation between overweight/obesity and less than good self-rated health among adolescent girls. The association between overweight/obesity and less than good self-rated health was not observed among the boys.

Unhealthy lifestyle

Regarding the impact of lifestyle factors, our results show that several unhealthy lifestyle factors were intertwined with less than good self-rated health in girls with overweight/obesity. This was noted for girls reporting not having lunch and dinner, compared to girls having these meals every day.

This is in line with previous research, concluding that students with healthy eating habits have higher self-rated health and quality of life(Ellison, Bergmark, & Blomdahl, 2018).

Similarly, we found that girls having overweight/obesity and reporting less than 6 hours of sleep per night had almost two-fold increased odds ratio for less than good self-rated health compared to their counterparts reporting sleeping more. This finding is in accordance with a large systematic review, concluding that shorter sleep duration was associated with worse health outcomes, such as higher adiposity indicators, poorer emotional regulation, poorer academic achievement and poorer quality of life/well-being among children and adolescents(Chaput et al., 2016).

Furthermore, girls in the present study reporting more than 4 hours per day of sedentary behaviour after school hours were significantly more likely to rate their health as less than good, compared to girls reporting less sedentary behaviour. This finding is in agreement with another large systematic review, showing that increasing duration/frequency of sedentary behaviour, was associated with unfavourable body composition, lower fitness, unfavourable social behaviour and lower self-esteem, among 5 to 17-year-olds(Carson et al., 2016).

Our modelling of an unhealthy lifestyle index further shows that the odds for less than good self-rated health in girls with overweight/obesity increases by exposed number of unhealthy lifestyle factors.

It has been suggested that interventions prioritizing several modifiable health factors such as diet, sleep duration and physical activity may achieve a greater effect than single factor interventions, regarding self-rated health among students (Craig et al., 2018).

Social vulnerability

In the present study, we found that different kinds of social vulnerability play an important role among girls with overweight/obesity, influencing their self-rated health. Two-fold increased odds ratios was observed for girls not being able to have close talks with a mother and if not having a friend for close talks. This is congruent with previous findings that having close relations with friends and parents is an important source of social support among adolescents with obesity (Herzer, Zeller, Rausch, & Modi, 2011).

A similar association was seen between having reported child abuse by an adult and less than goodself-rated health. Experiencing physical abuse in childhood seems to have strong adverse effects on self-related health and quality of life in children and adolescents (Annerbäck et al., 2014; Craig et al., 2018; Jernbro, Tindberg, Lucas, & Janson, 2015).However, this association is complex, since obesity seems to increase the risk of child maltreatment (Svensson et al., 2011).

Reporting worries about the family's economy was found to be another risk factor for less than good self-rated health among girls with overweight/obesity in the present study. The finding is in accordance with previous research, showing a strong association between overweight/obesity and less than good self-rated health in girls living with poorer socio-economic conditions (Krause & Lampert, 2015).

The modelling of a social vulnerability index shows that the odds for less than good self-rated health increased by the number of non-favourable factors that one is exposed to. In the final modelling with both unhealthy lifestyle and social vulnerability, the significant association between overweight/obesity and less than good self-rated health disappeared. However, the independent and dose-response associations between less than good self-rated health and unhealthy lifestyle factors and social vulnerabilities, respectively, remained.

Our results highlight the intriguing task to promote a healthy lifestyle and good psychosocial conditions for adolescents. In order to obtain the best achievable self-rated health in adolescent girls, primary prevention of overweight/obesity appears to be important. In the secondary prevention of overweight/obese girls, taking both lifestyle and psychosocial aspects of adolescence into account might be a crucial key to improve perceived health. In the clinic, a more holistic approach should be recommended, by listening to and involving the young woman in the care,(United Nations, 1989) by taking a structured psychosocial history developed and validated for adolescents (called HEADS)(Smith & McGuinness, 2017) and by working in an interdisciplinary manner when

aiming at weight loss(Craig et al., 2018; Herzer et al., 2011).Further research is called for since age-specific recommendations are needed, based on objective measures of lifestyle factors such as sleep pattern and duration, sedentary behaviour and body composition (Carson et al., 2016; Chaput et al., 2016).

