

Developmental Trends in Eating Self-Regulation and Dietary Intake in Adolescents

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Background: Research suggests that while capacities for self-regulation gradually improve during adolescence, eating habits become unhealthier. This study investigated whether there are age-related patterns in using self-regulation strategies (SRS) as well as in the self-reported dietary intake of fruit, vegetables, and unhealthy snacks. Moreover, we tested the strength of the relationship between different SRS (aimed at goal versus aimed at temptations) and dietary intake across different ages in adolescents. **Methods:** In total, 11,392 adolescents (49.5% boys, age range 10–17) from nine European countries took part at this study. Eating SRS, daily intake of fruit, vegetables, and unhealthy snacks were assessed. **Results:** Older adolescents had lower scores on self-regulation measures compared to younger ones, as well as lower intakes of fruit and vegetables and higher intakes of unhealthy snacks. The strength of the associations between strategies aimed at goal and unhealthy dietary intake, as well as between strategies aimed at temptation and healthy dietary intake, were generally small and/or insignificant. There were small age differences in the direction and strength of these patterns. **Conclusion:** The trends in SRS and dietary intake of fruit, vegetables and unhealthy snacks suggest that middle (13–15-years-old) but also older adolescents might benefit greatly from interventions focused on boosting eating SRS.

Keywords: adolescents, development, dietary intake, self-regulation strategies

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INTRODUCTION

Adolescence is a period of marked transformations in a youngster's life (pubertal changes, increased influence of peer group, cognitive and emotional changes) that may prove critical in setting lifestyle trajectories with implications for adult health. Among these, unhealthy eating plays a major role, as it is predictive for long-term eating habits and further unhealthy weight gain (Whitaker, Wright, Pepe, Seidel, & Dietz, 1997), as well as for a heightened risk for diabetes melitus, cardiovascular disease, or certain types of cancer (Tirosh et al., 2011).

One of the best predictors of accomplishing healthy eating goals in adolescents is the use of self-regulation strategies (SRS) (Kalavana, Maes, & De Gucht, 2010). When compromised, these strategies increase the pace and the amount of weight gain from childhood to adolescence (Francis & Susman, 2009). From a self-regulation perspective, unhealthy eating can be framed in terms of a conflict between immediate urges on one hand, and long-term reasoned plans and standards on the other (e.g. Baumeister & Heatherton, 1996; Carver, 2005; Vohs & Baumeister, 2004). Enhanced by key changes in brain development (maturation of prefrontal cortex) and in the micro-environment (growing influence of peer group, transition through different school structures) as well as by social pressure for selecting and reaching personal goals, self-regulation gradually improves between lower-end adolescence (11–12 years old) and the upper end (17–18 years old) (Gestsdottir & Lerner, 2008; Steinberg et al., 2008).

Although SRS refine during adolescence, dietary habits become unhealthier. The prevalence of daily fruit consumption decreases in both genders, from 42 per cent in 11-year-olds, down to 31 per cent in 15-year-old European adolescents. The reverse effect is evident for daily soft-drink consumption, with a steady increase in the same age interval and significant age differences in most of the 39 European countries involved in the Health Behavior in School-Aged Children (HBSC) study (Currie et al., 2012). These are disconcerting results, as research shows that better self-regulation translates into healthier eating patterns in adolescents (Junger & Van Kampen, 2010; Kalavana et al., 2010). Also, it is associated with decreases in body mass index (BMI) in the transition from childhood to adolescence (Duckworth, Tsukayama, & Geier, 2010) and to less sensitivity to food rewards (Bourget & White, 1984; Geller, Keane, & Scheirer, 1981; Nederkoorn, Braet, Van Eijs, Tanghe, & Jansen, 2006).

