Is healthy nutrition associated with mental well-being and flourishing?

Carolin Landefeld - 2112574

Department of Psychology, University of Twente

Bachelor Thesis PSY

Positive Psychology and Technology (PPT)

1st Supervisor: Dr. Marijke Schotanus-Dijkstra

2nd Supervisor: Christina Ulrich

July 24, 2021

Abstract

Research shows that certain healthy foods are positively associated to mental well-being. This is an important implication for positive psychology, a domain that investigates factors which improve mental well-being of humans instead of primarily focusing on preventing and treating mental illnesses. The present study investigates whether healthy nutrition is associated with flourishing, the highest mental well-being state that can be reached. With a cross-sectional study design, 153 participants completed an online survey which assessed their mental health and whether they were following healthy nutrition. Results showed no significant correlation between flourishing and healthy nutrition. These findings are in some contrast to what could be assumed on the basis of existing research in this field. Future research should make use of a longitudinal research design to explore the relationship of healthy nutrition and flourishing. In addition, an assessment method should be used that supports the participants with the accurate and timely recording of the food intake after meals.

Keywords: flourishing, well-being, healthy nutrition

Is healthy nutrition associated with mental well-being and flourishing?

Eating healthy has many benefits, including positive effects on a healthy physiology (Davy & Davy, 2019) and mental health (Owen & Corfe, 2017). According to the World Health Organization and the German Nutrition Society, a healthy nutrition includes a balanced diet with healthy carbohydrates as an energy source, various types of vegetables and several portions of fruit per day, dairy products as a protein base and reduced meat consumption (WHO, 1999; 10 Regeln der DGE, n.d.). Such a healthy diet is one of the most important conditions for good health. A dietary pattern like this can prevent a number of diseases such as obesity, cardiovascular disease, cancer, and type 2 diabetes (Locke, Schneiderhan, & Zick, 2018). But not only physical diseases can be prevented through healthy nutrition; a new line of research has found that a healthy eating habit is also associated with a lower risk of mental disorders (Owen & Corfe, 2017). Within this new scope, it has been found that a healthy diet is associated with a reduced risk of depression, anxiety disorders (Firth et al., 2020) and bipolar disorders (Lakhan et al., 2008).

Until now, the majority of this research is concerned about how nutrition contributes to mental disorders and how healthy diets can prevent and treat mental illnesses. In recent years, however, the concept of positive psychology has gained more attention, and with it, the focus on how to improve mental health (Gable & Haidt, 2005). The notion of positive psychology about mental health is well captured with the definition of the World Health Organization which emphasizes that it is “a state of well–being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community” (World Health Organization, 2005). Concretely, this definition of mental health acknowledges, both, the absence and presence of mental illness as well as the absence and presence of mental well-being (Keyes, 2002). This means that a person who does not experience a mental illness can still have low levels of well-

being. On the contrary, a person might suffer from a mental illness but also experience relatively high levels of well-being (Keyes, 2002).

Within this concept, the highest level of mental health is seen as flourishing. A person flourishes when he or she experiences the presence of mental health and high levels of mental well-being (Keyes, 2002). More specifically, flourishing is defined as possessing high levels of emotional, social and psychological well-being (Keyes, 2002). Emotional well-being refers to happiness and life satisfaction (Penninx et al., 1998). Social well-being includes specific features that are important for a fulfilling social life, such as satisfying relationships, fulfilling and fertile activities as well as being able to adapt to change (Keyes, 1998). Psychological well-being, on the other hand, involves factors such as a dedicated life, personal development and self-acceptance (Ryff, & Singer, 2008). In sum, a person who flourishes experiences high mental well-being and is functioning well in life (Keyes, 2002).

Individuals who are flourishing have been found to be associated with many benefits. Flourishers have better social relationships, learn effectively, are able to work efficiently, and have overall better health and life expectancy (Huppert & So, 2009). Moreover, the absence of flourishing increases the likelihood of all-cause mortality in men and women in every age group (Keyes, 2012; Keyes & Simoes, 2012). Given all these beneficial effects on peoples' life and their functioning within society, it is important to find out which factors contribute to the individuals' achievement of flourishing.

Thus far, it is clear that flourishers often possess good physical health (Huppert & So, 2009; Keyes & Simoes, 2012). However, it is unclear how flourishing is related to healthy nutrition. As discussed before, the relationship between healthy eating and psychopathology is well established (Firth et al., 2020; Lakhan et al., 2008; Owen & Corfe, 2017). But less is known about its association with flourishing.

Until now a few studies have shown that healthy eating is associated with mental well-being. For example, following a Mediterranean diet, which is very similar to the WHO's definition of a healthy diet, and where meat is either not consumed at all or only in small quantities, has been found to be associated with certain aspects of mental well-being. The correlational study of López-Olivares, Mohatar-Barba, Fernández-Gómez, and Enrique-Mirón (2020) showed that the adherence of a Mediterranean diet is associated with emotional well-being. This finding was confirmed by a follow-up study which found a positive relationship between the adherence to a Mediterranean diet and subjective well-being (Moreno-Agostino et al., 2019). Furthermore, in the so-called blue zones where people live extremely long, due to several factors, a healthy nutrition is a significant contributor to this longevity. Among other beneficial qualities, these people possess high mental well-being (Buettner & Skemp, 2016; Hitchcott, Fastame, & Penna, 2018).

