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Eat healthy, feel better: Are differences in employees' longitudinal healthy-eating trajectories reflected in better psychological well-being?

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Abstract

Eating healthily in terms of fruit and vegetable consumption has beneficial effects for employees and their organisations. Yet, we know little about how employees' eating behaviour develops over longer periods of time (*trajectories*) as well as about how subgroups of employees in these trajectories differ (*trajectory classes*). Gaining such insights is critical to understand how employees address healthy eating recommendations over time as well as to develop individualised interventions that also consider the development of healthy eating (i.e. improvement versus impairment beyond mean levels). We analysed panel data (Longitudinal Internet Studies for the Social Sciences) from 1054 employees by means of growth mixture modelling. Our analyses revealed three relevant classes of healthy-eating trajectories: a favourable trajectory class, an unfavourable trajectory class and a strongly improving trajectory class. Furthermore, unfavourable healthy-eating trajectories were especially critical with respect to impaired psychological well-being. Specifically, we found robust results for impaired positive and negative

affects, but not for self-esteem, in the unfavourable trajectory class. We discuss limitations and implications of these findings, thereby encouraging research and practice to further consider such fine-grained approaches (i.e. focusing on subgroups within a larger population) when addressing healthy-eating promotion over time.

KEYWORDS

employees, healthy eating, longitudinal, psychological well-being, trajectories

INTRODUCTION

Eating healthily in terms of fruit and vegetable consumption has beneficial effects, including enhanced well-being (Conner et al., 2015) and vitality (Conner et al., 2017). While eating behaviour remains stable within intervals of less than a year (Henderson et al., 2023), it changes over the life course (Burton-Jeangros et al., 2015; Umberson et al., 2008). Little is known, however, about how healthy eating unfolds over several years in adult life. Typically, this life stage runs in parallel with employment that can affect healthy eating (e.g. due to job stress; Nagler et al., 2013). Meanwhile, organisations aim at maintaining a healthy workforce (e.g. by supporting healthy eating) to reduce healthcare costs (Carls et al., 2011). Hence, it is essential to know more about how healthy eating develops in employees' lives over time.

Importantly, employees may differ in the development of their healthy eating (i.e. healthy eating trajectories) such that their healthy eating can develop in a favourable (i.e. stable high or increasing trajectories) or an unfavourable way (i.e. stable low or decreasing trajectories). Studying trajectories is important because similarly increasing versus decreasing trajectories could result in identical mean levels but imply different conclusions (i.e. improvement versus impairment). Research already began to uncover predictors of eating trajectories (e.g. Umberson et al., 2008), but differences between employees in their trajectories and the consequences of these differences remain unstudied. Yet, this knowledge would provide a basis for individualised, development-focused interventions by addressing positive enhancement of healthy eating in case of favourable trajectories or providing strategies for behaviour change in case of unfavourable trajectories.

Regarding consequences, research has largely focused on physical benefits of healthy eating including, for example, reduced cardiovascular incidence (Sofi et al., 2010) and obesity prevention (Franz et al., 2007) but neglected psychological outcomes (Blanchflower et al., 2013; Mujcic & Oswald, 2016). With psychological well-being as an important target in organisational health promotion (Kuoppala et al., 2008), research moved towards this direction by identifying improved mood states and happiness as psychological benefits of eating healthily (Blanchflower et al., 2013; Peltzer & Pengpid, 2017). However, most of these studies are cross-sectional (Rooney et al., 2013). Indeed, knowledge on longer-term psychological benefits is still in its infancy (for exceptions, Boehm et al., 2018; Ocean et al., 2019)—especially in the employee population. Bearing in mind organisations' interest in maintaining a (psychologically) healthy workforce over time, a longitudinal perspective is needed.

In this study, we address this gap and examine the *development* of employees' healthy eating with a longitudinal study. Specifically, using panel data from the Longitudinal Internet Studies for the Social Sciences (LISS, Scherpenzeel & Das, 2010), we first identify healthy-eating trajectory classes to explore how employees differ in their healthy-eating trajectories over a period of around 6 years. Proposing that there are favourable (i.e. stable high or increasing) and unfavourable (i.e. stable low or decreasing) healthy-eating trajectory classes, we then test their differential effects on psychological well-being. We thereby rely on the broaden-and-build theory (Fredrickson, 2001) and suggest that employees in favourable trajectory classes benefit over time in terms of higher positive affect, lower negative affect and higher self-esteem compared to those in unfavourable trajectory classes.

Our study contributes to the literature on public health and employee psychological well-being. First, we adopt a longitudinal perspective and disentangle different patterns of healthy-eating over time, allowing for the identification of critical subgroups within an employee population (i.e. unfavourable healthy-eating trajectory classes). Thereby, we take into account that employees may either maintain a specific eating behaviour (i.e. stable patterns) or vary in their eating behaviour over time (i.e. changing patterns). Identifying such considerable differences between employees may serve as a basis for interventions. For example, employees showing little but stable healthy eating over time may need other impulses (e.g. strategies to develop healthy-eating habits) than employees showing higher levels but decreasing trajectories (e.g. approaches to identify reasons and enact counter-strategies). With pure mean-level interpretations, tendencies of behaviour change are masked, and targeted interventions would thus not be possible.

Second, by combining public health research with theoretical assumptions of the broaden-and-build theory (Fredrickson, 2001), we examine psychological long-term effects of healthy-eating trajectory classes. Specifically, we study how the development of healthy eating over time differentially relates to psychological well-being more than 6 years after the starting time, even under consideration of baseline levels. In more practical terms, we analyse whether employees psychologically benefit from healthy, or suffer from unhealthy, eating over time. These insights contribute to the emerging literature on the psychological relevance of healthy eating (Blanchflower et al., 2013; Mujcic & Oswald, 2016). Hence, our study contributes to a better understanding of sustained psychological effects of healthy eating—emphasising the promotion of healthy eating in daily work life.