The boys

Our finding that boys have a higher prevalence of overweight/obesity than girls have previously been shown in Sweden (Vaezghasemi et al., 2012).However, the association between obesity and low self-rated health among boys is unclear. Some previous studies, however, found an association (Herman et al., 2014; Krause & Lampert, 2015).Nonetheless, we can only speculate about the non-existing relation between a lower self-rated health and overweight/obesity among boys. However, the difference among boys and girls regarding overweight/obesity and less than good self-rated health inconsistent with a previous Swedish study(Vaezghasemi et al., 2012).The difference between gender in overweight/obesity also seen for the adult population in the county of Sörmland (Sörmland County Council. Hälsan i Södermanland, 2019).The social norms may have shifted, towards an acceptance of increased body weight, particularly among men(Burke, Heiland, & Nadler, 2010).

Strengths and limitations

One limitation of the study was the missing data on body weight and length. We can only speculate on any direction of selection-bias due to missing data, which may lead to an underestimation of any associations (Huang & Lee, 2015).Another limitation was the self-reported data, however, being the only feasible strategy for a large scale school-based survey. Self-reported sleep duration is known to overestimate actual sleep time (Chaput et al., 2016). On the other hand, adolescents tend to underestimate sedentary behaviour.(Affuso et al., 2011)For regular eating habits, we can only speculate on any direction of bias.

Strength of the study, was the large study size including 1,759 girls, enabling analysis on the associations between overweight/obesity and self-rated health. Also, the students were able to anonymously answer the questionnaire, including “sensitive” questions such as economic stress and various kinds of child abuse. However, the worse outcomes of the sensitive questions may have been left out, possibly leading to selection-bias and thus an underestimation of the noted association (Huang & Lee, 2015).

Finally, the population-based study design may allow generalization to Swedish girls and, with some caution, to other similar populations.

Conclusions

In conclusion, our data show that girls with overweight/obesity are at increased risk for less than good self-rated health. Among girls, both unhealthy lifestyle and social vulnerability influence the relation between overweight/obesity and less than good self-rated health. A supporting approach, including both lifestyle and psychosocial aspects is needed at all levels of healthcare, school and at leisure. Safeguarding adequate sleep

duration and strengthening supportive factors such as having a close friend or parent to talk to might increase the self-rated health among girls with obesity.

Funding

Sanna Tiikkaja and Ylva Tindberg received funding for this study from Centre for Clinical Research Sörmland, Uppsala University.

Acknowledgements

We thank Nicklas Pihlström at Centre for Clinical Research Sörmland for statistical advice.

Conflicts of interest

The authors declare that there is no conflict of interest.

References

Affuso, O., Stevens, J., Catellier, D., McMurray, R. G., Ward, D. S., Lytle, L., . . . Young, D. R. (2011). Validity of self-reported leisure-time sedentary behavior in adolescents. *Journal of Negative Results in BioMedicine, 10*(1), 2. doi:10.1186/1477-5751-10-2

Annerbäck, E. M., Sahlqvist, L., & Wingren, G. (2014). A cross-sectional study of victimization of bullying among schoolchildren in Sweden: background factors and self-reported health complaints. *Scand J Public Health, 42*(3), 270-277. doi:10.1177/1403494813514142

Annerbäck, E. M., Svedin, C. G., & Dahlström, Ö. (2018). Child physical abuse: factors influencing the associations between self-reported exposure and self-reported health problems: a cross-sectional study. *Child Adolesc Psychiatry Ment Health, 12*, 38. doi:10.1186/s13034-018-0244-1

Annerbäck, E. M., Wingren, G., Svedin, C. G., & Gustafsson, P. A. (2010). Prevalence and characteristics of child physical abuse in Sweden - findings from a population-based youth survey. *Acta Paediatr, 99*(8), 12291236. doi:10.1111/j.1651-2227.2010.01792.x

Bauldry, S., Shanahan, M. J., Boardman, J. D., Miech, R. A., & Macmillan, R. (2012). A life course model of selfrated health through adolescence and young adulthood. *Social science & medicine (1982), 75*(7), 1311-1320. doi:10.1016/j.socscimed.2012.05.017

Breidablik, H. J., Meland, E., & Lydersen, S. (2009). Self-rated health during adolescence: stability and predictors of change (Young-HUNT study, Norway). *Eur J Public Health, 19*(1), 73-78. doi:10.1093/eurpub/ckn111

Burke, M. A., Heiland, F. W., & Nadler, C. M. (2010). From "overweight" to "about right": evidence of a generational shift in body weight norms. *Obesity (Silver Spring), 18*(6), 1226-1234.