Moreover, prior studies found that an increased vegetable and fruit consumption has an positive effect on mental well-being. For example, a correlational study by Conner, Brookie, Richardson, and Polak (2015), which required completion of a diary over 13 days, found that fruit and vegetable consumption predicted greater emotional well-being as well as greater curiosity and creativity. A similar longitudinal study was conducted by Mujcic & Oswald (2016), which showed that an increased fruit and vegetable consumption increases happiness, life satisfaction, and well-being among Australian adults. Additionally, White, Horwath and, Conner (2013) also found that eating more fruits and vegetables promotes emotional well-being in young adults. In an intervention study in which participants received a daily reminder to increase their fruit and vegetable consumption by two servings a day, an increase in psychological well-being and resulting improvement in flourishing was found (Conner, Brookie, Carr, Mainvil, & Vissers, 2017). Based on these findings, it is possible that a

comprehensive healthy nutrition and an increased consumption of fruits and vegetables might promote flourishing.

Nevertheless, these prior studies have not specifically focused on the relationship between a general healthy nutrition and flourishing. Therefore, the aim of the current study is to examine whether healthy nutrition is associated with flourishing. It is expected that people who are flourishing have healthier nutrition habits (H1). In particular, it is expected that flourishers are more likely to eat more fruit and vegetables compared to non-flourishers (H2), and that non-flourishers are more likely to eat more meat than flourishers (H3). Moreover, other nutritional factors that make up healthy nutrition are considered, to expand prior research.

Method

Design

This study was part of a bigger online cross-sectional study about flourishing and different associations with mental health and lifestyle behaviours. It used two questionnaires to assess the association between flourishing (as the dependent variable) and healthy nutrition (as the independent variable). The study was approved by the Ethics Committee of the Faculty of Behavioural Sciences at the University of Twente (No. 210168).

Participants and Procedure

The participants were recruited via convenience sampling, since they have been asked to participate through a WhatsApp message or Instagram poll from the researchers' social environment. In order to participate in the study, participants needed an internet connection and to be 18 years or older and German speaking. After being asked to participate in the study, participants had to fill in their name and email address to receive the link for more information and registration. Before filling in the survey, for which a period of one week was available, the participants were given online informed consent. Completing the questionnaire took approximately 15 minutes. In total, 241 participants were recruited for this study. After

removing participants who did not complete the questionnaire, the final data set included 153 German speaking people, aged 18 to 83 (M_{age} = 33.6, SD_{age} = 15.8) and a proportion of 62.7% females. Within the 153 participants, 69 (45.1%) were defined as flourishing.

Materials

Mental wellbeing

Whether a person flourishes or not was assessed with the German version of the Mental Health Continuum-Short Form (MHC-SF) (Keyes et al., 2008). The MHC-SF consists of 14 items and can be self-administered. Within this 14-item scale, three items measure emotional well-being (e.g. “During the past month, how often did you feel happy?”), six items measure psychological well-being (e.g. “During the past month, how often did you feel that you liked most parts of your personality?”) and 5 items measure social well-being (e.g. “During the past month, how often did you feel that you had something important to contribute to society?”). Respondents rate their experience over the last month on a 6-point Likert-type scale ranging from *never* (0) to *every day* (5), where a higher mean score indicates higher mental well-being.

Participants were considered to be flourishing if they scored a 4 or 5 on at least one of the emotional well-being items, as well as a 4 or 5 on at least 6 of the items of social and psychological well-being. Individuals who scored 1 or even 0 on at least one measure of emotional well-being and 1 or 0 on at least six of the social and psychological well-being items were considered to be languishing. Individuals who were neither flourishing nor languishing were categorized with moderate mental health. The questionnaire has a good reliability with α = .68 (Keyes et al., 2008; Keyes, 2018). In the present sample Cronbach's Alpha showed a good internal consistency of the MHC-SF, α = .86.

Healthy nutrition

Healthy nutrition was measured using 11 items created from definition of a healthy nutrition of the WHO and the German nutrition society (WHO, 1999; 10 Regeln der DGE, n.d.).

These questions were for example “On average, how often do you eat a portion of meat?” or, “How many portions of fruits and/or vegetables do you eat on average?”. The questions could be answered on a 6-point Likert-type scale ranging from “daily” (6) to “less than 1 time per month to not at all” (1). When asking about the consumption of fruit, vegetables and legumes, the question was aimed at asking about the portions consumed per day: “How many portions of fruit and/or vegetables do you eat on average”. These questions could be answered with a 6-point Likert-type scale, ranging from “five or more portions a day” (6) to “zero portions a day” (1). The full questionnaire can be found in the Appendix (Appendix A). Out of these items, a sum score was calculated for *healthy nutrition* running from 0 to 7. For this sum score, only answer possibilities were used that fall into the definition of healthy nutrition of this study. More specifically, this means that only answer possibilities were considered to be healthy when; only 1-2 times a week, meat was consumed (3), only 1-2 times a week, fish was consumed (3). Every day, milk, was consumed (6). A sum of five portions of fruit, vegetables and legumes were consumed daily (6). Starchy foods, and whole grain were consumed daily (6). Only one time a month or less sugar, fats, processed food and sugar drinks (1) were consumed (WHO, 1999; 10 Regeln der DGE, n.d.). These answer possibilities that were considered to be healthy were coded as 1 (healthy), subsequently the other answer possibilities were coded as 0 (not healthy) (Table 1). Hence, the scores of the new dummy variables were summed up and therefore the sum score was computed.

Table 1

Sum score for Healthy Nutrition

Product Types	Answer Possibility considered as Healthy
Meat	3 (1-2 times a week)
Fish	3 (1-2 times a week)
Milk	6

	(daily)
Sum of Fruit, Vegetables, Legumes	6
	(five portions a day)
Starchy foods	6
	(daily)
Whole grain	6
	(daily)
Sugar	1
	(1 time a month or less)
Processed	1
	(1 time a month or less)
Sugar drinks	1
	(1 time a month or less)
Oil and fats	1
	(1 time a month or less)

Data analysis

To statistically analyse the collected data, IBM SPSS (Version 25.0) was used. A dummy variable was created for *flourishers* (1) and *non-flourishers* (0). Because none of the participants were languishing, only people with moderately mental health would fall into the category of non-flourishing. The descriptive statistics were computed for the characteristics of the participants and for flourishers and non-flourisher. Moreover, it was examined whether the data was normally distributed. A p-value greater than 0.05 indicated a normal distribution (Mishra et al., 2019). Furthermore, means of the demographics for gender and age were calculated, in order to compare them with flourishers and non-flourishers using an independent t-test and Chi-squared analysis.