EMPLOYEES' HEALTHY-EATING TRAJECTORIES OVER TIME

Eating healthily in terms of fruit and vegetable consumption is a well-acknowledged aspect of a healthy lifestyle (Rooney et al., 2013). Indeed, fruit and vegetable consumption helps prevent diseases and strengthens individuals' physical (Lock et al., 2005; van Duyn & Pivonka, 2000) and psychological health (Głąbska et al., 2020; Tuck et al., 2019). The World Health Organization (WHO, 2003) suggests consuming at least five portions of fruits and vegetables every day. Yet, adults often do not meet the recommendations (Mc Morrow et al., 2017). With a large part of the adult population being in working positions, time-related barriers due to work are frequently mentioned reasons for this backlog (Kearney & McElhone, 1999). At the same time, work settings can also be a promising context for healthy-eating interventions (Sorensen et al., 2004). Accordingly, research acknowledged the relevance of healthy eating in employees' lives (e.g. Liu et al., 2017; Sonnentag et al., 2017).

Interestingly, we know little about how employees' eating behaviour develops over longer time periods. Yet, a longitudinal perspective is important to develop interventions that aim at long-term behaviour change. Especially studying development over time—employees' healthy-eating trajectories—allows for insights beyond mean levels of healthy eating that would obscure different tendencies of behaviour change. Indeed, changes in healthy eating may differ between individuals (Stok et al., 2018). While some employees may show rather stable healthy-eating patterns over time, others may show increasing (e.g. along interventions; Inauen et al., 2017) or decreasing (e.g. along job stressors and fatigue; Nagler et al., 2013) healthy-eating patterns. In more abstract terms, there may be heterogeneous subgroups, so-called *trajectory classes*, occurring within the population over time. Although research emphasised the theoretical rationale of when and how quickly changes happen (Dormann & Griffin, 2015), there is, to the best of our knowledge, no literature suggesting suitable intervals to capture change in healthy eating. To balance between an interval in which changes realistically happen (e.g. lifespan; Umberson et al., 2008) and a theoretically meaningful period (e.g. half year; Henderson et al., 2023), we zoom into a timeframe of 6 years (five waves) to realistically capture systematic changes in employees' healthy eating.

Taken together, employees may differ in their healthy-eating trajectories over time, which we investigate within an exploratory approach. Indeed, studying healthy-eating trajectories of all employees at once may be too short-sighted, as there may be substantial differences in how healthy eating develops over time for specific subgroups. Understanding these differences is a critical step to then shed light on their consequences. Therefore, we ask the following:

> *Research Question*: Which different classes of healthy-eating trajectories occur within an employee population?

HEALTHY-EATING TRAJECTORY CLASSES AND PSYCHOLOGICAL WELL-BEING

In general, we assume that there are favourable and unfavourable healthy-eating trajectory classes which can have diverging implications for psychological well-being. We define favourable classes by high stable or increasing trajectories and unfavourable classes by low stable or decreasing trajectories. Building on our core assumption, we suggest that membership of a favourable versus unfavourable healthy-eating trajectory class differentially relates to psychological well-being. In other words, employees with favourable healthy-eating trajectories over time should experience better psychological well-being than employees with unfavourable healthy-eating trajectories over time.

We ground our reasoning on the broaden-and-build theory (Fredrickson, 2001), stating that positive states expand the so-called thought-action repertoire. That is, positive states enable more flexibility of action along with an improved access to broader options of thinking and action tendencies. Transferring this theoretical approach to our research focus, healthy eating goes along with short-term positive states (Blanchflower et al., 2013; Mujcic & Oswald, 2016) which might then improve the thought-action repertoire and result in sustained psychological well-being. For example, studies demonstrated healthy eating to improve vitality (Conner et al., 2017), happiness (Wahl et al., 2017) and positive affect (White et al., 2013). Theoretically, positive states may enable gain cycles (Reis et al., 2015) that help build psychological resilience, thereby protecting and enhancing sustained psychological well-being (Fredrickson, 2001).

Indeed, longitudinal studies provide first evidence for the link between short-term positive states and sustained psychological well-being (e.g. Hakanen et al., 2008 for proactive behaviours that may less likely occur when psychological well-being is low). In addition, previous research mentioned biochemical mechanisms (e.g. nutrients in fruits and vegetables strengthen the immune system; Lampe, 1999) that may relate to better psychological functioning (Rooney et al., 2013), reflecting sustained psychological well-being. Overall, healthy eating may translate into sustained psychological well-being, as it captures a 'long-term investment in future well-being' (Wahl et al., 2017, p. 1).

We examine psychological well-being, among others, in terms of positive and negative affects. In detail, *positive affect* describes experiences of activation and pleasure reflected in, for instance, alertness, pride or enthusiasm (Watson et al., 1988). Contrarily, *negative affect* captures activated and unpleasurable experiences, including, nervousness, guilt or distress (Watson et al., 1988). In fact, affect has been increasingly studied in its dynamic nature over the last decades (cf. Sonnentag, 2015), but researchers also acknowledged its stable components (i.e. affectivity; e.g. Bowling et al., 2008; Kaplan et al., 2009). As such, affect has been studied widely in both affect and personality literatures (cf. Beal & Ghandour, 2010). These literatures clearly consider stable components of affect which, however, can still develop over longitudinal periods (Watson & Walker, 1996). More broadly, it is critical to differentiate between time-varying states of affect (i.e. momentary moods) and its relatively stable tendencies of feeling (Barsade & Gibson, 2007). In this longitudinal study, we rely on the latter conceptualisation, thus viewing affect as a core facet of stable tendencies in psychological well-being (cf. Diener, 1984). Thereby, we adopt the definition of psychological well-being as the 'preponderance of positive affect over negative affect' (Diener, 1984, p. 543) in terms of employees' sustained psychological well-being.

