

# Diet During COVID: The influence of Stress and Income loss on individuals' Healthy Eating Behaviour (HEB)

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### **Abstract**

*The purpose of this research is to examine the changes in individuals' Healthy Eating Behaviour (HEB) during the 2020/2021 coronavirus pandemic. Expected changes are a worsening of HEB and this is theorized to be caused by increases in pandemic induced stress and loss of income as a result of the pandemic. With the use of first wave data from the UCL COVID study, linear regression analyses have been performed to test the possible relationship between stress, loss of income and HEB. No significant evidence has been found for a worsening of HEB. Significance has been found on the associations between HEB and stress and HEB and loss of income. The findings of this research may contribute to a growth in knowledge regarding individuals eating behaviour and possibly influence future policy makers dealing with a comparable health crisis.*

### **Keywords**

Healthy Eating Behaviour (HEB); Stress; Income; COVID

## Introduction

On the 20th of May 2021, the Dutch government initiated a new campaign with the intention of making people healthier. This was because the corona crisis very clearly showed how important a healthy lifestyle can be (NOS, 2021). One of the risk factors of suffering from serious harm or even dying from COVID-19 namely is obesity, which is associated with severe forms of the disease (Caussy et al., 2020). Potential causes of obesity are considered to be high intake of energy-dense foods and sugars and a number of preventive measures that are proposed are focused around healthy diets, high in fruits and vegetables (Swinburn et al., 2004). Because an individual's diet and the severity of the course of the disease might be related, it is interesting to further explore this relationship. More precisely, this research will focus on individuals' healthy eating behaviour (HEB) from both before and during the global pandemic.

It is argued that certain macro and micro phenomena during the pandemic could seriously influence healthy eating behaviour on an individual level. Firstly, it is believed that since the start of the coronavirus pandemic people will experience an increase in overall stress. There is not yet a scientific consensus on the exact number, but many scholars argue that there are multiple observable stressors that arose during the pandemic (Biondi & Iannitelli, 2020; Taylor et al., 2020; Hamouche, 2020; Fruehwirth, Biswas & Perreira, 2021) and the term 'COVID stress syndrome' has even been coined (Taylor et al., 2020). Following these findings, it is hypothesized that through processes of homeostasis, cortisol secretion and internal reward systems, this stress has the potential to lead to unhealthy eating behaviour (UEB). Another way in which this global crisis could have an effect on peoples' is through income changes. A sudden drop in income, as many have experienced (The World Bank, 2020), could lead to people choosing faster and cheaper options of which fruits and vegetable rarely seem to be a part of. Another possible effect of this loss of income could be a worsening of already high stress levels due to financial and economic strain, which in its turn will potentially lead to unhealthy EB. In this research, it is argued that that form of economic stress will operate as a partial mediator between loss of income and HEB.

Because dietary habits have been proven to influence the severity of the disease, it is interesting to find out whether individuals have altered these habits for the better or worse. So far, the factors of diet and stress during the pandemic have been looked at from a medical point of view where stress often was the dependent variable (Bousquet et al., 2020; Rishi et al., 2020;...). This fuels the notion that there appears to be a gap in scientific research on the

exact influence stress and change in income have on peoples' dietary decisions, which this research tries to dive into. We attempt to do so by looking into the relationship between the previously mentioned predictors and individuals' HEB from another point of view, namely from the idea that the pandemic in and of itself, through both stress, income and a partial mediation of the two, influences ones' choices when it comes to eating healthy. This possible correlation is even better specified by the main research question:

How have stress and change in income, caused by the coronavirus pandemic, influenced individuals' healthy eating behaviour (HEB)?

The relationships between income, stress and eating habits are not a novelty in scientific research. Not only have the effects of stress on eating habits been well documented (Cartwright et al., 2003; Groesz et al., 2012; Barrington et al., 2014; Unusan, 2006; Habhab et al., 2009; Gardiner et al., 2019; Roohafza et al., 2006; O'connor et al., 2008; Barrington et al., 2012), but there have also been plenty of associations found between income and dietary choices (Turrel, 1998;) and the effect of loss of income on stress is another association that has already been observed and dived into (Ruengorn et al., 2021; Shrivastava et al., 2018).

