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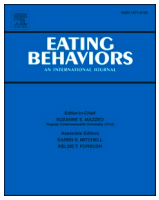

Intuitive eating and its influence on self-reported weight and eating behaviors

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ABSTRACT

Intuitive eating (IE) is an adaptive eating behavior that involves paying attention to the body's physiological signals, including eating when hungry and stopping when feeling full. A growing body of literature has examined the effect of IE on the development of maladaptive eating behaviors and body weight, even though IE is not centered around the latter. However, longitudinal observation studies among the general population are still rare. Therefore, this study aimed to longitudinally examine the links between IE and changes in body weight, maladaptive eating behaviors (reward, external, restrained eating), and overeating frequency over time. For this purpose, we used data from the first (2017) and the fourth waves (2020) of the Swiss Food Panel 2.0 survey, which included 1821 randomly selected Swiss participants. The same participants completed a self-administered questionnaire annually, measuring their self-reported eating behaviors and weight status. IE was measured with the Intuitive Eating Scale-2. Results showed that women with high IE scores were more likely to maintain their body weights (within ±2 kg) and less likely to gain weight (>2 kg) than women with low IE scores. No such effects were found for men. Furthermore, IE was linked to a reduction in maladaptive eating behaviors and overeating frequency over time in both genders. Results suggest that IE may counteract maladaptive eating behaviors, which can promote weight stability over time. Therefore, the encouragement of IE patterns seems to be a promising strategy to address problematic eating behaviors and the challenges associated with controlling food intake and prevention of overeating.

1. Introduction

For most individuals, dieting is an unsustainable approach to weight regulation (Denny et al., 2013; Hazzard et al., 2021; Tylka, 2006). Restrictive dietary behaviors decrease sensitivity to internal hunger signals and increase reliance on external cues (Denny et al., 2013; Gödde et al., 2022; Hazzard et al., 2021; Leong et al., 2016). Moreover, repeated dieting failures can lead to depression and lower self-esteem; in turn, these can cause emotional eating (Hazzard et al., 2021). Accordingly, more attention is paid to non-dieting approaches, such as intuitive eating (IE), which encourages people to eat in accordance with their bodily needs.

IE is the practice of eating based on physiological hunger and satiety cues (Tylka & Kroon Van Diest, 2013). People who have a greater tendency to engage in IE are not preoccupied with dieting; they do not distinguish between "good" and "bad" food but listen to their bodies' internal cues to determine when, what, and how much to eat (Tylka & Kroon Van Diest, 2013). According to Tylka and Kroon Van Diest (2013), IE has four dimensions. The first is "unconditional permission to eat," meaning that individuals can eat what they want when they are hungry. The second dimension, "eating for physical rather than emotional reasons," states that individuals eat to satisfy their hunger rather than to cope with emotional distress. The third dimension, "reliance on hunger and satiety cues," means that individuals trust their internal signals, eat when they feel hungry, and stop when they are full. The fourth dimension, "body-food choice congruence," indicates that individuals select nutritious foods that help their bodies function well (Tylka & Kroon Van Diest, 2013). Although IE is not centered on body weight and weight loss, and most weight-related statements have been removed from Tribole & Resch's book (Tribole & Resch, 2020), IE principles are sometimes misused in commercial weight-loss programs (e.g., intueat, 2022). However, in the scientific literature, it is not fully understood whether and how IE affects weight development. This is an important issue since the "unconditional permission to eat" aspect could raise concerns about negative weight development (Tribole, 2017; Tribole & Resch, 2020).

Most observational IE studies have focused on body mass index

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(BMI) (e.g., Horwath et al., 2019; Smith et al., 2020), eating behaviors (e.g., Gödde et al., 2022; Smith et al., 2020), and body image (e.g., Avalos & Tylka, 2006; Cardoso et al., 2020). However, the influence of IE on weight changes over time has rarely been assessed, most likely because weight does not matter when eating intuitively. Nevertheless, people with higher IE scores appear to have lower BMI values than those with lower IE scores (Linardon et al., 2021; Van Dyke & Drinkwater, 2014), and individuals with stable weights are more likely to eat intuitively than those who gain or lose weight (Tylka et al., 2020). Furthermore, women who try to lose weight experience a substantial decrease in their IE scores (Leong et al., 2016). Although IE and its principles do not focus on weight, some studies have investigated that relationship (e.g., Leong et al., 2016; Linardon et al., 2021; Tylka et al., 2020; Van Dyke & Drinkwater, 2014), but more evidence is required to determine whether and how IE and weight changes are related.