We focus on these two aspects of psychological well-being because the affective components are well-aligned with our rationale based on the broaden-and-build theory (Fredrickson, 2001). More precisely, the theory focuses on specific states that have potential to beneficially activate or regulate thoughts and actions. Investigating the translation into sustained psychological well-being integrates these ideas, as sustained psychological well-being should result from an improved affect regulation—including downregulation of negative affect and upregulation of positive affect. Beyond, recent literature suggests psychological well-being—including positive and negative affects—as a critical criterion in organisational science, thereby clearly going beyond performance outcomes only (Tay et al., 2023). Bringing together the relevance of affect in organisations with literature on healthy eating, it is somewhat surprising that positive and negative affects are rarely studied as consequences of healthy eating. The little available (short-term) research on psychological well-being outcomes supports the relations for affective components of psychological well-being (e.g. White et al., 2013). Thus, we suggest positive and negative affects as theoretically and empirically sound and, above all, highly relevant outcomes.

Taken together, we propose that favourable healthy-eating trajectories over time (i.e. stable high or increasing) are positively reflected in psychological well-being and become evident in higher positive and lower negative affects, while unfavourable healthy-eating trajectories over time (i.e. stable low or decreasing) are negatively reflected in psychological well-being, becoming evident in lower positive and higher negative affects. Thus, we suggest the following:

> **Hypothesis 1.** Employees in favourable healthy-eating trajectory classes will experience better psychological well-being in terms of (a) higher positive affect and (b) lower negative affect than employees in unfavourable healthy-eating trajectory classes.

Furthermore, we propose that membership in a favourable versus unfavourable healthy-eating trajectory class differentially relates to self-esteem. *Self-esteem* refers to individuals' overall perception of their own worth (Rosenberg, 1965a) which arises from information in social interactions (Shavelson et al., 1976). High self-esteem describes positive self-appraisal and personal satisfaction, which can protect the self. Indeed, self-esteem is relevant for employees given its relation to job success and satisfaction (Kuster et al., 2013).

We focus on self-esteem as another concept relevant for psychological well-being (Sánchez & Barrón, 2003). Indeed, self-esteem aligns with our theoretical rationale based on the broaden-and-build theory (Fredrickson, 2001) but points to another potentially relevant mechanism driven by the social environment. In detail, eating behaviour is strongly influenced by the social context (Higgs & Thomas, 2016), so that social desirability of healthy eating may foster one's positive self-perception (e.g. fuelled by continuous positive feedback). Contrarily, not meeting healthy-eating recommendations over time may be critical to employees' self-esteem (e.g. due to continuous negative feedback). The positive self-perception may serve as a positive state broadening the thought-action repertoire and ultimately enhance sustained psychological well-being. Again, also, the few available (short-term) studies support our assumptions (e.g. Elfhag et al., 2008). Thus, integrating our temporal perspective and theoretical rationale, we propose the following:

> **Hypothesis 2.** Employees in favourable healthy-eating trajectory classes will experience better psychological well-being in terms of higher self-esteem than employees in unfavourable healthy-eating trajectory classes.

With our hypotheses, we do not specify differences between stable levels and changes over time. In general, over time, healthy eating should relate to better psychological well-being than unhealthy eating, but there may be further differences with respect to stable high and low trajectories versus changing trajectories (i.e. starting low and increasing or starting high and decreasing). As such, increases may be more beneficial to psychological well-being than high stable levels because high stable levels may feel ordinary while positive changes may evoke additional positive states (e.g. pride when receiving positive feedback; happiness when experiencing benefits of healthy eating). Similarly, decreases in healthy eating may be more detrimental for psychological well-being than low stable levels, as a negative trend may evoke additional negative states (e.g. shame when receiving criticism; adverse mood when lacking important nutrients). However, these patterns only provide examples of how the relations may look like. We refrain from further specifying our hypotheses at this point, as the identification of healthy-eating trajectory classes is of exploratory nature. Yet, we do acknowledge such differences in trajectories and will consider them in our analyses.

METHOD

Data set and sample

We drew on data from a longitudinal panel (i.e. LISS panel; Scherpenzeel & Das, 2010), focusing on specific questionnaires (i.e. health and personality), waves (i.e. healthy-eating data from five waves between 2013 and 2018 and psychological well-being data from 2019) and participants (i.e. employees working at least 20 h per week). We included participants who provided

well-being data in 2019 and at least three health questionnaires between 2013 and 2018. Our final data set then included 1054 (out of 4,445) employees. For details about the data set and cleaning procedure, please see supporting information.

Our final sample included 35.4% female and 47.2% male employees (17.5% without information). The mean age in 2013 was $M = 43.4$ ($SD = 11.0$) years. Most participants had permanent contracts (89.5%), working $M = 37.2$ ($SD = 8.7$) hours per week. The sample's body mass index (BMI) ranged between 16.6 and 34.9 kg/m^2. The average BMI indicated an overweight population ($M = 25.0$, $SD = 3.5$) following WHO (1995).[1]

MEASURES

With fruit and vegetable consumption as a critical aspect of a healthy lifestyle (Lock et al., 2005; van Duyn & Pivonka, 2000) and in line with previous research (Dehghan et al., 2011), we focused on these two indicators of healthy eating. Participants answered the questions 'Do you eat fruit?' and 'Do you eat raw or cooked vegetables?' on a 6-point response format (1 = *never*, 2 = *one to three times per month*, 3 = *one time per week*, 4 = *two to four times per week*, 5 = *five to six times per week*, 6 = *every day*). We averaged their answers on fruit and vegetable consumption, leading to one healthy-eating score.