To examine the association between *flourishing, mental well-being,* well-being subscales and *healthy nutrition,* consumption of *fruit and vegetables,* consumption of *meat*, and other nutritional factors, Pearson correlation coefficients were calculated. A correlation coefficient of 0.3 was interpreted as weak, between 0.3 and 0.7 as moderate and a correlation coefficient above 0.7 as good (Cohen, 1992). To test whether there was a difference between flourishers and non-flourishers in their healthy nutrition*,* independent t-tests were conducted.

Also, to examine the difference between flourishers and non-flourishers in their consumption of the different nutritional factors, a Chi-Square analysis has been conducted.

Results

No significant differences were found between flourishers and non-flourishers in regard to gender $X^2(5, N = 153) = 2.23$, $p > 0.05$ and age ($t(151) = -.250$, $p = .803$) in flourishers ($M = 33.27$, $SD = 15.17$) and non-flourishers ($M = 33.90$, $SD = 16.35$). The Shapiro Wilk test showed a significant departure from normality for the data ($p > 0.05$).

Correlations

The results of the Pearson Correlation analysis (Table 1) showed no significant correlation between *flourishing* and *healthy nutrition* ($r = -.03$, $p = .756$), *fruit and vegetable* consumption ($r = -.08$, $p = .306$), and *meat* consumption ($r = .01$, $p = .891$). Also, no significant correlations were found between *flourishing* and the other nutritional factors ($ps > 0.05$).

In regard to mental well-being and the subscales of flourishing, different significant correlations have been found with *healthy nutrition* and other nutritional factors (Table 1). *Healthy nutrition* was weakly positively correlated with *mental well-being* ($r = .32$, $p = .000$), *emotional well-being* ($r = .32$, $p = .000$), and *psychological well-being* ($r = .37$, $p = .000$). No significant correlation was found with social well-being. Furthermore, weak positive correlations were found between the consumption of fish and *mental well-being, emotional well-being* and *psychological well-being.* The consumption of *legumes* was weakly positively correlated with *mental well-being* and *social well-being*. Also, weak positive correlations were found between *starchy foods* and *emotional well-being* and *psychological well-being,* as well as between *whole grain* and *mental well-being*, *emotional well-being* and *psychological well-being*. Furthermore, the consumption of *sugar drinks* was weakly negatively correlated with *mental well-being*, *social well-being* and *psychological well-being.*

Table 2

Correlations between Flourishing, Mental well-being and Healthy nutrition

	Flourishing	Mental well-being	Emotional well-being	Social well-being	Psychological well-being
Meat	-.01	.07	.10	.01	-.07
Fish	-.01	.23**	.20*	.12	.25**
Milk	.04	.03	.13	-.03	.01
Fruit and vegetable	.08	.20	.09	.03	.13
Legumes	.09	.17*	.09	.18*	.14
Starchy foods	.01	.15	.19*	.00	.19*
Whole grain	-.01	.22**	.26**	.06	.26**
Processed	.10	-.11	-.08	-.04	-.15
Fats and sugars	.06	.11	.14	-.06	.09
Sugar drinks	.13	-.25**	-.15	-.20*	-.25**
Fats and oils	.04	.12	-.13	.04	.15
Healthy nutrition	-.03	.32**	.32**	.12	.37**

***. Correlation is significant at the 0.01 level (2-tailed)*

**. Correlation is significant at the 0.05 level (2-tailed)*

Differences between flourishers and non-flourishers

The results of the independent t-tests showed no significant difference ($t(44) = .943$, $p = .743$) between flourishers ($M = 1.80$, $SD = 1.54$) and non-flourishers ($M = 2.23$, $SD = 1.53$), in their *healthy nutrition*. Also, no significant differences were found between flourishers and non-flourishers in their consumption of *fruit and vegetable* ($t(151) = -1.03$, $p = .306$) and in their consumption of *meat* ($t(151) = 1.38$, $p = .891$), as well as in the other nutritional factors

(*ps* > 0.05) (Table 3). In addition, the results of the Chi-Square analysis show that there were no considerable differences between flourisher and non-flourishers in the frequency of consumption of the different foods (Table 3).

Table 3

Chi-square Analysis for Comparison of Flourisher and Non-flourisher in Nutritional factors, and independent t-test results

Variables	Flourisher *N* (%)	Non-flourishers *N* (%)	*p*
Meat			
Daily	4 (5.8)	7 (8.3)	
3-6 times a week	17 (24.6)	18 (21.4)	
1-2 times a week	21 (19.8)	23 (27.4)	
2 times a month	6 (8.7)	12 (14.3)	
Less than 2 times a month	2 (2.9)	4 (4.8)	
Less than 1 times a month to not at all	19 (27.5)	20 (23.8)	
M (SD)	3.39 (1.68)	3.43 (1.65)	.891
Fish			
Daily	0 (0.0)	1 (1.2)	
3-6 times a week	0 (0.0)	1 (1.2)	
1-2 times a week	19 (27.5)	20 (23.8)	
2 times a month	15 (27.1)	23 (27.4)	
Less than 2 times a month	10 (14.5)	6 (7.1)	
Less than 1 times a month to not at all	25 (36.2)	33 (39.3)	
M (SD)	2.40 (1.24)	2.44 (1.32)	.868
Milk			
Daily	21 (30.4)	23 (27.4)	
3-6 times a week	20 (29.0)	22 (26.2)	
1-2 times a week	13 (18.8)	18 (21.4)	
2 times a month	5 (7.2)	8 (9.5)	
Less than 2 times a month	1 (1.4)	3 (3.6)	
Less than 1 times a month to not at all	9 (13.0)	10 (11.9)	
M (SD)	4.40 (1.64)	4.29 (1.62)	.650
Fruit and vegetable			
5 or more portions a day	21 (30.4)	23 (27.4)	
4 portions a day	20 (29.0)	22 (26.2)	
3 portions a day	13 (18.8)	18 (21.4)	
2 portions a day	5 (7.2)	8 (9.5)	
1 portion a day	1 (1.4)	3 (3.6)	
0 portions a day	9 (13.0)	10 (11.9)	