Cross-sectional studies have suggested that IE is inversely associated with maladaptive eating behaviors, such as restrained, emotional, and external eating (Bruce & Ricciardelli, 2016; Kerin et al., 2019; Linardon et al., 2021; Van Dyke & Drinkwater, 2014). While emotional eating involves eating in response to emotions (e.g., stress and reward), external eating responds to external influences (e.g., food smells), regardless of hunger or satiety (van Strien et al., 1986). Restrained eating involves restricting one's food intake, mainly for weight-loss or weight-maintenance purposes (Tuschl, 1990). Restrained, external, and emotional eating can also have an impact on weight (Neumann et al., 2018; Neumark-Sztainer et al., 2012). In fact, a common outcome of these eating behaviors is overeating, defined as eating more than a person physically needs or is comfortable with (Polivy & Herman, 2020), which, among other factors, increases the risk of weight gain (Davis, 2009; Koenders & van Strien, 2011). Emotional eaters tend to overeat as a coping mechanism when experiencing negative or positive emotions, external eaters have difficulties in resisting external food temptations, and restrained eaters are inclined to overeat when their cognitive self-control is undermined (Koenders & van Strien, 2011; Snoek et al., 2013; van Strien et al., 2009). In contrast, IE is negatively associated with overeating frequency (Horwath et al., 2019). People with higher IE scores overeat less often than those with lower IE scores, probably because they pay attention to their internal signals and stop eating when they feel full, are less prone to succumb to external influences, and might not use eating as a mechanism for coping with positive or negative emotions.

Many studies on IE have been conducted primarily with women (e.g., Bruce & Ricciardelli, 2016) and have used a cross-sectional design (e.g., Linardon et al., 2021). Other studies have employed longitudinal observation study designs (e.g., Christoph et al., 2021; Hazzard et al., 2021; Leong et al., 2016; Linardon, 2021; Messer et al., 2021, 2022), with Christoph et al. (2021) and Hazzard et al. (2021) analyzing young adults, Leong et al. (2016) selecting only 40–50-year-old women, and Messer et al. (2021, 2022) analyzing only women. Therefore, no observational study seems to have examined the longitudinal effects of IE on maladaptive eating behaviors, such as emotional, external, and restrained eating; overeating frequency, and weight changes in a population-based sample. So far, only the effects of IE on disordered eating behaviors, such as binge eating (Christoph et al., 2021; Hazzard et al., 2021; Linardon, 2021; Messer et al., 2021, 2022), and on body image (Messer et al., 2021, 2022) have been researched. Only one cross-sectional study has assessed weight changes associated with IE without an intervention (Tylka et al., 2020). Promoting the concept of IE in intervention studies has generally shown a decrease in maladaptive eating behaviors, especially restrained eating, while there have been mixed results about body weight changes (Schaefer & Magnuson, 2014). Nevertheless, longitudinal observation studies are important to investigate the impacts of IE on health indicators, including weight changes and eating behaviors, over time. Therefore, in this study, we aim to longitudinally evaluate how IE is related to weight changes, changes in maladaptive eating behaviors, and overeating frequency over a three-year period in a population-based, non-clinical sample and without any intervention.

2. Methods

2.1. Participants

This study was based on the first (T1, 2017) and fourth (T2, 2020) waves of the Swiss Food Panel 2.0, which is a population-based longitudinal study assessing eating behaviors, weight management, and their underlying psychological mechanisms among the Swiss population (e.g., Horwath et al., 2019; Sob et al., 2021). Participants were randomly selected residents of Switzerland. The same individuals completed a paper-and-pencil questionnaire for each subsequent year. The participants who did not indicate their genders or ages and those who completed <50 % of the questionnaire were excluded from the analysis ($n = 918$). Since the analyses in this study included the use of weight and weight changes, women who were pregnant during one of the years under study were excluded ($n = 444$). The participants with missing weight values ($n = 70$) and with extreme BMI values (< 16.5 kg/m^2 or ≥ 40.0 kg/m^2) were also excluded ($n = 25$) because such extreme values might indicate serious psychological conditions (Petry et al., 2008; Rajan & Menon, 2017; Rindler et al., 2023; Sarwer & Polonsky, 2016). Participants who did not answer all items related to IE ($n = 168$) were excluded, too. The final sample used in this study comprised 1821 participants. Compared to the general Swiss population (Swiss Federal Statistical Office, 2022a, 2022b, 2022c), our study sample was, on average, older (58 vs. 42 years), had higher educational levels (59 % vs. 43 %), and included more people with a normal BMI range of 18.5–24.9 kg/m^2 (57% vs. 55 %). Table 1 depicts the sociodemographic characteristics of the study sample at the baseline (T1, 2017) and at the follow-up (T2, 2020), separated by gender.