As indicators of psychological well-being, we analysed positive and negative affects as well as self-esteem. Using the Positive and Negative Affect Schedule (Watson et al., 1988), participants answered 10 items for positive and negative affects each, referring to their present feelings on a seven-point scale from 1 (*not at all*) to 7 (*extremely*). A sample item for positive affect is 'proud' and for negative affect 'distressed'. Cronbach's alpha was .87 for positive affect and .93 for negative affect. Self-esteem was assessed with the Rosenberg Self-Esteem Scale (Rosenberg, 1965b). Participants were asked to answer how strongly they agree to 10 statements capturing their self-esteem with a seven-point response format from 1 (*totally disagree*) to 7 (*totally agree*), that we recoded where necessary. A sample item is 'On the whole, I am satisfied with myself'. Cronbach's alpha was .91.

ANALYTICAL STRATEGY

We conducted growth mixture analyses using Mplus 8.7 (Muthén & Muthén, 2017) and used full information maximum-likelihood estimation to deal with missing data (Newman, 2014). Before testing our assumptions, we specified a linear latent growth model in which the intercept of healthy eating reflected data from 2013 and the trajectory reflected data from 2013 to 2018. We considered the different intervals of data collection (cf. Table S1) when modelling the trajectories.[2] In all our models, we kept the intercept variance constant and fixed the slope variance in all classes at 0.01 to avoid convergence issues. To examine our research question regarding the identification of healthy-eating trajectory classes (i.e. subgroups within the overall sample that show low intraclass variances), we specified several models to successively test two, three, four and five trajectory-class solutions. To decide how many classes fit the data best, we compared diverse fit indices following recommendations (Tofighi & Enders, 2008) and similar research (Mühlenmeier et al., 2022). For details about the fit indices considered, please see supporting information.

Next, to test our hypotheses regarding the relation between healthy-eating trajectory classes and psychological well-being, we computed separate models for positive affect, negative affect and self-esteem (for construct validity, see supporting information). We added the variables to our previous model as auxiliary variables (i.e. Bolck–Croon–Hagenaars [BCH] analysis; Asparouhov & Muthén, 2014), so that we could observe differences in outcomes between classes while keeping class membership consistent (Chawla et al., 2020).

RESULTS

The descriptive statistics and correlations of our variables are displayed in Table 1.

Identification of trajectory classes

Table 2 shows the fit indices and numbers of persons per class, from a one-class up to a five-class solution. Fit indices of the two- or three-class solutions were most appropriate. While the two-class solution showed the first bent towards flattening curves in Akaike information criterion (AIC = 9882.67), Bayesian information criterion (BIC = 9942.20) and sample-size-adjusted BIC (SSA-BIC = 9904.08), there was another slight bent in these indicators for the three-class solution (AIC = 9849.97, BIC = 9924.38, SSA-BIC = 9876.74), after which the curves became flat. In addition, the two-class solution showed the largest value of minimal probability of correct class affiliation (.79) and the smallest value of maximal probability of false class affiliation (.21), but entropy was better for the three-class solution (.76 compared with .68). Also, the last significant improvement of the Lo–Mendell–Rubin adjusted test (LMR) occurred for the three-class solution ($p < .001$). A more nuanced solution with four classes was inappropriate, as entropy and probability of false class affiliation reached worse values and the LMR test did not show further improvement.

TABLE 1 Descriptive statistics and intercorrelations of variables.

	Variable	*M*	*SD*	1	2	3	4	5	6	7
1	Healthy eating (2013)[a]	4.58	0.98							
2	Healthy eating (2015)[a]	4.69	0.99	.72***						
3	Healthy eating (2016)[a]	4.74	1.01	.70***	.69***					
4	Healthy eating (2017)[a]	4.78	1.00	.66***	.67***	.75***				
5	Healthy eating (2018)[a]	4.76	1.01	.67***	.65***	.73***	.77***			
6	Positive affect (2019)[b]	4.46	0.95	−.02	−.01	.07	.03	.02		
7	Negative affect (2019)[b]	1.96	0.99	−.09*	−.15***	−.13**	−.17***	−.11*	−.05	
8	Self-esteem (2019)[b]	5.72	0.97	.02	.04	.08	.09*	.06	.35***	−.55***

[a]Response format = 1–6 (frequency of consumption of fruits and vegetables), data from 2013 to 2018 (for details on the assessment period, see Table S1 in the supporting information).
[b]Response format = 1–7 (agreement), data from 2019.
*$p < .05$, **$p < .01$, and ***$p < .001$.

TABLE 2 Healthy-eating trajectory classes (2013–2018).

Number of classes	Log-likelihood	FP	SCF	AIC	BIC	SSA-BIC	LMR (*p*)	Entropy	Class prob.	Error prob.	*N* C1	*N* C2	*N* C3	*N* C4	*N* C5
1	−4971.92	9		9961.84	10006.48	9977.90					1,054				
2	−4929.34	12	1.49	9882.67	9942.20	9904.08	.00	.68	.79	.21	785	269			
3	***−4909.99***	***15***	***1.35***	***9849.97***	***9924.38***	***9876.74***	***.00***	***.76***	***.55***	***.25***	***791***	***243***	***20***		
4	−4897.24	18	1.43	9830.48	9919.77	9862.60	.18	.73	.58	.28	14	552	119	369	
5	−4887.85	21	1.50	9817.69	9921.86	9855.16	.11	.77	.55	.30	12	554	112	371	5

Note: Bold and italicised = chosen class solution for further analyses.
Abbreviations: AIC, Akaike information criterion; BIC, Bayesian information criterion; Class prob., minimal probability of correct class affiliation; Error prob., maximal probability of false class affiliation; FP, number of free parameters; LMR (p), *p*-value of the Lo–Mendell–Rubin adjusted test; N C1–5, number of persons per class; SCF, scaling correction factor; SSA-BIC, sample-size-adjusted BIC.