However, these elements, and their potential connection, have not been widely investigated during a global pandemic. Since such an extreme event happens once in a generation, this is a unique moment to further look into the triangular connection that stress, (change in) income and HEB composite. At the time of writing, the pandemic has been going on for almost 2 years in most western countries. If there are significant behavioural changes that can be observed, the lengthy duration of the current crisis should even further emphasize the importance of looking at these potential changes. Both long-term physiological and psychological effects of the pandemic can be found (Del Rio, Colins & Malani, 2020), even connected to nutrition (Butler & Barrientos, 2020), indicating that the consequences of the crisis can be felt long after its conclusion. Those consequences, especially related to individuals' food choices can be unique to this situation and unlike we have ever encountered before. Hopefully, this research will add to the overall scientific knowledge there is on the theoretical triangular relationship that we propose and give greater insight in how they are affected by an extreme global crisis such as the current pandemic.

This greater insight will also be beneficial for current societal processes, since the pandemic is still ongoing in most countries. Prevention and overall personal health could become part of governments' tactics regarding the current pandemic. When significant

changes to individuals' dietary habits are found and can be ascribed to the pandemic, this could make officials realise that there should be an emphasis on staying healthy in the communication between governments and their people. When alternatives to freedom-limiting virus containing tactics should arise, perhaps society can benefit from these alternatives. By lessening freedom restrictions and strengthening overall public health, perhaps we are better suited to deal with this pandemic for a longer amount of time.

## Theory

To answer the main question of this research it is important understanding the mechanisms in which the current pandemic could influence peoples eating habits and, more importantly, their consumption of fruits and vegetables. This research argues that that influence can be observed through three different paths.

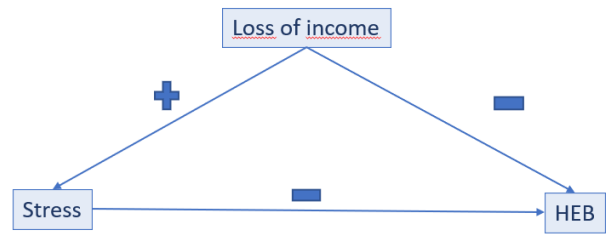


Figure 1. Theoretical model of Stress-Income-HEB relationship

## Income

One major way in which the Covid pandemic can influence peoples eating habits is through loss of income. Because the coronavirus pandemic and subsequent lockdowns have caused a worldwide economic shock on a macro-level (deepest economic recession for all countries as forecasted by The World Bank (2020)), it is very plausible to argue that negative financial consequences will trickle down to individuals and their households (Martin et al, 2020). For instance, widespread loss of jobs, particularly for low-wage workers, decrease in job vacancies and increases in unemployment insurance claims in the United States have been caused by the crisis (Chetty et al., 2020). Variations of these effects between sectors, occupations and different levels of income have been found in both the Netherlands (Von Gaudecker et al., 2020) and the US (Chetty et al., 2020). These negative consequences seem to be even worse in developing countries, where, for example, a third of respondents reported forced stoppage of work due to the pandemic (Khamis et al., 2021).

How this change in income could influence dietary decisions, is partly explained by Turrell (1998). He looked at socioeconomic differences in food preferences and the subsequent dietary choices individuals make. Found was, that respondents with higher incomes were mostly in line with dietary guideline recommendations and reported liking a higher number of healthy foods, compared to lower income individuals. This difference, was argued to be caused by an overall disliking of healthy alternatives by low income individuals (Turrell, 1998). That still raises the question as to why significant differences between SES groups in their food preferences have been found. This question can partly be explained by Bourdieu's conceptualization of class related differences in taste (1987). He states that there are two opposing concepts that can be ascribed to class, namely "tastes of freedom (luxury)" for the privileged and "tastes of necessity" for the working class (Bourdieu, 1987). Bourdieu found that heavy, fatty and coarse foods are those of the tastes of necessity for the working

class, while the bourgeois tastes of freedom consist of light, refined and delicate foods. Upper class individuals, as stated by Bourdieu (1987), prioritized style and presentation over substance, in other words: quality over quantity. The tastes of necessity are of course the other way around, they involve foods that are both filling and most economical, i.e. quantity over quality.