M (SD)	3.38 (1.31)	3.17 (1.22)	.306
Legumes			
5 or more portions a day	0 (0.0)	1 (1.2)	
4 portions a day	1 (1.4)	3 (3.6)	
3 portions a day	6 (8.7)	2 (2.4)	
2 portions a day	14 (20.3)	13 (15.5)	
1 portion a day	34 (49.3)	39 (46.4)	
M (SD)	2.22 (0.92)	2.05 (1.04)	.292
Starchy foods			
Daily	44 (63.8)	52 (61.9)	
3-6 times a week	22 (31.9)	28 (33.3)	
1-2 times a week	2 (2.9)	4 (4.8)	
2 times a month	1 (1.4)	0 (0.0)	
Less than 2 times a month	0 (0.0)	0 (0.0)	
Less than 1 times a month to not at all	0 (0.0)	0 (0.0)	
M (SD)	5.58 (0.63)	5.57 (0.59)	.933
Whole Grain			
Daily	17 (24.6)	24 (28.6)	
3-6 times a week	17 (24.6)	22 (26.2)	
1-2 times a week	27 (39.1)	26 (31.0)	
2 times a month	5 (7.2)	6 (7.1)	
Less than 2 times a month	1 (1.4)	2 (2.4)	
Less than 1 times a month to not at all	2 (2.9)	4 (4.8)	
M (SD)	4.55 (1.16)	4.57 (1.30)	.918
Processed			
Daily	8 (11.6)	12 (14.3)	
3-6 times a week	8 (11.6)	10 (11.9)	
1-2 times a week	23 (33.3)	17 (20.2)	
2 times a month	14 (20.3)	13 (15.5)	
Less than 2 times a month	5 (7.2)	6 (7.11)	
Less than 1 times a month to not at all	11 (15.9)	26 (31.0)	
M (SD)	3.52 (1.52)	3.18 (1.81)	.212
Fats and sugars			
Daily	21 (30.4)	20 (23.8)	
3-6 times a week	16 (23.2)	29 (34.5)	
1-2 times a week	26 (37.7)	23 (27.4)	
2 times a month	4 (5.8)	5 (6.0)	
Less than 2 times a month	0 (0.0)	3 (3.6)	
Less than 1 times a month to not at all	2 (2.9)	4 (4.8)	
M (SD)	4.70 (1.14)	4.55 (1.28)	.457
Sugar drinks			
Daily	2 (2.9)	5 (6.0)	
3-6 times a week	11 (15.9)	4 (4.8)	

1-2 times a week	15 (21.7)	17 (20.2)	
2 times a month	11 (15.9)	11 (13.1)	
Less than 2 times a month	10 (14.5)	10 (11.9)	
Less than 1 times a month to not at all	20 (29.0)	37 (44.0)	
M (SD)	2.90 (1.56)	2.48 (1.60)	.103
Fats and oils			
Daily	32 (46.4)	41 (48.8)	
3-6 times a week	27 (39.1)	29 (34.5)	
1-2 times a week	9 (13.0)	10 (11.9)	
2 times a month	1 (1.4)	1 (1.2)	
Less than 2 times a month	0 (0.0)	2 (2.4)	
Less than 1 times a month to not at all	0 (0.0)	1 (1.2)	
M (SD)	5.30 (0.75)	5.23 (1.01)	.595

Discussion

The primary objective of this study was to examine the association between healthy nutrition and flourishing. Thereby, healthy nutrition was defined as eating five portions of fruit, vegetables and legumes a day, and daily consumption of milk products, foods containing starch and whole grain. Meat and fish should be eaten only two times a week, and fats and sugar should be avoided as much as possible (WHO, 1999; 10 Regeln der DGE, n.d.). Due to the many positive effects of healthy eating on different aspects of well-being (Buettner & Skemp, 2016; Hitchcott et al., 2018; López-Olivares et al., 2020; Moreno-Agostino et al., 2019), it was hypothesised that this kind of nutrition would also be positively associated with flourishing. However, no association between healthy nutrition and flourishing was found in the current study. Moreover, flourishers did not differ significantly in their average eating habits from people who were not flourishing.

A possible reason for these results could be that healthy nutrition does not positively affect all parts of well-being that make up flourishing. In that case, it is likely that this influence is not strong enough to directly differentiate between the dichotomy of flourishers and non-flourishers. For example, people who would score high on emotional and social well-being but moderately on psychological well-being would not be considered as flourishers (Keyes, 2002).

Therefore, it might be that the influence of healthy nutrition is too weak to significantly differentiate between flourishers and non-flourishers. In line with this, the results from the present study showed that only two of the well-being scales were correlated with healthy nutrition. Positive weak correlations have been found between healthy nutrition and emotional well-being, psychological well-being, and overall mental well-being. These associations between healthy nutrition and certain subscales of well-being are consistent with previous research. For example, a positive significant relationship has been found between Mediterranean diet and emotional well-being (López-Olivares et al., 2020; Moreno-Agostino et al., 2019). While it becomes clear that healthy diet is linked to mental well-being, it seems that this is not alone sufficient to have a significant influence on the final outcome of flourishing. Therefore, more research is required to get a better understanding of the association between healthy nutrition and flourishing.