One explanation for these paradoxical patterns suggests that, while resources for self-regulation increase with age, that is not necessarily true for their *intentional* use. Older adolescents may be less inclined to actively control their eating compared to their younger counterparts, although they are well aware of the benefits of healthy eating (Crăciun, Tăut, & Băban, 2012; Stok,

De Vet, De Ridder, & De Wit, 2012). Although there are few data on the extent of the use of intentional eating self-regulation in adolescence and its effects on dietary intake, even less is known about whether eating self-regulation is stable or, rather, changes over time. If eating tends to become less healthy, then we might assume that intentional use of eating self-regulation also decreases with age. Research converges on this hypothesis in different self-regulation domains, showing steady declines in intentional self-control from childhood to adolescence in selection, optimisation, and compensation (SOC) self-regulatory strategies (Bowers et al., 2011); declines in the self-regulated learning and grades (Simmons & Blyth, 1987) or in self-efficacy beliefs (Urda & Midgley, 2003). Building on these findings, the present study investigates whether more pronounced unhealthy eating in older adolescents is also increased by decreased rates of intentional eating self-regulation.

Also, the strength and the association of SRS and dietary intake may vary across younger compared to older adolescents. Self-regulatory success equally depends on the effectiveness of both *temptation-focused strategies*, aimed at decreasing the appeal of immediate urges, and *goal-focused strategies* used for boosting goal attainment, both of which can be broken down into behavioral actions and changing the psychological meaning (Fishbach & Converse, 2011; Fishbach, & Trope, 2005; Trope & Fishbach, 2000). Research findings suggest that different SRS may have asymmetrical effects over eating, i.e. temptation-focused strategies are more efficient in overcoming immediate unhealthy temptations while goal-related strategies are more effective in the long-term aligning of behavior with self-set standards (healthy eating). Thus, goal-directed strategies such as planning are efficient in promoting healthy eating, like fruit and vegetable consumption (Adriaanse, De Ridder, & De Wit, 2009) but may not be as efficient in reducing unhealthy eating (e.g. Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011). Moreover, they may even have ironic effects by strengthening the undesirable habit (e.g. Adriaanse, van Oosten, De Ridder, De Wit, & Evers, 2011). On the contrary, temptation-focused strategies—thinking about something else (changing the psychological meaning) or thinking about the food temptation more abstractly—have proved beneficial in delaying gratification in children (Mischel, 1996; Metcalfe & Mischel, 1999) and have been associated with lower intake of unhealthy snacks and soft drinks in adolescents (Luszczynska et al., 2013). Given that with age, adolescents gain more control over their food choices and are more exposed to obesogenic stimuli (Hill, 2002), the self-regulation challenges they have to tackle are different from those encountered by their younger counterparts. Hence, older adolescents have more occasions to use SRS aimed at managing unhealthy temptations and at ensuring goal striving as well. However, they may also be more prone to act on impulse (Steinberg et al., 2008) and thus probably try to inhibit these

unwanted impulses if they interfere with the healthy eating goal. Here, this would translate into a stronger relationship between strategies aimed at temptations and healthy snacking habits. Hence, a meaningful step forward would be to investigate the strength of the association between self-regulation and dietary habits at different stages of development (ages).

Starting from these theoretical premises, the aims of the present study were twofold: (a) to assess the age-related dynamics in the use of eating self-regulation and in the intake of fruit, vegetables, and unhealthy snacks; and (b) to assess the extent to which the strength and the direction of the relationships between eating SRS and dietary intake of fruits, vegetables, and unhealthy snacks vary across ages.

METHODS

Study Participants and Procedure

A sample comprising 11,392 adolescents (49.5% males) from nine European countries was recruited for the study, as part of a larger cross-country collaborative project involving Belgium ($n = 1,134$; 54.7% males), Denmark ($n = 1,165$; 50.1% males), Finland ($n = 1,157$; 48% males), Germany ($n = 1,397$; 48.7% males), the Netherlands ($n = 1,274$; 53.6% males), Poland ($n = 1,445$; 43.5% males), Portugal ($n = 1,189$; 48.4% males), Romania ($n = 1,401$; 48.8% males), and the United Kingdom ($n = 1,230$; 51.2% males). Schools were selected based on their availability to participate. However, the selection of schools was made in order to cover different regions (rural and urban) as well as more affluent and poorer areas. Adolescents were aged 10 to 17 ($M = 13.21$, $SD = 2.00$). More details regarding the sample and the study procedure can be found in De Vet et al. (2014).