Further details about the Swiss Food Panel 2.0 are available in previous publications (e.g., Hagmann et al., 2019; Horwath et al., 2019). This study was reviewed and fully approved by the Ethics Committee of ETH Zurich (EK 2017-N-19). Implied consent was obtained.

2.2. Measures

2.2.1. Intuitive eating (IE)

IE was assessed using validated translations (Camilleri et al., 2015; Carbonneau et al., 2016; van Dyck et al., 2016) of the 23-item Intuitive

Table 1
Description of the study population ($N = 1821$), separate for men and women.

	Men ($n = 948$)		Women ($n = 873$)	
	2017	2020	2017	2020
Age [years] M (SD)	60 (14.6)	63 (14.6)	54 (15.2)	57 (15.2)
Educational Level (%)				
Low	3.7	4.2	5.8	5.2
Middle	33.1	33.0	39.7	39.7
High	63.2	62.8	54.5	55.1
BMI [kg/m^2] M (SD)	25.6 (3.4)	25.7 (3.5)	23.3 (3.7)	23.6 (3.8)
Underweight: < 18.5 kg/m^2 (%)	0.3	0.3	5.5	4.6
Normal weight: 18.5–24.9 kg/m^2 (%)	46.4	47.3	68.6	66.8
Overweight: 24.9–29.9 kg/m^2 (%)	42.6	40.2	19.7	21.2
Obese: ≥ 30.0 kg/m^2 (%)	10.6	12.3	6.3	7.3

Note. BMI: body mass index.
Educational level was split into three categories: low - no education, primary, and lower secondary school; middle - upper secondary and vocational school; high - higher secondary school, college, and university.

Eating Scale (IES-2) developed by Tylka and Kroon Van Diest (2013). All items were rated on a 5-point Likert scale and averaged to obtain a total IE score (Cronbach's $\alpha_{2017} = 0.82$, $\alpha_{2020} = 0.83$). Higher scores indicate higher levels of IE.

2.2.2. Reward eating (emotional eating) frequency

Reward eating frequency was assessed with the following three items: "When I am particularly happy, I eat more than usual." "When I want to reward myself for something good, I allow myself something to eat." "I feel the need to eat when I am very happy about something." Participants reported how often they ate in response to positive emotions on a 5-point scale, and a mean value was calculated across all 3 items (Cronbach's $\alpha_{2017} = 0.73$, $\alpha_{2020} = 0.76$). Higher scores indicate that independent of a person's hunger state, one eats more frequently as a reward in response to positive emotions.

2.2.3. External eating frequency

External eating frequency was assessed using the following four items (adapted from van Strien et al., 1986): "When I see other people eating or cooking (e.g., on TV), I feel the need to eat." "I eat more than usual when I eat in the company of other people." "When I see or smell tasty food, I want to eat it." "I eat more than usual when I have a large selection of food." Participants responded on a 5-point scale, and a mean value was calculated across all four items (Cronbach's $\alpha_{2017} = 0.70$, $\alpha_{2020} = 0.75$). Higher scores indicate that a person is frequently triggered to (over-)eat by eating-related cues linked to social situations or the smell and visual appeal of food, regardless of one's hunger state (van Strien et al., 1986).

2.2.4. Restrained eating

Restrained eating was assessed with the "concern for dieting" subscale of the Restraint Scale (Dinkel et al., 2005; Herman & Polivy, 1980). Four items were rated on a 5-point scale, and two items were rated on a 4-point scale. A mean value was calculated across all six items (Cronbach's $\alpha_{2017} = 0.66$, $\alpha_{2020} = 0.65$). Higher scores indicate that a person is frequently concerned about dieting. The "weight fluctuations" subscale was not used, following the suggestion that it be disregarded (Dinkel et al., 2005; Meule et al., 2012; Stroebe, 2008).

2.2.5. Overeating frequency

Participants' self-perceived overeating frequency was assessed with one item: "How often does it happen to you that you eat too much or overeat?" (van Strien et al., 2009). The item was rated on a 5-point scale. High values indicate a higher overeating frequency.