In addition to the overall healthy nutrition, the present study has also examined whether certain individual food factors are associated with flourishing and well-being. In previous research it was shown that an increased fruit and vegetable intake is associated with higher emotional well-being (Conner et al., 2015; White et al., 2013), increased psychological well-being, and even flourishing (Conner et al., 2017). Moreover, a reduced meat consumption or even the complete renunciation of meat was found to have a positive effect on mental well-being, emotional well-being and psychological well-being (López-Olivares et al., 2020; Moreno-Agostino et al., 2019; Wright et al., 2017). Therefore, it was hypothesized that flourishers would be more likely to eat more fruits and vegetables than non-flourishers, and that non-flourishers would be more likely to eat more meat than flourishers. But these hypotheses could not be confirmed in the current study.

A possible reason for these unexpected results might be that only one item has been used in the assessment of the consumption these foods. In previous studies, fruit and vegetable

intake was operationalised using more comprehensive methods. For example, a diary had to be filled out every day for 13 days, in which four questions had to be answered to assess the amount of intake (Conner et al., 2015). In another study, fruit and vegetable consumption was recorded over several years, with various questions asking about portion sizes consumed the previous day (Boehm et al., 2018). Due to this more detailed assessment, participants' attention was more focused on the consumption, which might have led to a more accurate and detailed evaluation of the intake. For example, it is possible that participants in the present study have underestimated their meat consumption and overestimated their vegetable and fruit intake as single item questionnaires are more prone to self-perception biases that hold up a favourable image. Due to this, it is likely that no correlation could be found between these specific dietary factors and well-being due to possible distortions caused by the use of single items.

While these hypotheses were not confirmed, the results of the current study showed that other food factors did correlate with well-being. For example, weak positive significant correlations have been found between mental well-being, emotional well-being, psychological well-being and the consumption of fish, starchy foods, whole grain and legumes, and weak negative significant correlations with sugar drinks. Similar tendencies can also be found in existing research. Silvers and Scott (2002) have reported that the consumption of fish is positively associated with higher self-reported mental well-being. Also, a reduction of dairy fat was found to be correlated with an increase of psychological well-being (Halyburton et al., 2007), and that sugar intake has been found to be negatively correlated with mental illness (Jacques et al., 2019, as cited in Peet, 2004) as well as depression (Shi, Taylor, Wittert, Goldney, & Gill, 2010). Still, as with a comprehensive healthy nutrition and flourishing, these food factors were not associated with overall flourishing. But these findings further emphasize the importance of a more differentiated understanding between specific nutrition habits and aspects of well-being.

Overall, the results of the current study and findings of other research emphasise the complexity of healthy nutrition. A healthy diet is a constantly changing concept and new perspectives are always being added, or existing ones, which have been previously labelled as healthy, are revised and altered as unhealthy. Within the Mediterranean diet for example, which is considered as particularly healthy, a certain amount of red wine is considered as healthy (Moreno-Agostino et al., 2019). This is in contrast to the definition of the WHO and the German nutrition society which both do not consider the consumption of wine as part of a healthy diet (WHO, 1999; 10 Regeln der DGE, n.d.). Similar inconsistencies arise with other definitions, which consider for example a gluten free (Gaesser & Angadi, 2012) or plant-based diet (Giulia et al., 2021) to be most healthy or the consideration that fish could be increasingly less healthy due to the growing microplastic pollution (Barboza, Vethaak, Lavorante, Lundebye, & Guilhermino, 2018). After all, healthy nutrition remains a complex construct that is constantly changing through societal, cultural, and environmental factors (Schröder, 2016). Therefore, the results about the relationships between healthy nutrition and flourishing from the present study need to be considered in the light of this complexity.

Strengths and Limitations

One strength of the present study is the use of the MHC-SF which is a widely validated and reliable instrument to measure well-being and flourishing. The present sample was found to be representative for the German population, since the age ranges from 18-86 years and it shows a share of 63% females. Also, almost half of the participants where flourishing and none of them languishing. This is also representative for the German-speaking population as it is comparable to the Netherlands, where 36.5% were found to be flourishing (Schotanus-Dijkstra et al., 2016). Also, despite the COVID-19 pandemic during which the mental well-being of people decreased considerably (Panchal et al., 2020; Villani et al., 2021), people in the current sample were nevertheless able to manifest a good mental well-being. Importantly, this study

was the first to not only focus on the different dimensions of mental well-being associated with certain foods, but also on the relation between flourishing and a generally healthy nutrition.

The results of this study have to be interpreted by considering some limitations. First of all, given the cross-sectional design of this study it is not possible to draw conclusions about causality. More specifically, it is not possible to say whether people with higher mental well-being are more likely to have certain diet habits, such as eating fish, or whether people who eat more fish would be more likely to develop better mental well-being. A bidirectionality could be possible and it is not clear whether one of these aspects causes the other. Secondly, since the present study only investigated German speaking people, the assessment of nutritional factors was limited to people who are likely to possess a western diet. This is important to consider when interpreting the current results. For example, a Mediterranean diet is considered to be healthier than a western diet (García-Montero et al., 2021; Shively et al., 2019), different findings can be expected in studies that focus on this type of diet.