The research was conducted in accordance with the ethical regulations in each country and with the approval of country-specific ethical boards. Informed consent regarding participation in the study was obtained from all participants prior to data collection. The questions were originally developed in English and country-language versions were obtained by translating the items by researchers fluent in English with input from native English speakers. Finally, the items were back-translated into English.

Measures

Self-Reported Snacking. Unhealthy snacking was taken as a proxy for unhealthy dietary intake and daily fruit and vegetable consumption as a measure of healthy dietary intake. Studies show that increased fruit consumption (Alinia, Hels, & Tetens, 2009) as well as increased vegetable intake (te Velde, Twisk, & Brug, 2007) are associated with lower body weight in ado-

lescents and adults. Prototypical (un)healthy food intake was assessed with three single items tapping the average daily intake of fruit, vegetables (Johnson, Wardle, & Griffith, 2002), and unhealthy snacks (Lally, Bartle, & Wardle, 2011). In order to assess unhealthy snacking more reliably, adolescents were prompted to count as snacks country-specific unhealthy items such as chocolate, cookies, crisps, etc. Adolescents were required to indicate their consumption on a 0 (less than 1/none) to 5 (more than 4) scale with the following items: (1) How many servings of fruit do you eat on an average day? (2) How many serving spoons of cooked or raw vegetables do you eat on an average day? (3) How many snacks do you eat on an average day? (You may count as one snack: one handful of crisps or pretzels, a handful of biscuits/winegums, one chocolate bar, etc.)

Eating SRS. The Tempest Self-Regulation Questionnaire for Eating (TESQ-E; De Vet et al., 2014) was used in order to assess eating self-regulation. The scale has 24 items, tapping on different eating SRS. TESQ-E describes three higher-order approaches subsuming lower-level ones. The first one is *action towards temptation* comprising avoidance (e.g. If I am in town, I make sure that I don't go by fast-food places) and control of temptation (e.g. If I am in front of the PC, I make sure there is some healthy food within reach). The second one is *changing the meaning of temptation* with distraction (e.g. If I have the urge to eat candy, I find something else to do) and suppression (e.g. If I want to eat unhealthy things, I just tell myself "no!"). The third one is *actions towards goal* which comprises items describing goal setting (e.g. I plan to bring a piece of fruit to school) and goal deliberation (e.g. If I feel like eating something unhealthy, I think about whether I really want it). The confirmatory factor analysis of TESQ-E ($N = 11,392$) showed that the theoretical distinction into three generic approaches addressing the goal or the temptation is statistically meaningful, $NFI = .93$, $CFI = .93$, $RMSEA = .043$, $AIC = 5530.33$.

Each of the three higher-order approaches was computed by averaging the scores on the two corresponding subscales and was subsequently used in all the analyses. The reliability was good for all three approaches: action towards goal (Cronbach's $\alpha = .84$), action towards temptation (Cronbach's $\alpha = .82$), and changing the meaning of temptation (Cronbach's $\alpha = .85$). A detailed discussion regarding the psychometric properties of TESQ-E can be found in De Vet et al. (2014). Furthermore, the TESQ-E scale is publicly available in all nine languages at <http://www.tempestproject.eu/tesq-e-questionnaires>.

Body Mass Index (BMI). BMI was computed from self-reported weight (in kilograms) and height (in centimetres). In order to establish overweight/obesity status, Cole, Bellizzi, Flegal, and Dietz (2000) cut-offs were

employed. On average, adolescents reported a $BMI = 20.01$, $SD = 2.82$. In all, 24.1 per cent of the respondents were overweight and 2.1 per cent were obese. Although the data presented are not directly comparable since they vary in terms of sampling procedures, age ranges, and the year(s) of data collection, they are similar to those reported by the International Association for the Study of Obesity (IASO) (2010), showing that 20 per cent of school-aged children in the 27 European Union member states are overweight or obese. More pronounced differences were observed with data from HBSC (Currie et al., 2012), reporting that around 14 per cent of the 11–15-year-old adolescents from the nine countries involved in the present study were overweight or obese at the time of data collection (2008/09).