2.2.6. Weight-change category

Participants indicated their current body weights in kilograms (kg). Based on the self-reported weights in T1 and T2, a weight-change value was calculated (T2 – T1). Other studies used a ± 2.5-kg cutoff value to classify weight gain, loss, and maintenance (de Mutsert et al., 2014; Nanri et al., 2010; Park et al., 2018; Tylka et al., 2020). However, since this longitudinal study's participants almost exclusively reported whole numbers, a ± 2.0-kg mark was used to form the weight-change categories. Participants were divided into these three categories: weight gain (> 2.0 kg), stable weight (within ±2.0 kg), and weight loss (< -2.0 kg).

2.2.7. Sociodemographic data

The questionnaire included further questions about each participant's gender, age, and educational level. The response options for gender were man and women.

2.3. Statistical analyses

Pearson's correlation analyses using data from T1 were conducted to explore cross-sectional associations among variables. Paired *t*-tests were conducted to test for differences between T1 and T2. Pearson chi-square tests with post-hoc analyses using adjusted residuals with Bonferroni correction (MacDonald & Gardner, 2000) were performed to examine whether participants with low or high IE scores differed in their weight-change categories. Based on a median split on IE ($Mdn_{2017} = 3.70$, $Mdn_{2020} = 3.75$), the participants were divided into two groups: those with low ($n = 908$, 40.9 %) and those with high IE scores ($n = 913$, 50.1 %). The participants whose scores matched the median ($n = 24$) or whose IE group changed between T1 and T2 ($n = 464$) were excluded from the chi-square analysis to ensure that only those participants with stable high or low IE scores were included. Thus, the chi-square analysis included $n = 1333$ participants. Additionally, chi-square sensitivity analyses were performed, with cutoff values of 1.5 kg and 2.5 kg, instead of 2 kg, for the weight-change categories. Sensitivity analyses were also conducted using a one-way ANOVA with continuous IE scores, instead of IE groups. To facilitate interpretation, we decided to mainly report the results of the chi-square test based on IE groups and a weight change cutoff value of 2 kg. The sensitivity analyses and the one-way ANOVAs are provided in the supplementary materials (Tables S1 and S2).

Finally, to explore whether IE was linked to better eating behaviors three years later, separate hierarchical multiple linear regression analyses were performed. In particular, an analysis of change (i.e., a regressor variable approach) was conducted, which is the analysis of choice for longitudinal continuous data with two measurement points (Hartmann et al., 2015; Keller & Hartmann, 2016; Twisk, 2003). Separate regressions were calculated, with reward, external, and restrained eating, as well as overeating frequency at T2, as outcomes. In the first step, age at T2 and the corresponding T1 values of the outcome variables were included as covariates. This enabled us to remove the influence of the initial variable at T1 so that the estimated effects from the other predictor variables were independent of it (Cohen et al., 2003). In the second step, continuous IE scores at T1 and changes in IE scores (T2 – T1) were included as predictors.

All statistical analyses were performed using IBM SPSS Statistics (version 29.0, IBM Corporation, Armonk, NY, 2020) and conducted separately by gender. A significance level of $p \leq 0.01$ was applied.

3. Results

3.1. Correlations among variables

Table 2 presents the correlations among the study variables at T1. Negative correlations were observed between IE and BMI, reward eating, external eating, and overeating frequencies. The strongest negative correlation was found between IE and restrained eating. In other words, the participants who had higher IE scores were less often triggered to eat by eating-related external cues and positive emotional states; they also reported lower levels of restrained eating and fewer overeating occasions. Furthermore, there were no or only small changes in the eating behavior scores between T1 and T2 (see Table 3).

3.2. Intuitive eating and weight changes between T1 and T2

Chi-square tests were performed to examine the relation between IE (high, low) and weight-change categories (Table 4). The overall association between IE and weight changes was significant for women (X^2_{Women} (2) = 9.89, $p = 0.007$) and non-significant for men ($p > 0.05$). Post-hoc analyses focusing on women (Fig. 1) revealed that those with low IE scores were more likely to gain >2 kg of body weight compared to those with high IE scores ($p = 0.009$) over the 3-year period under study. Furthermore, women with high IE scores were more likely to maintain their weights within ±2 kg than those with low IE scores ($p = 0.002$). There was no difference between the IE groups in terms of weight loss.