Lastly, another limitation of the current study is the assessment method of healthy nutrition. The questionnaire in the present study asked about the average amounts of certain foods retrospectively and at only one point in time. It is possible that this time lag and cross-sectional approach affected data quality in a negative way. Existing research used longitudinal designs as well as assessments on a daily basis with multiple questions to evaluate healthy nutrition. This might have resulted in a more accurate assessment by the participants of their own eating behaviours. Furthermore, some of the items can be understood to refer to the same or very similar types of food at the same time, resulting in a loss of distinctiveness for the participants. Also, the examples used in the questions, which represent a selection of relevant foods per category, could have been considered exclusive by the participants. Both could have affected data quality negatively. A more accurate assessment of participants' nutrition could thus help to get a better understanding of its relationship with flourishing.

Future implications

Considering the limitations of this study, implications can be made for future research. When the relationship between flourishing and healthy nutrition is further investigated, a longitudinal research design should be used in order to make stronger statements about the association of flourishing and healthy nutrition. Also, the current study asked participants retrospectively about their eating behaviour without having a chance to accurately examine their eating behaviour. Consequently, future research should use a measurement method that pays particular attention to frequency and quantity of consumption so that participants can accurately report their eating behaviour. For example, an experience sampling method could allow to combine these goals and also to gain knowledge about the temporal dependency between participants' eating habits and well-being facets.

From the present study and reinforced by prior research, it can be concluded that a relationship between mental well-being and healthy eating habits exists. This finding is important for both the public and policy makers as it may be a simple and cost-effective way to support and promote well-being and physical health. Thus, this relationship should be made more public so that everyone can adapt their individual eating behaviour. In addition, politicians should also push for a healthier diet among the population. Possible starting points are laws and regulations for the introduction of limit values for certain less healthy products and ingredients or guidelines for nutrition in public institutions such as kindergartens, schools and universities. The findings could also be used to treat mental disorders (Firth et al., 2020; Lakhan et al., 2008; Owen & Corfe, 2017) and physical diseases (Davy & Davy, 2019; Locke, Schneiderhan, & Zick, 2018).

Conclusion

This research did not find an association between flourishing and healthy nutrition. These results are contrary to what could be suggested on the basis of previous research.

However, the current study found correlations with overall healthy nutrition, different food factors and certain aspects of well-being. Thus, combining the findings of the current study and those of previous research, a relationship between healthy nutrition and flourishing is still conceivable. But it is not clear whether healthy nutrition influences flourishing or vice versa. In order to make more concrete conclusions, this possible relation should be further investigated within a longitudinal research design. These new conclusions could help to promote and facilitate the still emerging field of positive psychology to enforce people's mental well-being as well as healthy nutrition.

References

Barboza, L. G. A., Vethaak, A. D., Lavorante, B. R., Lundebye, A. K., & Guilhermino, L. (2018). Marine microplastic debris: An emerging issue for food security, food safety and human health. *Marine pollution bulletin*, *133*, 336-348. https://doi.org/10.1016/j.marpolbul.2018.05.047

Boehm, J. K., Soo, J., Zevon, E. S., Chen, Y., Kim, E. S., & Kubzansky, L. D. (2018). Longitudinal associations between psychological well-being and the consumption of fruits and vegetables. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, *37*(10), 959–967. https://doi.org/10.1037/hea0000643

Buettner, D., & Skemp, S. (2016). Blue zones: lessons from the world's longest lived. *American Journal of Lifestyle Medicine*, *10*(5), 318–321. https://doi.org/10.1177/1559827616637066

Cohen, J. (1992). Statistical power analysis. *Current directions in psychological science*, *1*(3), 98-101. https://doi.org/10.1111/1467-8721.ep10768783

Conner, T. S., Brookie, K. L., Richardson, A. C., & Polak, M. A. (2015). On carrots and curiosity: eating fruit and vegetables is associated with greater flourishing in daily life. *British journal of health psychology*, 20(2), 413-427. https://doi.org/10.1111/bjhp.12113

Conner, T. S., Brookie, K. L., Carr, A. C., Mainvil, L. A., & Vissers, M. C. (2017). Let them eat fruit! The effect of fruit and vegetable consumption on psychological well-being in young adults: A randomized controlled trial. *PloS one*, 12(2), e0171206. https://doi.org/10.1371/journal.pone.0171206

Davy, K. P., & Davy, B. M. (2019). Advances in nutrition science and integrative physiology: Insights from controlled feeding studies. *Frontiers in physiology*, 10, 1341. https://doi.org/10.3389/fphys.2019.01341

Firth, J., Solmi, M., Wootton, R. E., Vancampfort, D., Schuch, F. B., Hoare, E., ... & Stubbs, B. (2020). A meta-review of "lifestyle psychiatry": the role of exercise, smoking, diet and sleep in the prevention and treatment of mental disorders. *World Psychiatry*, 19(3), 360-380. https://doi.org/10.1002/wps.20773

Gable, S. L., & Haidt, J. (2005). What (and why) is positive psychology? *Review of General Psychology*, *9*(2), 103–110. https://doi.org/10.1037/1089-2680.9.2.103

Gaesser, G. A., & Angadi, S. S. (2012). Gluten-free diet: imprudent dietary advice for the general population? *Journal of the Academy of Nutrition and Dietetics*, *112*(9), 1330–1333. https://doi.org/10.1016/j.jand.2012.06.009

García-Montero, C., Fraile-Martínez, O., Gómez-Lahoz, A. M., Pekarek, L., Castellanos, A. J., Noguerales-Fraguas, F., ... & Ortega, M. A. (2021). Nutritional Components in Western Diet Versus Mediterranean Diet at the Gut Microbiota–Immune System Interplay. Implications for Health and Disease. *Nutrients*, 13(2), 699. https://doi.org/10.3390/nu13020699

Giulia, M., Cristina, G., Daniela, P., Paolo, L., Alessandro, M., Francesca, D. D., & Annalisa, N. (2021). Vegan diet health benefits in metabolic syndrome. *Nutrients*, *13*(817). https://doi.org/10.3390/nu13030817

Halyburton, A. K., Brinkworth, G. D., Wilson, C. J., Noakes, M., Buckley, J. D., Keogh, J. B., & Clifton, P. M. (2007). Low-and high-carbohydrate weight-loss diets have similar effects on mood but not cognitive performance. *The American journal of clinical nutrition*, 86(3), 580-587. https://doi.org/10.1093/ajcn/86.3.580

Healthy Living [PDF]. (1999). Regional Office for Europe Copenhagen: World Health Organization.