doi:10.1038/oby.2009.369

Bygdell, M., Ohlsson, C., Célind, J., Saternus, J., Sondén, A., & Kindblom, J. M. (2017). The rise and the recent decline of childhood obesity in Swedish boys: the BEST cohort. *Int J Obes (Lond), 41*(5), 807-812. doi:10.1038/ijo.2017.23

Carson, V., Hunter, S., Kuzik, N., Gray, C. E., Poitras, V. J., Chaput, J. P., . . . Tremblay, M. S. (2016). Systematic review of sedentary behaviour and health indicators in school-aged children and youth: an update. *Appl Physiol Nutr Metab, 41*(6 Suppl 3), S240-265. doi:10.1139/apnm-2015-0630

Chaput, J. P., Gray, C. E., Poitras, V. J., Carson, V., Gruber, R., Olds, T., . . . Tremblay, M. S. (2016). Systematic review of the relationships between sleep duration and health indicators in school-aged children and youth. *Appl Physiol Nutr Metab, 41*(6 Suppl 3), S266-282. doi:10.1139/apnm-2015-0627

Cole, T. J., Bellizzi, M. C., Flegal, K. M., & Dietz, W. H. (2000). Establishing a standard definition for child overweight and obesity worldwide: international survey. *Bmj, 320*(7244), 1240-1243.

doi:10.1136/bmj.320.7244.1240

Craig, B. A., Morton, D. P., Morey, P. J., Kent, L. M., Gane, A. B., Butler, T. L., . . . Price, K. R. (2018). The association between self-rated health and social environments, health behaviors and health outcomes: a structural equation analysis. *BMC Public Health, 18*(1), 440. doi:10.1186/s12889-018-5323-y

Elofsson, S., Bergmark, K., & Blomdahl, U. (2018). *Matvanor och hälsa. En rapport från Ung livsstil Malmö.*In.

Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., Mullany, E. C., . . . Gakidou, E. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 19802013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet, 384*(9945), 766-781. doi:10.1016/s0140-6736(14)60460-8

Goisis, A., Sacker, A., & Kelly, Y. (2016). Why are poorer children at higher risk of obesity and overweight? A UK cohort study. *Eur J Public Health, 26*(1), 7-13. doi:10.1093/eurpub/ckv219

Griffiths, L. J., Dezateux, C., & Hill, A. (2011). Is obesity associated with emotional and behavioural problems in children? Findings from the Millennium Cohort Study. *Int J Pediatr Obes, 6*(2-2), e423-432. doi:10.3109/17477166.2010.526221

Güngör, N. K. (2014). Overweight and obesity in children and adolescents. *J Clin Res Pediatr Endocrinol, 6*(3), 129143. doi:10.4274/Jcrpe.1471

Herman, K. M., Sabiston, C. M., Tremblay, A., & Paradis, G. (2014). Self-rated health in children at risk for obesity: associations of physical activity, sedentary behaviour, and BMI. *J Phys Act Health, 11*(3), 543-552. doi:10.1123/jpah.2012-0124

Herzer, M., Zeller, M. H., Rausch, J. R., & Modi, A. C. (2011). Perceived social support and its association with obesity-specific health-related quality of life. *J Dev Behav Pediatr, 32*(3), 188-195. doi:10.1097/DBP.0b013e318208f576

Heshmat, R., Kelishadi, R., Motamed-Gorji, N., Motlagh, M. E., Ardalan, G., Arifirad, T., . . . Qorbani, M. (2015). Association between body mass index and perceived weight status with self-rated health and life satisfaction in Iranian children and adolescents: the CASPIAN-III study. *Qual Life Res, 24*(1), 263-272. doi:10.1007/s11136-014-0757-x

Huang, T. H., & Lee, W. C. (2015). Bounding formulas for selection bias. *Am J Epidemiol, 182*(10), 868-872. doi:10.1093/aje/kwv130

Jernbro, C., Tindberg, Y., Lucas, S., & Janson, S. (2015). Quality of life among Swedish school children who experienced multitype child maltreatment. *Acta Paediatr, 104*(3), 320-325. doi:10.1111/apa.12873

Kelsey, M. M., Zaepfel, A., Bjornstad, P., & Nadeau, K. J. (2014). Age-related consequences of childhood obesity. *Gerontology, 60*(3), 222-228. doi:10.1159/000356023