Views like those of Bourdieu, with an emphasis on differences in preferences still only account for half of the variability of income on food choice, when introduced in Turrels' analysis (1998). The other half could be explained by both physical and economical access to healthy food. Pechey and her partners (2014) argue that individuals in lower income groups have less physical access to healthy food outlets and are more exposed to unhealthy alternatives. Subsequently, when the choice between healthy and unhealthy foods is physically accessible, lower income groups are likely to choose more energy-dense foods (high in sugars and fats), due to them providing cheaper sources of calories (Pechey et al., 2014). The accessibility of food is a major focal point in COVID-related food research. The reason why is because during the pandemic, existing food systems were abruptly affected (Clapp & Moseley, 2020). This has the potential to lead to disrupted food supplies, price increases, rising levels of food insecurity and potentially even a further collapse of incomes according to Clapp and Moseley (2020). This vulnerability of the food systems and connectivity between economics and individuals' diets suggest that these two may be correlated.

This correlation between income loss and calory intake is also mentioned by Barry Popkin (2001). He states that the level of response from energy, fat and other nutrient intake to income change however is dependent on the demand for certain foods and overall dietary patterns. Examples of this are the rise in away-from-home consumption when income increases, in the Philippines. This type of consumption strongly consists of fried foods, thus making fat consumption highly responsive to income change. Similarly, the proportion of energy intake from fats is highly responsive to income changes in China, mainly caused by an increase in Pork fat consumption (Popkin, 2001). This latter example is also backed up by Aggarwal and her colleagues' (2011) findings that state that higher income was both associated with higher diet cost and higher quality of diet. These higher quality diets were, in fact, conceptualized as more healthy, compared to lower quality diets. Another finding regarding these high quality diets was that they were significantly higher in cost and these costs, in their turn were a significant mediator in the income-diet pathway (Aggarwal, et al., 2011). Suggesting that when people want to eat healthier, it will cost them more money. All

of these findings lead us to our second hypothesis: An experienced loss of income leads to a decrease of HEB (H1)

### **Stress**

The second path in which the current pandemic could influence individuals' eating habits is through an increase in stress. In this paper it is argued that this can occur in two manners. First of all, there has already been conducted a certain amount of research on the direct effects of the current pandemic on individuals' mental health and stress levels. According to Biondi and Iannitelli (2020) there are three sources of stressors that are connected to the disease that is caused by the novel coronavirus. The first, slightly obvious, source is the pandemic as a whole. It is considered the prime stressor due to it being a non-visible threat to individuals' and society's health. This threat is associated with an increase in individual pandemic concern. Nelson and Bergeman (2020) found that individuals were more stress-reactive on days that they were particularly worried about the pandemic. This act of worrying was, according to Nelson and Bergeman, mainly seen to be influenced by another major stressor that was also found by Biondi and Iannitelli, namely the 'infodemic'. This is the excessive news exposure regarding the pandemic, which can be seen as terrorizing and distressful (Biondi & Iannitelli, 2020). The third and final stressor which was highlighted by the two researches were nationwide lockdowns. The lockdowns and their subsequent social distancing measures have been a disruption of individuals' reality and normality of life. According to Fofana and colleagues (2020) lockdowns were also associated with an increased proneness to evolving psychological problems, including stress. All three stressors are considered to be traumatic, unexpected and able to affect anyone regardless of social, cultural or political differences. According to the two scholars, the phase people go through when facing these stressors is characterized by the change they experience which begins with disbelief ("who would have thought") and underestimation ("it's just a flu"), and could eventually progress, due to new and inventive coping mechanisms, into enormous anxiety.