Hitchcott, P. K., Fastame, M. C., & Penna, M. P. (2018). More to Blue Zones than long life: positive psychological characteristics. *Health, Risk & Society*, 20(3-4), 163-181. https://doi.org/10.1080/13698575.2018.1496233

Huppert, F. A., & So, T. (2009). What percentage of people in Europe are flourishing and what characterises them. In *IX ISQOLS Conference* (pp. 1-7). http://citeseerx.ist.psu.edu/viewdoc/download

Jacques, A., Chaaya, N., Beecher, K., Ali, S. A., Belmer, A., & Bartlett, S. (2019). The impact of sugar consumption on stress driven, emotional and addictive behaviors. *Neuroscience & Biobehavioral Reviews*, 103, 178-199. https://doi.org/10.1016/j.neubiorev.2019.05.021

Keyes, C. L. M. (1998). Social well-being. *Social psychology quarterly*, 121-140. https://doi.org/10.2307/2787065

Keyes, C. L. M. (2002). The Mental Health Continuum: From Languishing to Flourishing in Life. *Journal of Health and Social Behavior, 43*(2), 207-222. https://doi.org/10.2307/3090197

Keyes, C. L., & Simoes, E. J. (2012). To flourish or not: Positive mental health and all-cause mortality. *American journal of public health*, *102*(11), 2164-2172. https://doi.org/10.2105/AJPH.2012.300918

Keyes, C. L. M. (2018). Overview of the mental health continuum short form (mhc-sf). doi:10.13140/RG.2.2.24204.62088

Kulkarni, A. A., Swinburn, B. A., & Utter, J. (2015). Associations between diet quality and mental health in socially disadvantaged New Zealand adolescents. *European Journal of Clinical Nutrition*, 69(1), 79-83. https://doi.org/10.1038/ejcn.2014.130

Lakhan, S. E., & Vieira, K. F. (2008). Nutritional therapies for mental disorders. *Nutrition journal*, 7(1), 1-8. https://doi.org/10.1186/1475-2891-7-2

Locke, A., Schneiderhan, J., & Zick, S. M. (2018). Diets for health: Goals and guidelines. American family physician, 97(11), 721-728. https://www.aafp.org/afp/2018/0601/p721.html

López-Olivares, M., Mohatar-Barba, M., Fernández-Gómez, E., & Enrique-Mirón, C. (2020). Mediterranean diet and the emotional well-being of students of the campus of Melilla (University of Granada). *Nutrients*, 12(6), 1826. https://doi.org/10.3390/nu12061826

Mishra, P., Pandey, C. M., Singh, U., Gupta, A., Sahu, C., & Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. *Annals of cardiac anaesthesia*, *22*(1), 67. https://doi:10.4103/aca.ACA_157_18

Moreno-Agostino, D., Caballero, F. F., Martín-María, N., Tyrovolas, S., López-García, P., Rodríguez-Artalejo, F., ... & Miret, M. (2019). Mediterranean diet and wellbeing: evidence from a nationwide survey. *Psychology & health*, 34(3), 321-335. https://doi:10.1080/08870446.2018.1525492

Mujcic, R., & J. Oswald, A. (2016). Evolution of well-being and happiness after increases in consumption of fruit and vegetables. *American Journal of Public Health*, 106(8), 1504-1510. https://doi:10.2105/AJPH.2016.303260

Owen, L., & Corfe, B. (2017). The role of diet and nutrition on mental health and wellbeing. *Proceedings of the Nutrition Society*, 76(4), 425-426. https://doi:10.1017/S0029665117001057

Panchal, N., Kamal, R., Orgera, K., Cox, C., Garfield, R., Hamel, L., & Chidambaram, P. (2020). The implications of COVID-19 for mental health and substance use. *Kaiser family foundation*. https://doi:10.2147/PRBM.S264286

Peet, M. (2004). International variations in the outcome of schizophrenia and the prevalence of depression in relation to national dietary practices: an ecological analysis. *The British Journal of Psychiatry,* 184(5), 404-408. doi:10.1192/bjp.184.5.404.

Penninx, B. W., Guralnik, J. M., Simonsick, E. M., Kasper, J. D., Ferrucci, L., & Fried, L. P. (1998). Emotional vitality among disabled older women: The Women's Health and Aging Study. *Journal of the American Geriatrics Society*, *46*(7), 807-815. https://doi.org/10.1111/j.1532-5415.1998.tb02712.x

Ryff, C. D., & Singer, B. H. (2008). Know thyself and become what you are: A eudaimonic approach to psychological well-being. *Journal of happiness studies*, 9(1), 13-39. https://doi.org/10.1007/s10902-006-9019-0

Schotanus-Dijkstra, M., Pieterse, M. E., Drossaert, C. H., Westerhof, G. J., De Graaf, R., Ten Have, ... & Bohlmeijer, E. T. (2016). What factors are associated with flourishing? Results from a large representative national sample. *Journal of happiness studies*, 17(4), 1351-1370. https://doi.org/10.1007/s10902-015-9647-3

Schröder, T. (2016). Ernährungstrends im Kontext von Individualisierung und Identität. *HiBiFo–Haushalt in Bildung und Forschung*, *5*(3), 23-24. https://elibrary.utb.de/doi/pdf/10.3224/hibifo.v5i3.11

Silvers, K. M., & Scott, K. M. (2002). Fish consumption and self-reported physical and mental health status. *Public health nutrition*, 5(3), 427-431. doi:10.1079/phn2001308. PMID: 12003654.