Statistical Analyses

Missing data varied from 0.2 per cent (gender) to 6.5 per cent (family affluence). We estimated the missing values with linear trend at point algorithm for SPSS. MANOVA with Bonferroni corrected post-hoc analyses was used to test for age differences in using eating SRS, as well as in intake of different foods. Effect sizes were reported by using the partial η^2 which reflects the variance explained by a given variable of the variance remaining after excluding variance explained by other predictors (Levine & Hullett, 2002).

In order to test the strength of the relationship between the SRS and dietary habits across age groups, several steps were undertaken. A path model was specified in AMOS 20 (IBM Corporation, Chicago, IL) comprising direct relationships between the three eating self-regulation approaches with the three prototypical categories of food (daily fruit, vegetable, and snack intake). Before running the analyses, the intraclass correlations (ICC) at school level were calculated for all three independent variables as well as for the dependent ones, as an indicator of the possible non-independence due to clustering, by using the formula of ICC(1) provided by Bliese (2000). To test for the possible general causal model, we used the cross-validation in covariance structure modeling, by using the steps described in Byrne (2001). The hypothesised model specified the direct associations between self-regulatory approaches and intake of fruit, vegetables, and unhealthy snacks (see Figure 2). The sample was randomly split in half and the model was tested first in one subsample from the population included in the present study (calibration sample). The exogenous variables, as well as the endogenous ones, were assumed to be correlated and the error covariances were specified. This model was tested against an alternative, nonrecursive model (specifying relationships in both directions) first in the calibration sample (subsample 1) and further in a validation sample (subsample 2). Model–data fit was assessed based on fit indices such as the Tucker–Lewis Index (TLI), Comparative Fit Index (CFI), Normed Fit Index (NFI) and Root Mean

Square Error of Approximation (RMSEA). In general, models with fit indices $> .90$ and a RMSEA $< .05$ indicate a good fit (Byrne, 2001). The comparative fit of these models was assessed by using chi-square difference tests. Finally, in order to test for possible age differences in the strength of associations between SRS and dietary intake of fruit, vegetables, and unhealthy snacks, a multiple group analysis was conducted with age categories in the 10–17-year-old interval as moderator. Critical ratios for differences of regression weights (z -scores) were used to identify significant differences between groups on each path of interest, greater than 1.96 for 95 per cent CI, and greater than 2.58 for 99 per cent CI.

RESULTS

Descriptive Statistics

The intercorrelations between self-regulation approaches as well as their correlations with self-reported fruit, vegetable, and unhealthy snack intake are presented elsewhere (De Vet et al., 2014). Since BMI had non-significant or very weak associations with self-regulation and dietary intake (all r s $< .04$, all p s $> .01$), we decided to exclude it from the main analyses.

Age Differences in Eating SRS and in Dietary Intake

A MANOVA with age as between-subjects factor revealed significant effects of age on all three eating SRS: action towards goal, $F(7, 11384) = 96.75$, $p < .001$, partial $\eta^2 = .06$; action towards temptation, $F(7, 11384) = 143.61$, $p < .001$, partial $\eta^2 = .08$; changing the meaning of temptation, $F(7, 11384) = 70.69$, $p < .001$, partial $\eta^2 = .04$. Bonferroni adjusted post-hoc analyses revealed that adolescents aged 14 to 17 years old use eating SRS to a lesser extent than the 10-year-olds: action towards goal, all $M_{S_{14-17 \text{ years old}}}$ interval = [2.19; 2.35], SD s interval = [.84; .90] versus $M_{10 \text{ years old}} = 2.81$, $SD = .91$; action towards temptation, $M_{S_{14-17 \text{ years old}}}$ interval = [2.03; 2.18], SD s = [.74; .83] versus $M_{10 \text{ years old}} = 2.75$, $SD = .87$; changing the meaning of temptation, $M_{S_{14-17 \text{ years old}}}$ interval = [2.07; 2.16], SD s interval = [.79; .82] versus $M_{10 \text{ years old}} = 2.54$, $SD = .87$, all p s $< .001$.