A number of scholars have found that this increase in stress will in fact influence peoples eating habits, and particularly their fruit and vegetable intake. Cartwright and his colleagues found that stress is not associated with a simple de- or increase in overall consumption. It is, however associated with an increase in fatty foods and snack intake and, most importantly, a decrease in fruit and vegetable intake (Cartwright et al., 2003). This relationship was also found by Groesz and her colleagues (2012), who conducted research among a large variety of women. They found that greater perceived and chronic stress led to

more non-nutritious (high calorie, high fat) food intake and a self-reported decrease in healthy food (fruits and vegetables) consumption. However, explaining how an increase in stress could directly influence healthy eating behaviour seems to be a challenge. An explanation that is given by Barrington and her colleagues (2014) is that stress is caused by an overwhelming demand on an individual's resources, and that this overload leads to a rise in perceived stress. This is then associated with cognitive, behavioural and physiological changes, which aim to maintain a level of homeostasis (Barrington et al., 2014). This is the internal process that regulates stability and constancy, which is needed to properly function. Even under negative external influences (Stöppler, 2021), which in this case pandemic induced stress is an example of. According to Barrington and her associates (2014), a chronic activation of this stress response is related to a dysregulation in the body. This dysregulation, in its turn, has been associated with an increase in appetite, with a preference for sugary and fatty foods.

The role of cortisol in this process should be emphasized, according to Adam & Epel (2007). They theorize that threat related stress could lead to an increase in cortisol, which is strongly associated with the humans' reward system. This association however, is said to be partially mediated by an increase in hormones such as insulin and leptin (Adam & Epel, 2007). A negative state of 'hedonic withdrawal' can be caused by the effects of these hormonal mediators, which drives people to try to relieve themselves of this negative feeling. A way in which people have learned to do so is to reward themselves with the intake of highly palatable foods, which has been described as self-medication through food. This manner of stress eating has the potential to further stimulate the reward system, through increased cortisol and insulin levels, creating a positive feedback loop that maintains opioid stimulation from palatable foods (Adam & Epel, 2007). This finding, in combination with the serious number of empirical articles that found a negative relationship between increase in stress and HEB (Unusan, 2006; Habhab et al., 2009; Gardiner et al., 2019; Roohafza et al., 2006; O'connor & Conner, 2011; Barrington et al., 2012), leads to the second hypothesis of this article, namely: An increase in pandemic induced stress leads to a decrease in HEB (H2).

### **Stress-Income-HEB**

Although the aforementioned consequences of the coronavirus are of an economic nature, they could indeed have greater psychological effects. Namely through the concept of economic stress. This term was referred to by Helder (1988) as "the pressures and strains that arise from a substantial income loss". He argued that this sudden change in state was much more stressful than chronic deprivations, such as poverty and hardship. This argument is



backed up by the 2021 research, conducted by Ruengorn and colleagues (2021). They evaluated experienced economic strain that was caused by and occurred during the first wave of the COVID pandemic and the subsequential risk for mental health problems in a large sample of over 2300 participants. They not only found that individuals who lost their jobs were at a higher risk of perceiving stress, but the researchers also concluded that anxiety and overall mental health problems were associated with respectively, income loss and most notably self-reported financial problems (Ruengorn et al., 2021). Mental health and economically difficult times, according to Shrivastava and his colleagues (2018) also seem to have an interdependent relationship. They state that economic downturn-caused work changes have the ability to increase emotional and cognitive demands of work. These demands will then even worsen the absence and withdrawal from the labour market, due to stress-related symptoms.