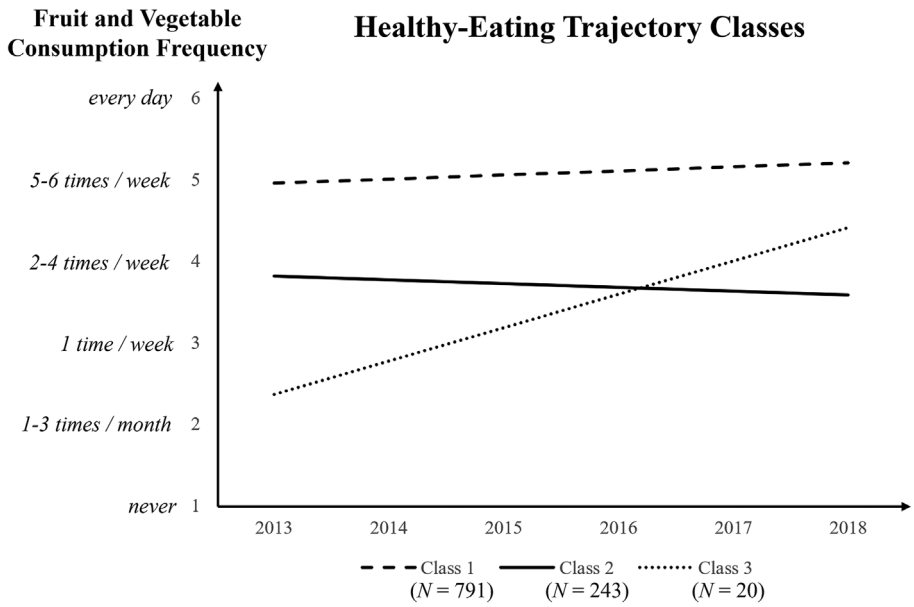

FIGURE 1 Plot of healthy-eating trajectory classes (three-class solution).

To investigate a more differentiated trajectory pattern, we decided to consider the three-class solution for our subsequent analyses. Indeed, the third class was not theoretically redundant, even though it was relatively small.[3] Table S2 in supporting information shows the trajectory patterns of healthy eating for all three classes from 2013 to 2018, which are further illustrated in Figure 1. Class 1 ($N = 791$) showed generally high and slightly increasing healthy-eating patterns over time (intercept = 4.96, slope = 0.05). Class 2 ($N = 243$) showed medium healthy-eating patterns with a lower start level than Class 1 and slight decrease over time (intercept = 3.81, slope = −0.05). Class 3 ($N = 20$) showed strongly improving healthy-eating patterns with a low start level and steep increase over time (intercept = 2.36, slope = 0.41). All intercepts and slopes were significant.

With respect to our research question, we thus identified three classes. We interpret Class 1 as the *favourable trajectory class* (high value and increase in healthy eating) and Class 2 as the *unfavourable trajectory class* (lower value and decrease in healthy eating) for our further analyses. Following our reasoning on the relevance of changes over time beyond mean levels, Class 3 as the *strongly improving trajectory class* seems to show rather favourable patterns, too. Overall, most of the sample (76.9% of the sample; Class 1 with $N = 791$ and Class 3 with $N = 20$) thus showed favourable healthy eating patterns over time.[4,5]

Test of hypotheses

Next, we examined whether the favourable, unfavourable and strongly improving trajectory classes (from 2013 to 2018) had differential relations with psychological well-being (in 2019). Results are summarised in Table 3. The favourable trajectory class showed significantly higher values ($p = .017$) in positive affect ($M = 4.52$, SE = 0.04) and lower values ($p < .001$) in

TABLE 3 Three healthy-eating trajectory classes (2013–2018) as predictors of psychological well-being (states in 2019 and residuals from 2013 to 2019).

			Positive affect		Negative affect		Self-esteem	
Class	**Class name**	***N***	**State**	**Residual**	**State**	**Residual**	**State**	**Residual**
1	Favourable trajectory class	791	4.52^{2}	0.05^{2}	1.87^{2}	-0.06^{2}	5.78^{2}	0.02
2	Unfavourable trajectory class	243	4.29^{1}	-0.18^{*1}	2.26^{1}	$0.25^{*1,(3)}$	5.56^{1}	−0.09
3	Strongly improving trajectory class	20	4.70	0.34	1.84	$-0.57^{(2)}$	5.59	0.20

Note: The table includes the mean values. Superscripts indicate significant differences at $p < .05$ between the respective classes (e.g. superscript 2 = difference to Class 2). Superscripts in brackets indicate a marginally significant difference at $p < .10$ between the respective classes. *95% Confidence interval does not include zero, indicating a significant change from 2013 to 2019.

negative affect ($M = 1.87$, SE = 0.04) compared with the unfavourable trajectory class ($M = 4.29$, SE = 0.08 and $M = 2.26$, SE = 0.09, respectively). The favourable trajectory class showed significantly higher values ($p = .017$) in positive affect ($M = 4.52$, $SE = 0.04$) and significantly lower values ($p < .001$) in negative affect ($M = 1.87$, $SE = 0.04$) compared with the unfavourable trajectory class ($M = 4.29$, $SE = 0.08$ and $M = 2.26$, $SE = 0.09$, respectively). These results provide initial support for Hypothesis 1a and 1b. Additionally, the favourable trajectory class reported significantly higher values ($p = .020$) in self-esteem ($M = 5.78$, $SE = 0.04$) compared with the unfavourable trajectory class ($M = 5.56$, $SE = 0.08$), thereby providing initial support for Hypothesis 2. Hence, the favourable healthy-eating trajectory class showed better psychological well-being in 2019 than the unfavourable healthy-eating trajectory class. Interestingly, we did not find any differences between the strongly improving trajectory class and the other two classes, although the values of positive and negative affects descriptively seem to be best in the strongly improving trajectory class.[6]