There was also a significant effect of age on the consumption of all foods, although effect sizes show small differences across groups: fruit intake, $F(7, 11383) = 47.161$, $p < .001$, partial $\eta^2 = .03$; vegetable intake, $F(7, 11384) = 13.307$, $p < .001$, partial $\eta^2 = .008$; unhealthy snacks intake, $F(7, 11384) = 11.915$, $p < .001$, partial $\eta^2 = .007$. Post-hoc analyses with Bonferroni corrections revealed that adolescents aged 14 to 16 years reported eating healthy foods to a lesser extent compared to those aged 10–12: fruit intake, $M_{S_{14-16 \text{ years old}}} = [1.54; 1.85]$, SD s = [1.29; 1.34] versus all $M_{S_{10-12 \text{ years old}}} = [2.07; 2.23]$,

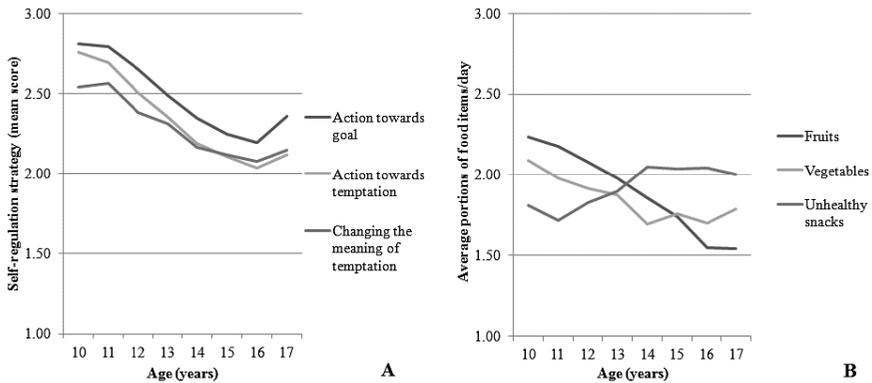


FIGURE 1. Age patterns in the use of eating SRS (Panel A, left) and in dietary intake (Panel B, right).

SDs interval = [1.25; 1.37], all $ps < .001$; vegetable intake, all Ms_{14-16} years old interval = [1.69; 1.78], *SDs* interval = [1.25; 1.32] versus all Ms_{10-12} years old interval = [1.91; 2.08], *SDs* interval = [1.38; 1.41], $ps = .001$. Unhealthy snacking had the opposite pattern showing that adolescents aged 14 to 16 years ate more unhealthy snacks compared to those aged 10 to 12: all Ms_{14-16} years old interval = [2.03; 2.04], *SDs* interval = [1.44; 1.49] versus M_{10-12} years old interval = [1.71; 1.82], *SDs* interval = [1.32; 1.40], $ps < .001$. There were significant differences between 17-year-olds and those aged 10 to 12 years old in the intake of fruit: M_{17} years old = 1.54, $SD = 1.29$, $ps < .001$, and vegetables: M_{17} years old = 1.78, $SD = 1.35$, $ps < .05$, but not for the intake of unhealthy snacks: M_{17} years old = 2.00, $SD = 1.48$, $ps < .12$. Figure 1 shows the decreasing trend of all three strategies from 10-year-old to 17-year-old adolescents (Panel A) as well as the trends in dietary intake across the same age interval (Panel B).

Group Differences in the Relationship between Self-Regulatory Strategies and Dietary Intake

Test of the Default Model. The intraclass correlation coefficients (ICC) for all the variables were between $-.011$ and $-.012$, suggesting that 1 per cent of the variance for each variable can be attributed to school clustering (Bliese, 2000).

The model-data fit was similarly good in both samples: TLI = 1.00, CFI = 1.00 and NFI = 1.00 (both samples), RMSEAs = .000 [90% CI = .000–.001], and .004 [90% CI = .000–.036], respectively, with no significant model-level differences, $\Delta\chi^2(8) = 6.26$, $p = .61$.