Chi-square sensitivity analyses with a cutoff value of 1.5 kg for weight change yielded the same results as those with a cutoff value of 2 kg for men and women. For both men and women, using a cutoff value of 2.5 kg for the weight-change categories did not reveal a significant

Table 2
Pearson correlations between intuitive eating, age, BMI, reward eating, external eating, restrained eating, and overeating frequency in 2017 (T1), separated by gender.

		1.	2.	3.	4.	5.	6.	7.
1.	Intuitive Eating		−0.15***	−0.27***	−0.22***	−0.12**	−0.37***	−0.19***
2.	Age	0.01		0.11***	−0.06	−0.23***	0.11***	−0.20***
3.	BMI	−0.27***	0.10**		0.11***	0.05	0.20***	0.15***
4.	Reward Eating	−0.31***	−0.16***	0.13***		0.53***	0.33***	0.30***
5.	External Eating	−0.25***	−0.35***	0.09**	0.55***		0.23***	0.34***
6.	Restrained Eating	−0.54***	−0.07	0.17***	0.39***	0.36***		0.24***
7.	Overeating Frequency	−0.33***	−0.29***	0.17***	0.33***	0.41***	0.34***	

Note. BMI: body mass index.
The coefficients for men are at the top right corner of the table, and the coefficients for women are at the bottom left of the table.
** $p \leq 0.01$.
*** $p \leq 0.001$.

Table 3
Mean values and standard deviation differences between T1 and T2 in eating behaviors, separated by gender.

		T1 (2017)		T2 (2020)			
	Range	M	SD	M	SD	t (df)	
Men (n_{max} = 948)							
Intuitive Eating	1–5	3.70	0.40	3.75	0.43	4.26 (947)	***
Reward Eating	1–5	2.10	0.76	2.06	0.74	−1.45 (928)	
External Eating	1–5	2.50	0.66	2.58	0.66	4.51 (927)	***
Restrained Eating	1–5	1.92	0.50	1.98	0.51	4.35 (891)	***
Overeating	1–5	1.71	0.74	1.67	0.71	−1.67 (923)	
Women (n_{max} = 873)							
Intuitive Eating	1–5	3.66	0.46	3.72	0.47	5.20 (872)	***
Reward Eating	1–5	2.06	0.71	2.00	0.71	−3.17 (854)	
External Eating	1–5	2.61	0.67	2.65	0.69	2.55 (856)	
Restrained Eating	1–5	2.11	0.56	2.12	0.56	0.72 (817)	
Overeating	1–5	1.75	0.78	1.71	0.77	−1.52 (858)	

Note. After Bonferroni correction, a significance level of $p \leq 0.001$ was used.
*** $p \leq 0.001$.

difference between the participants with low IE scores and those with high IE scores. That means, if a weight fluctuation of ±2.5 kg over a 3-year period is defined as a stable weight, the results of the statistical analyses become non-significant ($p = 0.014$) when applying a significance level of $p \leq 0.01$. However, for women, the percentage distribution pointed in the same direction as that shown when the cutoff values of 1.5 kg and 2 kg were used (see Table S1). One-way ANOVAs with continuous IE scores showed similar results. For men, there were no IE score differences between the weight-change categories. For women, their IE scores differed significantly between the weight-change categories, with the participants who gained or lost weight tending to have lower IE scores than those who stabilized their weights (see Table S2).

3.3. Intuitive eating as a predictor of change

Table 5 (focusing on men) and Table 6 (focusing on women) display the results of the hierarchical linear regression analyses that examined continuous IE scores as predictors of changes in eating behaviors and overeating frequency. Overall, including the baseline IE and the change in IE in the second step of the regression explained an additional 0.7–3.2 % variance in men and 0.3–2.8 % in women.

Changes in reward eating frequencies were significantly predicted by the baseline IE scores of both genders, while changes in external eating were significantly predicted by the IE scores of men only. The results further showed that the baseline IE and the changes in IE were both statistically significant predictors of changes in restrained eating and overeating frequency of both genders. In other words, individuals with higher baseline IE scores or increased IE scores between T1 and T2 reported less frequent restrained eating, reward eating, and overeating practices at T2.

4. Discussion

In this study, our goal was to investigate the relations between intuitive eating (IE) and weight changes, overeating frequency, and maladaptive eating behaviors (including reward eating frequency, external eating frequency, and restrained eating) in a large population-based sample. The results showed that women with high IE scores had a higher likelihood of maintaining their weights within ±2 kg, while those with low IE scores had a higher probability of gaining >2 kg of body weight between 2017 and 2020. In both genders, high baseline IE scores and increases in IE scores predicted lower frequencies of maladaptive eating practices three years later.