Robustness checks

One might argue that the favourable (versus unfavourable) trajectory class is only favourable due to initial better psychological well-being instead of better psychological well-being resulting from the more favourable healthy-eating trajectories. To reduce this possibility of reverse causation, we computed residual analyses in which we predicted the change in psychological well-being across the considered time period. Specifically, we predicted psychological well-being in 2019 by psychological well-being data from 2013, which was available for 61.0% of our sample. We then saved the residuals and tested class membership as a predictor of these psychological well-being residuals. These analyses revealed similar patterns for positive and negative affects. In detail, positive affect decreased more strongly ($p = .042$) in the unfavourable trajectory class ($M = -0.18$, $SE = 0.09$) than in the favourable trajectory class ($M = 0.05$, $SE = 0.04$) in which positive affect was stable over time. Negative affect increased more strongly ($p = .008$) in the unfavourable trajectory class ($M = 0.25$, $SE = 0.10$) than in the favourable trajectory class ($M = -0.06$, $SE = 0.04$) in which negative affect was stable over time. These results provide further support for Hypothesis 1a and 1b. Interestingly, the increase of negative affect in the

unfavourable trajectory class also tended to be stronger ($p = .069$) than in the strongly improving trajectory class in which negative affect seemed to be stable ($M = -0.57$, $SE = 0.42$). This tendency implies that the strong increase in healthy eating is positively reflected in at least stable low (descriptively even decreasing) levels of negative affect. Regarding the prediction of self-esteem residuals, we did not find any differences between the three classes (favourable trajectory class: $M = 0.02$, $SE = 0.03$; unfavourable trajectory class: $M = -0.09$, $SE = 0.07$; strongly improving trajectory class: $M = 0.20$, $SE = 0.25$), thus not providing further support for Hypothesis 2.

Going further, one might be concerned about conducting the residual analyses with a data set including only 61.0% of the baseline values. Therefore, we conducted another robustness check by repeating all analyses in a data set excluding participants who did not provide baseline data for psychological well-being in 2013. This procedure led to a substantially reduced and, importantly, demographically different data set, resulting in a sample of 641 employees.[7] Given the different basis for the analyses, we first reran the analysis of our research question (i.e. identifying trajectory classes) before testing our hypotheses (i.e. predicting psychological well-being) with this reduced data set. The detailed results of these analyses are provided in the supporting information (cf. Tables S3 to S5 and Figure S1). In brief, Class 1 and Class 2 are similar to the two first classes in the main analysis, but Class 3 differs in capturing an unfavourable decreasing trajectory. With respect to the relation between class membership and psychological well-being, the analysis with the reduced data set is in line with Hypothesis 1b only.

Overall, we found that employees of the favourable healthy-eating trajectory class report better psychological well-being compared with employees of the unfavourable healthy-eating trajectory class. However, with respect to the robustness checks, we only found clear patterns for positive and negative affects in the residual analyses based on the original data set. Additionally, we observed differences in psychological well-being between the favourable and unfavourable trajectory classes but not for the strongly improving trajectory class.

DISCUSSION

Our longitudinal perspective on healthy eating in employees' lives offers important insights into how employees differ in their healthy-eating trajectories over time and how these trajectories relate to psychological well-being. Analysing longitudinal data from the LISS panel (Scherpenzeel & Das, 2010), we identified three classes with most employees showing relatively stable and favourable healthy-eating trajectories over time (2013–2018). In addition, we found differential effects on psychological well-being, yielding interesting implications regarding the nature of different psychological well-being outcomes.

Theoretical implications

Our study showed systematic healthy-eating trends over time (i.e. linear change) that differed considerably between employees. Although changes were relatively minor (i.e. small slope estimates), these results underpin that it is worth to examine the differential development of healthy eating over several years in usual employee life. Thereby, we provide a helpful baseline to investigate and address barriers of healthy eating in the work context. For example, job stress

(Nagler et al., 2013) may, eventually, affect healthy eating of employees with downward trends stronger than those with upward trends. In our study, a considerable percentage of employees (23.1%) showed unfavourable healthy-eating trajectories with already low starting levels of healthy eating that further decreased over time. Thus, employees consuming fewer fruits and vegetables on average seemed to be more prone to show a further decline in healthy-eating behaviour. Overall, our study highlights the need to consider critical subgroups and their specific tendencies of behaviour change in healthy eating over time.

Importantly, the favourable and unfavourable healthy-eating trajectory classes differentially predicted psychological well-being. Specifically, positive affect and self-esteem were higher, and negative affect was lower in the favourable trajectory class than in the unfavourable trajectory class. These patterns suggest that more favourable healthy eating over time can be beneficial for psychological well-being. Our findings provide an important contribution because psychological outcomes of healthy eating have been rarely examined (Blanchflower et al., 2013; Mujcic & Oswald, 2016). More recent research, however, shed light on everyday fruit and vegetable consumption as an important aspect of healthy eating shaping psychological well-being (e.g. Anderson & Fowers, 2020; Warner et al., 2017). Studies also discuss potential reasons for the beneficial effects, including the benefits of increased vitamin intake (Kaplan et al., 2007) and increased serotonin levels along with the carbohydrates (Takeda et al., 2004). As such, our longitudinal findings are well in line with these short-term studies by highlighting the relevance of fruit and vegetable consumption for psychological well-being as an important aspect of a healthy workplace (Day et al., 2014).

Yet, findings from residual analyses (i.e. changes in psychological well-being from 2013 to 2019) provide interesting insights by emphasising that on the long run, it seems that rather *un*healthy eating that is detrimental to psychological well-being but not healthy eating being beneficial. In detail, actual changes in psychological well-being only occurred in the unfavourable trajectory class, namely, in terms of impaired affect, while the favourable trajectory class rather showed stable psychological well-being.[8] In contrast to the gain cycles suggested within the broaden-and-build theory (cf. Fredrickson, 2001), it seems that negative trends carry more weight. Specifically, healthy eating might protect from impairments of psychological well-being, thereby rather preventing resource loss. While these findings do not support the argument on resource building (cf. Fredrickson, 2001), they can be reconciled with the recently suggested concept of human sustainability (Barnes et al., 2023). According to this concept, human capital—including psychological well-being—can be maintained by the functions of maintenance, growth and generativity. Thereby, maintenance, defined as 'investing resources to uphold the present state' (p. 1972), has priority over growth and generativity, which go one step further (i.e. targeting expansion of and beyond the self). Synthesising these suggestions with our findings, employees' resource investment (i.e. engagement in healthy eating) only helps uphold but not expand their present psychological well-being. As such, our study provides an exemplary integration of the broaden-and-build theory into the framework of human sustainability.