The alternative model (model 2) used for cross-validation had poorer model-data fit indices: TLI = .87, CFI = .97, NFI = .97, RMSEA = .092 [90%

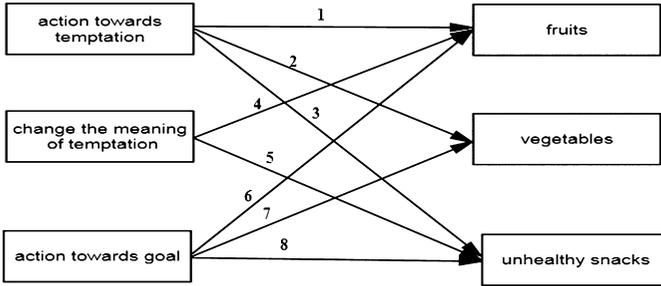


FIGURE 2. The hypothesised model of associations between eating self-regulatory strategies and dietary intake.

CI = .086–.098]. Also, it was significantly different from the hypothesised model tested in the split-half samples: $\Delta\chi^2(5) = 581.08$, $p = .001$ (alternative model versus calibration sample); $\Delta\chi^2(5) = 580.12$, $p = .001$ (alternative model versus validation sample).

Regarding the hypothesised model, the relationship between action towards goal and healthy eating was stronger (fruit: $\beta = .35$, $p < .001$; vegetables: $\beta = .16$, $p < .001$) than the relationship with unhealthy snacking ($\beta = .01$, $p = .23$). Conversely, action towards temptations was weakly related to fruit intake ($\beta = .02$, $p = .07$) and vegetable intake ($\beta = .06$, $p < .001$) and more strongly related to unhealthy snacking ($\beta = -.24$, $p < .001$). The same held true for the path from changing the meaning of temptation to eating fruit ($\beta = -.05$, $p < .001$) that was weaker than the path towards unhealthy snacking ($\beta = -.14$, $p < .001$).

Age Differences in the Relationship between Self-Regulatory Strategies and Dietary Intake

A constrained eight-group model (ages 10–17), assuming equal weights, intercepts, means, and covariances across age groups was tested, yielding good indices of model–data fit: $\chi^2(8) = 11.88$, $p = .15$, TLI = .99, CFI = .99 and NFI = .99, RMSEA = .006 [90% CI = .003–.009]. However, there was a significant difference in model fit when constraining all eight groups to be equal compared to the unconstrained model, $\Delta\chi^2(140) = 346.09$, $p < .001$, suggesting that there may be model-level differences across groups. Therefore, we analyzed possible path differences for all eight age categories involved.

Table 1 displays the beta weights for each of the paths included in the model.

The strength and directions of the paths remained fairly similar across ages. However, there were some differences in the 16- and in the 17-year-old

TABLE 1
Standardised Path Coefficients in Multiple Group Analyses for Different Age Categories

Path	Hypothesized model																
	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years									
1 Action tempt-fruits	.02	-.03	.01	-.01	-.01	.01	.03	.03									
2 Action tempt-vegetables	.12**	.05	.03	.001	.08**	.02	.13***	.13***									
3 Action tempt-snacks	-.23***	-.28***	-.28***	-.28***	-.30***	-.21***	-.16***	-.16***									
4 Change meaning tempt-fruits	-.04	.01	-.08**	-.01	-.05	-0.07	-.05	-.06**									
5 Change meaning tempt-snacks	-.14**	-.16***	-.13***	-.16***	-.12***	-.18***	-.10*	-.10***									
6 Action goal-fruits	.35***	.32***	.33***	.32***	.33***	.39***	.34***	.34***									
7 Action goal-vegetables	.16***	.18***	.18***	.19***	.09***	.17***	.06	.06									
8 Action goal-snacks	-.03	.07*	.02	.04	.02	.05	-.10**	-.10*									

Notes: * $p < .05$; ** $p < .01$; *** $p < .001$.

samples compared to the 12-, 13-, and 15-year-old ones, especially for the association between action towards temptation and self-reported consumption of vegetables, associations which were stronger in the older groups (16-year-olds) compared to the younger ones (12-year-olds). Also, the path from action towards goal and self-reported unhealthy snacking strengthened in the 16- and 17-year-old groups compared to ages 11, 12, 13, and 15. Conversely, the strength of the association between action towards goal and vegetable intake (Path 7) was weaker or non-significant in the 14- and 16-year-olds compared to the 11-, 12-, and 13-year-old groups. Nonetheless, the path from action towards temptation and unhealthy snacks became weaker in the 16- and 17-year-olds compared to the 12-, 13- and 15-year-olds (see Table 2).