Shi, Z., Taylor, A. W., Wittert, G., Goldney, R., & Gill, T. K. (2010). Soft drink consumption and mental health problems among adults in Australia. *Public health nutrition*, 13(7), 1073-1079. doi:10.1017/S1368980009993132

Shively, C. A., Appt, S. E., Vitolins, M. Z., Uberseder, B., Michalson, K. T., Silverstein-Metzler, M. G., & Register, T. C. (2019). Mediterranean versus Western diet effects

on caloric intake, obesity, metabolism, and hepatosteatosis in nonhuman primates. *Obesity*, 27(5), 777-784. doi:10.1002/oby.22436

Villani, L., Pastorino, R., Molinari, E., Anelli, F., Ricciardi, W., Graffigna, G., & Boccia, S. (2021). Impact of the COVID-19 pandemic on psychological well-being of students in an Italian university: a web-based cross-sectional survey. *Globalization and health*, 17(1), 1-14. https://doi.org/10.1186/s12992-021-00680-w

White, B. A., Horwath, C. C., & Conner, T. S. (2013). Many apples a day keep the blues away–Daily experiences of negative and positive affect and food consumption in young adults. *British journal of health psychology*, 18(4), 782-798. doi:10.1111/bjhp.12021

World Health Organization. (2005). Promoting mental health: concepts, emerging evidence, practice: a report of the World Health Organization, Department of Mental Health and Substance Abuse in collaboration with the Victorian Health Promotion Foundation and the University of Melbourne. World Health Organization.

Wright N, Wilson L, Smith M, Duncan B, & McHugh P. The BROAD study: A randomised controlled trial using a whole food plant-based diet in the community for obesity, ischaemic heart disease or diabetes. *Nutr Diabetes*. 2017 Mar 20;7(3):e256. doi:10.1038/nutd.2017.3.

10 Regeln der DGE. (n.d.). Retrieved February 12, 2021, from https://www.dge.de/ernaehrungspraxis/vollwertige-ernaehrung/10-regeln-der-dge/

Appendix A

Questionnaire Healthy Nutrition

1) How often do you eat a portion of meat on average?
(Note: 1 portion = 100 - 120g) For example: beef, pork, poultry, burgers, steak, bacon, sausage

6) Daily
5) 3-6 times per week
4) 1-2 times per week
3) 2 times per month
2) Less than 2 times per month
1) Less than 1 time per month to not at all

2) On average, how often do you eat a portion of fish?
(Note: 1 portion = 100-120g)

6) Daily
5) 3-6 times per week
4) 1-2 times per week
3) 2 times per month
2) Less than 2 times per month
1) Less than 1 time per month to not at all

3**) On average, how often do you eat or drink a portion of milk and/or dairy products?**
(Note: 1 portion = 150g) For example: milk, buttermilk, cheese, yoghurt, curd cheese, cream, cream fraiche, yoghurt dressing

6) Daily
5) 3-6 times per week
4) 1-2 times per week
3) 2 times per month
2) Less than 2 times per month
1) Less than 1 time per month to not at all

4) How many portions of fruit and/or vegetables do you eat on average?
(Note: 1 portion = one fruit or approx. 80g)

6) 5 or more servings per day
5) 4 portions per day
4) 3 portions per day
3) 2 portions per day
2) 1 portion per day
1) 0 portions per day

5) How many portions of the following foods do you eat on average?
(Note: 1 portion = 70g raw or 125g cooked). For example: Pulses, lentils, chickpeas, beans, (unsalted) nuts.

6) 5 or more servings per day
5) 4 portions per day
4) 3 portions per day
3) 2 portions per day
2) 1 portion per day
1) 0 portions per day

6) On average, how often do you eat products containing starch or cereals?
For example: Pasta, potatoes, rice, oatmeal, bread

6) Daily
5) 3-6 times per week
4) 1-2 times per week
3) 2 times per month
2) Less than 2 times per month
1) Less than 1 time per month to not at all

7) How often do you eat wholemeal products on average?
For example: wholemeal pasta, bread, rice, flour

6) Daily
5) 3-6 times per week
4) 1-2 times per week
3) 2 times per month
2) Less than 2 times per month
1) Less than 1 time per month to not at all

8) On average, how often do you eat or drink foods or drinks that are highly processed and/or contain preservatives, artificial flavours and colours?

6) Daily
5) 3-6 times per week
4) 1-2 times per week
3) 2 times per month
2) Less than 2 times per month
1) Less than 1 time per month to not at all

9) On average, how often do you eat sugary and/or fatty foods?
For example: chocolate, jelly, biscuits, fruit yoghurt, sausage, fast food, crisps

6) Daily
5) 3-6 times per week
4) 1-2 times per week
3) 2 times per month
2) Less than 2 times per month
1) Less than 1 time per month to not at all

10) On average, how often do you drink sugar-sweetened soft drinks?
For example: Nectars, fruit juice drinks, drinks with syrup, cola drinks, iced tea, lemonades

6) Daily
5) 3-6 times per week
4) 1-2 times per week
3) 2 times per month
2) Less than 2 times per month
1) Less than 1 time per month to not at all

How often do they use oils and butter in cooking, in dressings, or on bread?

6) Daily
5) 3-6 times per week
4) 1-2 times per week
3) 2 times per month
2) Less than 2 times per month
1) Less than 1 time per month to not at all