Interestingly, our residual analyses revealed peculiarities in different psychological well-being outcomes. While findings were robust for positive and negative affects even when controlling for baseline values, they did not hold for self-esteem. However, given that we found differences between the classes when not controlling for baseline self-esteem, it might be that experiencing self-esteem rather goes along with healthy eating over time instead of being an outcome across time. That is, employees with high self-esteem may perceive positive feedback from their environment, thereby maintaining both self-esteem and healthy eating. Adding to this implication, analyses based on a smaller data set (cf. robustness checks) similarly provided

slight evidence that healthy eating over time at least relates to negative affect. Specifically, the favourable trajectory class showed significantly lower values in negative affect in 2019 as well as marginally significantly more beneficial change in negative affect from 2013 to 2019 than the two unfavourable trajectory classes. This pattern of findings is unsurprising given the large data set reduction. Also, the specific demographic composition of the reduced sample might have affected the robustness of our findings. That is, gender may play a critical role in experiencing psychological well-being along with hormonal differences or structural inequalities, although meta-analyses are inconclusive about whether women or men experience more positive affect (cf. Batz & Tay, 2018). Similarly, it might be that young people attach especially high relevance to feedback from their environment so that results in self-esteem evoked by healthy eating over time are not robust when less young people are included. Still, the relatively univocal pattern for negative affect emphasises that healthy eating over time might be crucial in preventing adverse affective states independent of such demographic differences. This pattern is also in line with our preliminary analysis that showed correlations between healthy eating and negative affect at specific points in time but not between healthy eating and positive affect and self-esteem. Thus, it seems that healthy eating both at specific points in time as well as over time is likely to prevent resource loss but not to promote resource building. In sum, our diverging findings highlight the relevance of capturing different psychological well-being outcomes following healthy-eating trajectories.

Integrating our results into a broader context, we highlight that healthy eating over time is essential in work life, also from a well-being perspective. Fundamentally, specific trajectories do not just occur due to overall higher or lower initial psychological well-being, but psychological well-being rather occurs as a consequence of healthy eating over time. In our specific case, however, we cannot conclude that trajectories matter beyond mean levels as the class with increasing patterns also showed a higher mean level of healthy eating over time compared with the class with decreasing patterns. Nevertheless, we observed a tendency that increases matter beyond mean levels given the marginally significant difference between the strongly improving trajectory class and the unfavourable trajectory class. Hence, time may indeed be critical so that we encourage temporal perspectives in research on healthy eating.

Limitations and future directions

Our study has some limitations, some of which may also inspire future research. First, our data of healthy eating should be put in context. By capturing consumption of fruits and vegetables 'every day' as the highest scale score, we could not consider how many portions of fruit and vegetables employees actually ate per day. In fact, even the favourable trajectory class might still not reach the recommendations provided by WHO (2003)—which might even explain why our findings did not support resource-building processes (cf. Fredrickson, 2001). Probably, the levels of healthy eating even in the favourable trajectory class are still too low to allow for well-being improvement (i.e. beyond preventing its impairment). Hence, employing a more detailed scale of healthy-eating behaviour would be helpful in future research. In addition, we only included fruit and vegetable consumption, which is only one of many relevant aspects of healthy eating (e.g. overall energy intake or intake of sugars, fats and salt; WHO, 2003). Yet, research acknowledged fruit and vegetable consumption as an indicator of healthy eating (Dehghan et al., 2011). To paint a more comprehensive picture, however, it might still be interesting to examine trajectory classes of overall eating behaviour.

Second, our results on the trajectory classes only allow descriptive interpretations. We can describe how healthy eating develops over time for different employee subgroups, but we cannot identify causes (e.g. changes in employees' work setting). Research may address this issue by two approaches, namely, by analysing predictors of trajectory classes and by identifying more complex trajectory classes. Analysing predictors promises to uncover specific characteristics (e.g. trait self-control; Vainik et al., 2015) that might drive healthy eating development over time. Identifying more complex trajectory classes promises to learn about simultaneously occurring factors in employees' sphere that interact with their eating behaviour (e.g. trajectory classes including healthy eating *and* job factors). While uncovering predictors and simultaneous trajectories is a relevant avenue for research (i.e. development of interventions), these analyses are beyond the scope of our study. We thus encourage scholars to advance the understanding on longitudinal developments of employees' healthy eating by examining theoretically relevant predictors and modelling more complex trajectory classes.

Third, annual assessment of healthy eating and psychological well-being disregards changes within a year (e.g. caused by seasonal influences). Yet, this assessment should still reflect our constructs of interest. For healthy eating, there is evidence on the relative stability within shorter intervals (e.g. Henderson et al., 2023) as well as for uncritical differences of nutrient consumption between seasons (e.g. Schätzer et al., 2010). For psychological well-being, we viewed positive and negative affects as rather stable indicators although more recent studies emphasised the dynamic nature of these facets (cf. Sonnentag, 2015). Empirically, about 50% of the variance in affect seems to be at the person level (Podsakoff et al., 2019), so that affect can indeed serve as a stable indicator (e.g. Panaccio & Vandenberghe, 2009). We assumed that healthy-eating trajectories especially take effect on the stable variance component. Nevertheless, future research may use more fine-grained measures (e.g. monthly eating diaries) and consider potential situational variability of psychological well-being (cf. Eid & Diener, 2004) by controlling for momentary states when assessing overall tendencies.