These stress-related symptoms are in sharp contrast with the sound mental health that, according to Shrivastava et al. (2018) provide an essential base needed to operate optimally. Absence of this sound mental health may disrupt functionality, ability to take on new challenges, decision-making capabilities and opportunities for excellence and promotion (Shrivastava et al., 2018). That person's functionality, as described by those researchers can also be seen as 'cognitive bandwidth'. This is coined to be one's ability to plan, to stick to those plans, to pay attention, to make good decisions and resist temptations (Beenackers et al., 2018). When looking at the 'scarcity theory' in combination with that cognitive bandwidth, a connection can be made between financial induced stress and one's eating habits. This 'scarcity theory', according to Beenackers and her colleagues (2018) suggests that when dealing with scarcity, for instance scarcity of money, a lot of that cognitive bandwidth is taken up. When applied to the current COVID-19 pandemic, this theory would suggest that individuals that are already coping with stressors, such as job or financial insecurity may have even less bandwidth to make the healthy eating choices (Probst, Lee & Bazzoli, 2020). The pathway in which this reduction of cognitive bandwidth can affect healthy eating behaviour is through self-control, which is considered to be the 'capacity to regulate cognition and behaviour in order to achieve long-term goals' (Beenackers et al., 2018). Since self-control can be seen as a finite source, which has the potential reduce when demands are high, little of it may remain in times of financial scarcity, leaving little to no self-control for making healthy life choices. Especially when considering the current obesogenic society where unhealthy (food) choices are often easier over the healthy alternatives and stress, social pressure and social modelling are all able to trigger unhealthy lifestyle choices. When Beenacker and her

colleagues (2018) take into account that lower income groups are more often exposed to these negative circumstances, they argue that very little self-control is left for those lower income individuals to behave in a healthy way, particularly when kept in mind that many of our choices are impulsive. This impulsiveness then has the potential to take over even more easily when self-control is low or temptations are high, leading to people making even healthier decisions. (Beenackers et al., 2018). The further worsening of stress, caused by economic downfall and this potentially resulting in unhealthy lifestyle choices leads to the third and final hypothesis of this research: stress is the partial mediator between income and HEB (H3).

## **Data & Methods**

Data used in this research is derived from a national COVID-19 study that was conducted by the University of London Centre for Longitudinal Studies. A series of surveys had been run from their four national longitudinal cohort studies that have been conducted in the UK: the Millennium Cohort Study (MCS), Next Steps (NS), the 1970 British Cohort Study (BCS70) and the National Child Development Study (NCDS). Members of the MCS (Both cohort members as their parents were included) were born in the period 2000-2002, NS in 1989-1990, BCS70 in 1970 and NCDS participants were born in 1958. Of all the birth cohorts participants were followed up from birth, except for the NS, where participants were followed up from adolescence. Regular evaluations of these cohort studies are reported elsewhere (CLS, w.d.). For this research, a series of surveys conducted during the coronavirus pandemic have been used. These surveys were sent to all participants of each cohort. The main targets of exploration in these surveys were economic, social and health impacts of the COVID-19 crisis, whether this pandemic has enlarged or reduced existing societal inequalities and the prevailing factors that influence the fragility and adaptability to the pandemics consequences. The surveys were conducted in three waves of which the first one will be used during the analysis of this research. This due to the highest number of responses on our variables of interest, thus creating a higher chance of generalizability. Another reason for choosing the first wave was the fact that stress and stressful events were proven to be highest in May 2020 among US adults (Kujawa et al., 2020). Indicating that our expected correlations may be best observed when looking at measuring points closest to the start of the pandemic, which the first wave of course was. Participants were contacted solely through emails, which began early May of 2020. Questions aimed towards those individuals focused on getting insight in participants' lives and how it had changed from the period approaching the start of the pandemic. Participants who did not start, or had not fully completed the survey were sent

two reminders with weekly intervals. For the first wave, a total of 50.479 individuals were asked to participate, following the response of 18.042 individuals, a response rate of 36 percent was determined. Since income is one of the main variables of interest, it was chosen to filter out respondents from the MCS. Since those respondents are between 19 and 21 years old, we argue that the importance and therefore effect of income on lifestyle habits are relatively small compared to the general population. Prior to analysing the results, all missing values were looked into and dealt with. If participants had missing values on one of the used variables, they were filtered out of the data used. All of these filters and selections eventually resulted in a participant group consisting of N=12.624.