At baseline, an inverse relation between BMI and IE scores was

Table 4
Distribution of participants with high and with low IE scores and weight gain, stable weight, or weight loss between T1 and T2, separated by gender.

	MEN (n = 678)					WOMEN (n = 655)				
	Low IE Scores		High IE Scores			Low IE Scores		High IE Scores		
	n	%	n	%	X^2	n	%	n	%	X^2
Weight Gain	66	20.3	49	13.9		94	28.1	63	19.6	
Stable Weight	204	62.8	239	67.7		196	58.7	226	70.4	
Weight Loss	55	16.9	65	18.4	4.96	44	13.2	32	10.0	9.89**

Note. IE: intuitive eating.
Chi-square tests, frequencies, and column percentages are reported.
Weight gain (> 2.0 kg); stable weight (within ±2.0 kg); weight loss (< −2.0 kg).
** $p \leq 0.01$.

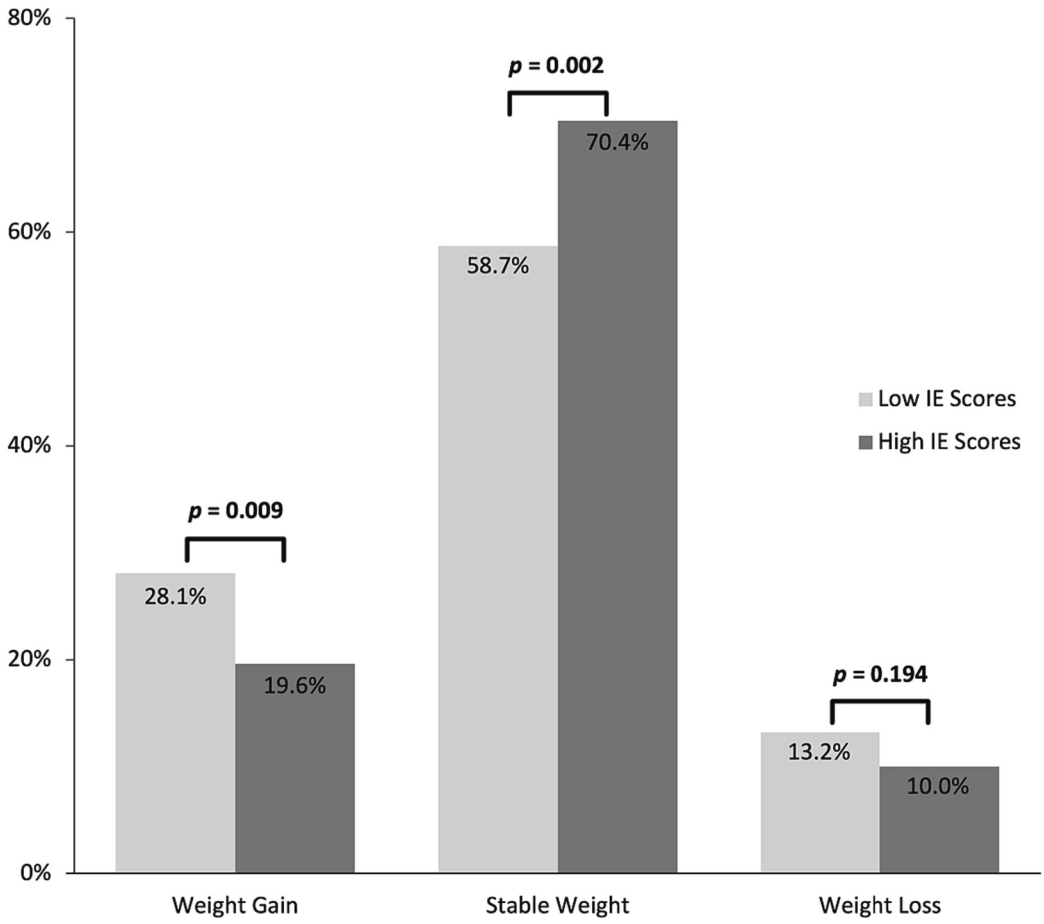

Fig. 1. Distribution of women with stable high and low IE scores ($N_{total} = 655$) who gained, lost, or stabilized their weights within three years.
Note. IE = intuitive eating.
A chi-square test and post-hoc analyses were conducted. For women with stable high IE scores, the values were > 3.7 ($n_{high} = 321$), and for women with stable low IE scores, the values were < 3.7 ($n_{low} = 334$). Weight gain was identified as a > 2.0-kg weight change, stable weight as a ± 2.0-kg weight change, and weight loss as a < −2.0-kg weight change between T1 and T2.