Krause, L., & Lampert, T. (2015). Relation between overweight/obesity and self-rated health among adolescents in Germany. Do socio-economic status and type of school have an impact on that relation? *Int J Environ Res Public Health, 12*(2), 2262-2276. doi:10.3390/ijerph120202262

Kvist, T., Dahllöf, G., Svedin, C. G., & Annerbäck, E. M. (2020). Child physical abuse, declining trend in prevalence over 10 years in Sweden. *Acta Paediatr, 109*(7), 1400-1408. doi:10.1111/apa.15215

Miller, A. L., Lee, H. J., & Lumeng, J. C. (2015). Obesity-associated biomarkers and executive function in children. *Pediatr Res, 77*(1-2), 143-147. doi:10.1038/pr.2014.158

Nylander, C., Fernell, E., & Tindberg, Y. (2015). Chronic conditions and coexisting ADHD-a complicated combination in adolescents. *Eur J Pediatr, 174*(9), 1209-1215. doi:10.1007/s00431-015-2521-9

Nylander, C., Seidel, C., & Tindberg, Y. (2014). The triply troubled teenager--chronic conditions associated with fewer protective factors and clustered risk behaviours. *Acta Paediatr, 103*(2), 194-200. doi:10.1111/apa.12461

Pizzi, M. A., & Vroman, K. (2013). Childhood obesity: effects on children's participation, mental health, and psychosocial development. *Occup Ther Health Care, 27*(2), 99-112. doi:10.3109/07380577.2013.784839

Rankin, J., Matthews, L., Cobley, S., Han, A., Sanders, R., Wiltshire, H. D., & Baker, J. S. (2016). Psychological consequences of childhood obesity: psychiatric comorbidity and prevention. *Adolesc Health Med Ther, 7*, 125-146. doi:10.2147/ahmt.S101631

Singh-Manoux, A., Martikainen, P., Ferrie, J., Zins, M., Marmot, M., & Goldberg, M. (2006). What does self-rated health measure? Results from the British Whitehall II and French Gazel cohort studies. *J Epidemiol Community Health, 60*(4), 364-372. doi:10.1136/jech.2005.039883

Smith, G. L., & McGuinness, T. M. (2017). Adolescent Psychosocial Assessment: The HEEADSSS. *J Psychosoc Nurs Ment Health Serv, 55*(5), 24-27. doi:10.3928/02793695-20170420-03

Statistiska Centralbyrån. Statistikdatabasen [Statistics Sweden. Statistical database]. (2020). [Online] http://www.statistikdatabasen.scb.se/pxweb/sv/ssd/?rxid=77e05e7e-6c1f-42f5-bf1b-9729749e67ab (March 04, 2020)

Svensson, B., Bornehag, C. G., & Janson, S. (2011). Chronic conditions in children increase the risk for physical abuse - but vary with socio-economic circumstances. *Acta Paediatr*, *100*(3), 407-412. doi:10.1111/j.16512227.2010.02029.x

Sveriges Riksdag. Lag (2003:460) om etikprövning av forskning som avser människor [Swedish Parliament. Ethical

Review Act]. (2003).[Online] http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Lag-2003460-ometikprovning_sfs-2003-460/(March 04, 2020)

Sörmland County Council, (2019), Hälsan i Södermanland.[Online]

Available:https://samverkan.regionsormland.se/utveckling-och-samarbete/statistik/halsan-isodermanland/(August 10, 2020)

Sörmland County Cuncil, (2020), Liv & Hälsa ung enkäter och publikationer. [Online] Available: https://samverkan.regionsormland.se/utveckling-ochsamarbete/statistik/folkhalsoundersokningar/liv-och-halsa-ung-2020/liv--halsa-ung/. (September 14, 2019) United Nations. (1989) Convention on the Rights of the Child: text of the draft convention as adopted by the Working Group at second reading. In. New York.

Vaezghasemi, M., Lindkvist, M., Ivarsson, A., & Eurenius, E. (2012). Overweight and lifestyle among 13-15 year olds: a cross-sectional study in northern Sweden. *Scand J Public Health*, *40*(3), 221-228. doi:10.1177/1403494812443603

World Health Organization, (2017),Report of the commission on ending childhood obesity. [Online] Available:https://apps.who.int/iris/bitstream/handle/10665/259349/WHO-NMH-PND-ECHO-17.1eng.pdf?sequence=1 (September 04, 2020)