### **HEB**

To measure healthy eating behaviour (HEB) the existing data provided a somewhat cumbersome method to do so. The data did provide measures which were previously used as indicators for HEB. Namely, simple and clear numbers were provided regarding individuals' fruit and vegetable intake. The consumption of fruits and vegetables was also used as an indicator for HEB in a significant amount of research (Strachan & Brawley, 2009; Fila & Smith, 2006; Long & Stevens, 2004). HEB is measured through two questions, starting with "*In the month **before** the start of the Coronavirus outbreak, how many portions of fresh fruit and vegetables did you eat in a typical day?*" where a portion of fruit was specified as "a whole piece of fruit, like an apple or banana or 80g of fruit (like in a fruit salad)" and a portion of vegetables, according to the survey, consists of "3 heaped tablespoons of cooked vegetables or beans/pulses or a handful of cherry tomatoes or a small bowl of salad. It does not include potatoes. Juice/smoothies can count as 1 portion per day". These specifications are in line with both NHS and WHO regulations and specifications (NHS website, 2021.; World Health Organization, w.d.). Secondly, the question "Since the start of the Coronavirus outbreak, how many portions of fresh fruit and vegetables have you eaten in a typical day?" was asked to the participants. Answers were provided that consist of the total number of fruits and/or vegetables that a participant consumes per day. Participants' answers varied greatly, and contained some extreme outliers. 59 respondents, or 0,4 percent of the sample provided a number of fruits and vegetables that immensely exceeded 10 portions. This was accounted for by sorting these extreme outliers in the value 10 and higher. Answers to these two questions were used in computing a variable that signified the change in fruit and vegetable consumption. First inspections showed that for the greater part of the population, figures after the outbreak were higher than before. This in combination with the fact that the change in

HEB is of interest, it was decided to subtract the figures from before the pandemic from those after the outbreak. Those answers were then recoded into our main variable of interest, the actual change in HEB.

### **Stress**

To measure stress, we used the question regarding participant's feelings of stress since the coronavirus outbreak. This was measured with a three point scale where respondents were asked if the amount of stress they have been feeling was more than before (anchor 1), same or without change (2) or less than before (3). Because this research is built around the idea that an increase in stress might influence HEB, this scale was used to create a new dichotomous variable, with the options of an increase in stress (1) or no increase in stress (0) due to the coronavirus. This new variable was then used to test both our first hypothesis (H1) and our third one (H3).

### **Income**

The main question which was looked at for the variable 'loss of income' was "Overall, how do you feel your current financial situation compares to before the Coronavirus outbreak?". Answers on this question were on a 5 point Likert scale, ranging from "I'm much worse off" (1) to "I'm much better off" (5). This creates a variable in which there are 5 different groups, which were then recoded into a dichotomous variable of 'loss of income', where 1 signalled a experienced loss of income and 0 signalled no experienced loss of income.

### **Control**

To fully test the hypotheses, it was important to eliminate as much white noise in the statistical process as possible. This is done by looking at other factors that might influence HEB. For example, men, younger individuals and individuals with a lower SES are all less likely to have a healthier eating pattern than their traditional comparison groups (Herman & Polivy, 2010; Lien, Jacobs & Klepp, 2002; Hiza et al., 2013). Similarly, individuals with a high level of self-reported health are also expected to have healthier eating behaviours than individuals with lower scores on their self-reported health (Mint et al., 2007). Another factor that might influence HEB is whether participants have partners or not. It is theorized by Powell and her colleagues (2015) that being in a paired relationship (having a spouse or partner) is significantly associated with an individual's weight and risk for obesity. This is due to partners motivating each other to either eat healthy or non-healthy food and the researchers even found that act of seeking for marriage may reduce a person's weight, causing them to behave more healthily (Powell et al., 2015). To control for each of these socio-demographic

effects, sex, age cohort, whether respondents have a partner or not and self-reported general health were modelled. Sex was modelled to be 1 when the respondent was male and 0 for females. Yes was the answer on whether respondents were in a relationship when they scored a 1 on the partner variable, 0 was the value for singles. Age cohorts were copied according to the grouping as done in the dataset. The respondents self-assessed general health was asked in the provided questionnaire, asking “In general, would you say your health is....”. Possible answers were on a 5 point scale, ranging from ‘poor’ as lowest till ‘excellent’ as the highest answer option. This was also copied and used in the manner which was provided during our analyses.