Table 5
Intuitive eating as predictor of changes in men's reward eating, external eating, restrained eating, and overeating frequency between T1 and T2.

	Reward Eating T2			External Eating T2			Restrained Eating T2			Overeating Frequency T2		
	b	β		b	β		b	β		b	β	
Constant	1.93		***	1.90		***	1.72		***	1.86		***
Age T2	0.00	−0.03	**	−0.01	−0.13	***	0.00	0.01		0.00	−0.09	***
Outcome Variable T1	0.55	0.56	***	0.61	0.62	***	0.60	0.59	***	0.51	0.53	***
Intuitive Eating T1	−0.24	−0.13	***	−0.13	−0.08	**	−0.24	−0.19	***	−0.21	−0.12	***
Change in Intuitive Eating	−0.27	−0.13		−0.12	−0.07		−0.21	−0.15	***	−0.18	−0.09	**
Total R^2		0.364	***		0.436	***		0.460	***		0.347	***
ΔR^2		0.021	***		0.007	**		0.032	***		0.013	***

Note. b: regression coefficient; β: standardized regression coefficient.
Continuous IE scores were used for the regression analyses.
ΔR^2 refers to the second step, when the variables intuitive eating T1 and change in intuitive eating were introduced into the regression model.
Only the results for the second steps of the regression analyses are displayed.
** $p < 0.01$.
*** $p \leq 0.001$.

identified, supporting the results of previous studies (Camilleri et al., 2016; Linardon et al., 2021; Tylka et al., 2020; Van Dyke & Drinkwater, 2014). For women, the present study found an association between stable IE practices and weight changes. Women's self-reported high stable IE scores (> 3.7) were related to their stable body weights (± 2 kg) over the three-year period. Women with low IE scores (< 3.7) were more likely to gain weight (> 2 kg) than those with high IE scores. However, women with high IE scores did not have a higher likelihood of losing >2 kg of body weight than women with low IE scores. This means that IE may not lead to weight loss, but it balances weight fluctuations and stabilizes weight within ±2 kg over time (Van Dyke & Drinkwater, 2014), at least in women. No effects were found in men.

Overall, a meta-analysis and a review showed a negative association between IE and maladaptive eating behaviors, such as emotional, external, and restrained eating (Linardon et al., 2021; Warren et al., 2017). Our findings partly support this negative relation, cross-

Table 6
Intuitive eating as predictor of changes in women's reward eating, external eating, restrained eating, and overeating frequency between T1 and T2.

	Reward Eating T2			External Eating T2			Restrained Eating T2			Overeating Frequency T2		
	b	β		b	β		b	β		b	β	
Constant	1.98		***	1.57		***	1.64		***	1.82		***
Age T2	0.00	−0.08	**	−0.07	−0.15	***	0.00	−0.02		−0.01	−0.11	***
Outcome Variable T1	0.56	0.56	***	0.70	0.67	***	0.66	0.67	***	0.57	0.58	***
Intuitive Eating T1	−0.26	−0.17	***	−0.09	−0.06		−0.24	−0.20	***	−0.21	−0.12	***
Change in Intuitive Eating	−0.08	−0.04		−0.05	−0.02		−0.23	−0.14	***	−0.25	−0.11	***
Total R^2		0.412	***		0.565	***		0.620	***		0.448	***
ΔR^2		0.022	***		0.003			0.028	***		0.016	***

Note. b: regression coefficient; β: standardized regression coefficient.
Continuous IE scores were used for the regression analyses.
ΔR^2 refers to the second step, when the variables intuitive eating T1 and change in intuitive eating were introduced into the regression model.
Only the results for the second steps of the regression analyses are displayed.
** $p < 0.01$.
*** $p \leq 0.001$.

sectionally and longitudinally. Overeating and reward, external, and restrained eating were negatively correlated with IE behaviors in this study. Furthermore, higher IE scores at T1 predicted a decrease in overeating frequency, reward eating, and restrained eating over time. Maladaptive eating behaviors were shown to play an important role in body-weight development (Neumann et al., 2018). Individuals who reported high tendencies toward emotional eating at baseline had more extreme weight fluctuations in the four consecutive years than those with lower levels of emotional eating (Keller & Siegrist, 2015). Sung et al. (2009) showed that restrained eating was positively associated with weight gain four years later. In a study involving weight-loss participants, Neumann et al. (2018) reported that those individuals who regained weight after two years increased their external eating behaviors during that time. Overeating is the common outcome of these three maladaptive eating behaviors (Snoek et al., 2013; van Strien et al., 2009) and probably one of the underlying causes of weight gain (Davis, 2009; Koenders & van Strien, 2011). Therefore, the combination of all these findings indicates that IE may counteract maladaptive eating behaviors and overeating frequency; consequently, people with higher IE scores are better at stabilizing their body weights.