DISCUSSION

The present results show that there is a steady decline in adolescents' eating self-regulation with increasing age and across all self-regulatory strategies: action towards goal, action towards temptation, and changing the meaning of temptation. This decline is more pronounced from early (10–12-year-olds) to mid-adolescence (14–16-year-olds), with a slow recovery in later adolescence (17-year-olds). The empirical literature describes a similar trend regarding the age dynamics of self-regulation in adolescence, with middle adolescents being more prone to engage in risk-taking and reckless behaviors than their younger or older counterparts (Steinberg et al., 2008). Involvement in unhealthy behaviors cannot be accounted for by lack of knowledge, ignorance, or irrationality (Reyna & Farley, 2006). This view would imply that younger adolescents would display even less eating self-regulation and unhealthier dietary habits, given the immaturity of self-control processes at this developmental stage. However, both younger and older adolescents have higher eating self-regulation scores compared to this age group, trends which are reflected in the self-reported dietary intake of different foods. Specifically, there is a steady change in fruit and vegetable consumption from 10 years old to 15 years old, with a slow recovery at 16–17 years old. The reverse pattern is evident for unhealthy snack intake which has the highest scores in middle adolescence (14 years old) and remains stable until 17 years old. These patterns are highly similar to those reported in the HBSC cohort study, showing that there is a 16 per cent drop in percentage of individuals who report having daily breakfast, an 11 per cent drop in those eating fruits daily and a 7 per cent increase in the prevalence of soft drink consumption from age 11 to 15 (Currie et al., 2012). The results can be tracked down in the empirical literature (e.g. Steinberg, 2008), which suggests that middle adolescence is a period marked by heightened vulnerability to risk-taking and reckless behavior. This is probably due to a maturational gap between the

TABLE 2
 Path Indicators of Age Differences in the Relationship between Eating Self-Regulation Approaches and Dietary Intake

	Path	10 years	11 years	12 years	13 years	14 years	15 years	16 years	17 years
1	Action tempt-fruits	na	na	na	na	na	na	na	na
2	Action tempt-vegetables	vs. 13 yrs $z = 2.25^*$	na	na	na	na	na	na	na
3	Action tempt-snacks	vs. 14 yrs $z = 2.44^*$	na	na	na	na	na	na	na
								vs. 12 yrs $z = 3.43^{**}$;	vs. 12 yrs $z = 3.43^{**}$;
								vs. 15 yrs $z = 2.25^*$	vs. 13 yrs $z = 3.50^{**}$;
									vs. 15 yrs $z = 2.55^*$
4	Change meaning tempt-fruits	na	vs. 12 yrs $z = -1.96^*$	na	na	na	na	na	na
5	Change meaning tempt-snacks	na	na	na	na	na	na	na	na
6	Action goal-fruits	na	na	na	na	na	na	na	na
7	Action goal-vegetables	na	na	na	na	vs. 12 yrs $z = -2.11^*$;	na	na	na
						vs. 13 yrs $z = -2.19^*$;		vs. 11 yrs $z = -2.43^*$;	
						vs. 16 yrs $z = -2.75^{**}$		vs. 15 yrs $z = 2.25^*$	
8	Action goal-snacks	vs. 11 yrs $z = -1.98^*$	na	na	na	na	na	na	na
								vs. 11 yrs $z = 3.02^{**}$;	vs. 15 yrs $z = -2.17^*$
								vs. 12 yrs, $z = -2.26^*$;	
								vs. 13 yrs $z = -2.57^*$;	
								vs. 15 yrs $z = -2.50^*$	

Notes: z -values correspond to the comparisons between the reference group (table header) and the group specified above the respective value.

* $p < .05$; ** $p < .01$.