### **Analytical approach**

First, general linear model analysis was applied to describe the gradient in HEB, using stress as predictor. This was done for the purpose of testing our first hypothesis, namely whether an increase in pandemic induced stress will lead to a decrease in HEB. Secondly, the same approach was taken to test the second hypothesis of this research: change in income is positively associated with HEB. In this second analysis HEB was again looked at as dependent variable, while in this case the change in income scale was used to predict possible change in HEB.

The most challenging to test was the third hypothesis, where it was theorized that stress is a partial mediator in the relationship between change in income and HEB. To do so, the method introduced by Baron and Kenny (1986), Judd and Kenny (1981) and James and Brett (1984) was used. This method, as discussed by those scholars, consists of four different steps. Firstly, in order to show a causal relationship between the main predictor variable and the outcome variable a simple linear regression had to be performed between income change (predictor) and HEB (outcome). This step established the effect that may be mediated. In order for a mediation to take place, the main predictor variable has to correlate with our expected mediator variable, namely stress. To test this, another linear regression with change in income as predictor, and this time stress as outcome variable was done. The third step in this approach is to test the actual mediation. For this, both loss of income and stress were used as predictor variables in a regression where the outcome variable was modelled to be HEB. By doing so, not only is the correlation between stress and HEB tested, but also a control for change in income is put in place to establish the effect of the mediator (stress) on the individuals’ HEB. The fourth step that is mentioned by Baron, Kenny, Judd, James and Brett is a final test to check if the mediation is a complete mediation. However, because it already

was hypothesized that the mediation would be partial, this test was not seen as necessary and therefor not performed in this research

## Results

### Descriptives

The descriptive statistics of all variables are displayed in Table 1. Change in HEB had a mean of .01, which indicates that, on average, there was the slightest increase in HEB. Stress had a mean of .38, thus indicating that for the better part of our sample, people did not experience an increase in stress. Loss of income had a mean of .32, which signifies that for the larger part, a loss of income has not been experienced by our participants. However, still a third of our sample experienced a loss of income, which sparks interest in the effects of this experienced loss. The mean of .41 of our sex variable indicates that there have been slightly more women who participated in our sample than men. Most of our participants had partners and, on average, reported their general health to be between good and very good.

**Table 1:** Descriptive Statistics (N=12.624)

	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation*</b>
<i>Independent</i>				
HEB	-9.00	7.00	.01	1.02
<i>Dependent</i>				
Stress	.00	1.00	.38	-
Loss of income	.00	1.00	.32	-
<i>Control</i>				
Sex	.00	1.00	.41	-
NCDS	.00	1.00	.37	-
BCS70	.00	1.00	.30	-
Next Steps	.00	1.00	.13	-
Parents MC	.00	1.00	.20	-
Partner	.00	1.00	.85	-
General Health	1.00	5.00	2.35	1.47

\* Not Shown for dichotomous and categorial variables

A simple linear regression was calculated to predict participants' change in HEB based upon loss of income. The results of this analysis are shown in Table 2, under model 1. As expected, loss of income was correlated with HEB ( $F(7, 12616) = 116.39, p < .001/2$ ), with an  $R^2 .006$ . Participants change in HEB, in this case, is equal to .20 plus .12 when a loss of income was present. Signalling that participants increase of .20 portions of fruit and vegetables, even further increased with .12 when a loss of income presented itself during the pandemic.

Another simple linear regression was calculated, this time to predict participants change in HEB based upon a potential increase in stress. Results of which can be seen in table 2, under model 2. Not as expected, HEB change was positive ( $B=.10$ ), meaning that individuals actually increased their HEB after the start of the pandemic. However, in line with our expectations, increase in stress was negatively correlated with change in HEB ( $F(7,12616) = 12.147, p < .001/2$ ), with an  $R^2$  of .006 (see Table 2). Participants change in HEB is equal to .10 minus .08 when an increase in stress was perceived. Participants' fruit and vegetable intake increase of .10 portions of fruit and vegetables decreased with .08 when they perceived an increase in stress during the pandemic.