Beyond overcoming limitations of our study, future research may be inspired to answer further research questions. First, our findings may motivate research to examine healthy-eating trajectories as predictors for work-related outcomes. For example, do employees of favourable classes benefit from the improvement in psychological well-being and, in turn, also show higher job performance or proactive behaviour? Examining these relations would advance the reasoning derived from the broaden-and-build theory (Fredrickson, 2001). That is, employees in favourable classes should be more able to show beneficial work outcomes because of highly flexible actions that come along with positive states. It would be interesting to examine if such effects occur even across time.

Second, few employees showed healthy-eating trajectories that started very low and strongly increased over time. Even though we did not find significant differences in predicting psychological well-being between this small class and the other two classes, the existence of this class gives relevant insights. Specifically, even if it only applies to few employees, it would be interesting to uncover predictors of the (desirable) strong increases over time. Thereby, future research could consider environmental factors that enable such strong increases (e.g. participation in personalised interventions or changing over to an organisation with a good health behaviour climate; Sonnentag & Pundt, 2016). These factors may help reduce barriers to healthy eating and allow for increases in healthy eating. Importantly, we suggest future research to rely on larger samples or longer timeframes to identify such patterns. In fact, larger samples would result in relatively more people in a small class, making it more likely to identify significant predictors and outcomes. Beyond, most changes happen slowly so that models with

higher-order trends within our timeframe did not provide reliable information. Yet, such patterns may theoretically occur (e.g. increasing healthy eating as response to an illness but failing to uphold increased levels) and be relevant.

Practical implications

Practitioners can learn from our study in terms of healthy-eating education and interventions. Regarding healthy-eating education, our study emphasised the role of healthy eating over time for psychological well-being—pointing to psychological benefits beyond well-known physical advantages (e.g. van Duyn & Pivonka, 2000). With the workplace as a fruitful context to address healthy eating (Sorensen et al., 2004), organisations may sensitise their employees to follow public recommendations (WHO, 2003) and maintain a healthy diet over time. Especially the insights on *psychological* benefits may be motivating for employees.

Regarding healthy-eating interventions, our findings revealed critical differences between employees that should be considered in practice. In fact, many interventions have been developed (for an overview, Maes et al., 2012), without systematically considering individual differences. Instead, organisations often rely on quite 'classical' measures to increase healthy eating (e.g. fruit baskets) although individualised measures might be more promising. For example, organisations may use mobile surveys that assess employees' eating behaviour over time. Such surveys would allow for personalised feedback and advice (e.g. identifying causes for decreases in healthy eating versus positively reinforcing increases in healthy eating). Employees with favourable trajectories may be encouraged for behaviour maintenance (e.g. inspiration with healthy recipes), while others may be informed on behaviour change (e.g. goal setting; Gollwitzer, 1999; Hagger & Luszczynska, 2014).

CONCLUSION

Our study showed how employees differ in healthy-eating trajectories over time. While employees with favourable healthy-eating trajectories maintained their psychological well-being, employees with unfavourable healthy-eating trajectories suffered in terms of impaired psychological well-being. Yet, more research is needed to draw conclusions on the relevance of trajectories in healthy eating beyond mean levels. We encourage research and practice to consider more fine-grained approaches to promote healthy eating because differences between employees over time may be relevant for successful interventions.

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CONFLICT OF INTEREST STATEMENT

There are no conflicts of interest in conducting or reporting the research.

DATA AVAILABILITY STATEMENT

Data of this study are available from the LISS panel.

ETHICS STATEMENT

This study is compliant with APA ethical standards. Permission to use data from the Longitudinal Internet Studies for the Social Sciences (LISS Panel) was granted to the first author who ensured to comply with the involved conditions.

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ENDNOTES

[1] It seemed that there were some unrealistic data on workhours and BMI, probably due to typing errors. We therefore set workhours larger than 80 h per week (e.g. 150 h per week) as well as BMI values below 15 (e.g. 0.33) and above 35 (e.g. 141.97) as missing.

[2] We modelled healthy eating in Wave 7 (i.e. 2013) as intercept, and then specified Wave 8 as 1.6 years later, Wave 9 as 3 years later, Wave 10 as 4 years later, and Wave 11 as 5 years later.

[3] To ensure that participants in this small class were not very specific in terms of demographics, we examined demographic data, however, not finding any peculiarities. Class members were 11 male and 6 female employees (with 3 participants not providing gender information), being $M = 43.4$ ($SD = 12.2$) years in 2013. They worked $M = 38.4$ ($SD = 7.9$) hours per week, in permanent employment. Their BMI was $M = 25.8$ ($SD = 3.1$).

[4] Considering the two-class solution (instead of the three-class solution) revealed similar patterns: The first class replicates the favourable class with $N = 785$ persons (intercept = 4.94, slope = 0.06) and the second class replicates the unfavourable class with $N = 269$ persons (intercept = 3.74, slope = −0.02). The only difference compared to the three-class solution is that for this two-class solution the slope of the unfavourable class is not significant ($p = 0.31$). Further separating another third class thus led to clearer trajectory patterns.

[5] To consider more complex temporal patterns, we also tested models with higher-order trends. Indeed, on average, there seemed to be a negative quadratic trend in healthy eating (quadratic slope estimate = −0.009, $SE = 0.003$, $p = .004$). In this data set, however, quadratic growth models with multiple classes did not converge.

[6] Again, the two-class solution yielded similar patterns such that the favourable class showed higher values in positive affect and self-esteem and lower values in negative affect compared with the unfavourable class.

[7] Comparing participants who remained in our main sample with those excluded for this additional analysis showed significant differences with regard to age, $t(799.17) = -5.43$, $p < .001$ and gender, $\chi^2(1) = 8.61$, $p = .003$, but not with regard to weekly working hours, $t(852.51) = -1.56$, $p = .120$, or BMI, $t(815.43) = -1.04$, $p = .297$. More women and more older participants remained in the reduced data set.

[8] In the reduced data set, change in psychological well-being was not significant for any of the three trajectory classes. Yet, given the large reduction of the sample, this nonresult might reflect an issue of statistical power.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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