Nevertheless, it is surprising that IE had significant longitudinal effects in terms of lowering engagement in self-reported maladaptive eating behaviors over time, especially since these behaviors are difficult to change because they are often reinforced for years and thus ritualized (Brewer et al., 2018). Although there were no major changes in IE over the three-year period, some participants altered their IE behaviors, which influenced their maladaptive eating behaviors. This means that even small changes in IE behaviors can have a positive impact on self-reported maladaptive eating habits and thus promote longitudinal weight stabilization.

The present study has some strengths, as well as limitations. Many of the previous IE studies involved primarily women (e.g., Bruce & Ricciardelli, 2016; Messer et al., 2021, 2022; Van Dyke & Drinkwater, 2014) or used student samples (Tylka & Kroon Van Diest, 2013), community samples (Carbonneau et al., 2016), or a limited age range (Christoph et al., 2021; Hazzard et al., 2021; Leong et al., 2016). In contrast, the major strengths of our study are its randomly selected, large, and population-based sample and its inclusion of both genders, thus achieving a greater representation of the general population. However, our analyses are limited to two measurement points. For this reason, we cannot draw any conclusion about the stability or duration of the observed changes in eating-related behaviors. Nevertheless, few longitudinal observation studies on IE have been published, and it is important to add knowledge about within-individual changes that are possibly related to IE to estimate its potential for positive changes. Although sensitivity analyses and one-way ANOVAs yielded slightly different results, all these findings pointed in the same direction, showing that the participants with stable weights had higher IE scores than those who lost or gained weight. Furthermore, the reward and external eating scales used in this study had acceptable levels of internal consistencies (Cronbach's α: 0.73–0.76), while the restrained eating scale had a rather low Cronbach's alpha value. All three scales fulfilled the criterion of unidimensionality. However, Cronbach's alpha is affected by the test length and scales with a rather small number of items were selected to keep the questionnaire manageable for the study participants. Lower reliabilities lead to an underestimation of the observed association. Therefore, the present study may have underestimated the effect sizes. Lastly, using BMI as a measure has its limitations because it does not accurately reflect a person's health status (Tomiyama et al., 2016).

5. Conclusion and implications

Overall, encouraging the acquisition of IE practices, which entails paying attention to internal body signals, eating when hungry, and stopping when full, is important and should be advocated. Nutrition practitioners should promote IE, not to facilitate weight loss, but to encourage eating behaviors that are more based on body signals and can thus gradually reduce maladaptive eating behaviors. In turn, this might help to maintain a stable body weight. Overall, the present study strengthens the idea that adaptive, non-dieting approaches can lead to a stable body weight even in food environments that promote overeating. However, IE programs that seek to market weight loss should be viewed critically since weight loss is not the focus of IE principles and the present study's results highlight the fact that weight loss cannot necessarily be expected. Nevertheless, since women with higher IE scores are more likely to stabilize their weights within ±2 kg than women with lower IE scores, this shows that weight gain is not something to worry about when eating intuitively and having an unconditional permission to eat. It should also be noted that weight is influenced by contextual factors and weight loss is not always a beneficial outcome. Further long-term research is needed to fully understand not only the impacts of IE on maladaptive eating behaviors, weight development, and aspects of wellbeing and body consciousness but also which factors have a positive or negative impact on the development of IE practices throughout a person's eating history.

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Ethical standards disclosure

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving the research

study participants were fully approved by the Ethics Committee of ETH Zurich (EK-2017-N-19). Implied consent was obtained from all subjects.

CRediT authorship contribution statement

Luana Giacone: Conceptualization, Formal analysis, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing. **Cynthia Sob:** Conceptualization, Methodology, Project administration, Writing – review & editing. **Michael Siegrist:** Supervision, Writing – review & editing. **Christina Hartmann:** Conceptualization, Methodology, Project administration, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.eatbeh.2024.101844.

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