Abbreviations: na = non-applicable given no significant differences between groups; vs. = versus; yrs = years.

cortical areas responsible for self-regulation (e.g. the prefrontal cortex) and those involved in emotional processing. From this point of view, we might speculate that middle adolescents “omit” to implement SRS in contexts where this would be required, although that doesn’t mean that they do not possess the abilities to regulate their behavior in accordance with external/internal demands (Stok et al., 2012). Differences in the use of eating self-regulation doubled by differences in healthy dietary intake in middle compared to early adolescence suggest that interventions aimed at developing SRS should be targeted especially to the 13–15-year-old group. Boosting self-regulation skills and prompting adolescents to use self-regulation in food-related contexts might prove helpful.

The present findings have some additional implications. First, we showed that SRS targeted at decreasing the impact of temptations are more important in avoiding unhealthy eating and are less responsible for healthy eating. Conversely, SRS involved in goal setting and goal engagement are more involved in following a healthy eating goal (e.g. eating fruit) than counteracting the food temptation (avoiding unhealthy snacks). Therefore, different self-regulatory strategies might have different roles in securing both sides of the healthy eating goal. Similar ideas are described in other studies on self-regulation. Higgins’ (1997) theory of “self-regulatory focus” suggests that people display tendencies to either avoid negative consequences associated with their acts (prevention focus) or to achieve higher-order goals (promotion focus), which trigger different self-regulatory strategies.

Next, we tested whether a model specifying the associations between self-regulatory strategies and self-reported dietary intake would be invariant across ages, or whether there are developmental differences in the strength and the directions of these associations. Our findings point to the conclusion that there is some age variance in the associations between self-regulatory strategies and eating, although the differences are rather small. Overall, goal-related actions are better related to healthy self-reported dietary intake, whereas temptation-related ones are better connected with unhealthy snacking across age groups. Hence, even though older adolescents may be less inclined to control their dietary intake, the direction and the strength of different strategies and dietary habits does not change too much with age. Older adolescents benefit to the same extent as younger ones from goal-directed self-regulation when they try to increase fruit intake. However, the connection between goal-directed self-regulation and self-reported vegetable intake becomes insignificant in later adolescence (16–17-year-olds). Conversely, the same age groups (16–17-year-olds) might be more inclined to use strategies aimed at temptation when trying to both increase vegetable intake and decrease unhealthy snack consumption compared to their younger counterparts. This may indicate that in older adolescence, unhealthy temptations might activate healthy goal representations (awareness of the need to

eat more vegetables when dealing with unhealthy snacks). Although these interpretations are speculative, they are nonetheless plausible, given that there is some research showing that unhealthy temptations might actually trigger the activation of a healthy goal (e.g. Fishbach, Friedman, & Kruglanski, 2003; Kroese, Adriaanse, Evers, & De Ridder, 2011).

The present study has some limitations. Given the cross-sectional design, causal relationships cannot be inferred from the data. Rather, these findings serve as a starting point for further studies that could longitudinally track adolescents to see whether SRS and eating habits vary across ages. The same holds true for the asymmetrical relationship between SRS and the intake of healthy versus unhealthy foods. Laboratory controlled studies as well as longitudinal ones may further explore whether indeed there is a difference in the effectiveness of using these SRS in managing unhealthy habits versus promoting healthier ones. Still, the present research provides a first insight into the matter and offers a solid starting point for future studies, as it shows that these asymmetrical relationships are rather similar across ages. Finally, self-reported daily consumption of fruit, vegetables, and unhealthy snacks is only a rough estimate of adolescents' dietary intakes. Further studies should include more valid measures of food intake such as nutritional diaries.

To conclude, this is one of the first studies to investigate age-related dynamics of eating SRS and dietary intake across different ages in adolescents. Our main finding was that the intentional use of eating self-regulation is employed to a lesser extent at older ages whereas self-reported unhealthy snack intake is reported more often. This makes it an excellent starting point for future research but also for intervention. Finally, we showed that, even though there are age differences in the intake of both healthy and unhealthy foods, the relationships between eating self-regulation and these habits is highly similar, which is again a strong basis for exciting new research in that area.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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