To test our third and final hypotheses regarding the mediating effect of stress in the pathway between HEB and income change, 2 more regression analyses have been performed. Firstly, to see whether there is an association between stress and income change, we performed a linear regression with change in income as predictor and stress as dependent variable (see Table 2, model 3). As expected, these two appear to be correlated ( $F(7,12616) = 172.85, p < .001/2$ ), suggesting a mediation of the income-HEB pathway through stress. However, to fully test this a final analysis had to be performed (see Table 2, model 4). Comparing the first and final model of our regression analyses, we can observe that the role of income loss, both loses strength ( $B=.12$  before and  $.02$  after introduction) and significance ( $p < .001$  before and  $p=.43$  after) when stress as a mediator is introduced. This finding, again is as expected.



Table 2: Regression analyses

<b>B</b>				
	Model 1	Model 2	Model 3	Model 4
Constant	.20***	.10**	.34*** (.02)	.11 (.05)
<i>Predictors</i>				
Loss of income	.12*** (.01)	-	-.12*** (.01)	-.02 (.01)
Stress	-	-.08*** (.02)	-	-.08*** (.02)
<i>Control</i>				
Sex	-.15*** (.01)	.08*** (.02)	-.15*** (.01)	.08*** (.02)
BCS70	-.06*** (.01)	-.06** (.02)	.07*** (.01)	-.06** (.02)
Next Steps	.13*** (.01)	-.04 (.03)	.14*** (.01)	-.04 (.03)
Parents MCS	-.05*** (.01)	-.06* (.03)	.06*** (.01)	-.06* (.03)
Partner	.01 (.01)	.05 (.03)	.01 (.01)	.05 (.03)
General health	-.07*** (.01)	-.04*** (.01)	.06*** (.01)	-.04*** (.01)
N	12624	12624	12624	12624
R <sup>2</sup>	.06	.01	.06	.01
Δ R <sup>2</sup>	-	.00	-	.00

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

## Discussion

The purpose of this research was to regain insight on change in individuals' HEB during the coronavirus pandemic. Because of the role of individuals' diet on the course of the disease and lack of scientific knowledge regarding our theoretical triangle, it was found to be a relevant research in these unique times. It was hypothesized that due to an increase in stress and a loss of income, both caused by the pandemic, a significant change would occur in peoples dietary habits. This was tested using a large UK sample group, provided by the UCL. An overall increase in HEB has been observed, but some significant results of our independent variables can be seen.

Firstly, we examined the effects of loss of income on HEB. Our analysis showed a strong correlation between these two factors, which was as expected. This finding indicates that when people experience a loss of income, it will most likely affect there eating habits negatively. This may be partly due to a decrease in food accessibility, which we discussed when constructing our hypothesis, when a decrease in financial resources is observed.

The second hypothesis of this research, an increase in pandemic induced stress would lead to a decrease in HEB, has not been proven by the executed analyses. This means that when a participant perceived an increase in stress after the outbreak of the pandemic, no significant decrease in HEB has been observed. It did, however show that the slightest increase in HEB that was observed, was tempered by the stress variable. This could in fact still indicate a relation between stress and HEB, but that has to be looked into further. One important given that future research should take into account is the interesting fact that stress has the potential to lead to an increase as well a decrease of overall food consumption (Groesz et al., 2010). Indicating that individual differences might explain the variance of the stress eating pathway.

Our third and final hypothesis, on the mediation effect of stress between loss of income and HEB, has also been statistically proven. The addition of extra regression analyses using loss of income and stress did change the proportion of variance of loss of income. This means that there has been found proof that a loss of income worsened pandemic induced stress and therefore, indirectly influenced the eating behaviour of individuals. As theorized earlier, it is expected that in line with scarcity theory, financial burden will worsen once abilities to make good decisions. Even having the potential to create a negative feedback loop where eating unhealthy foods gets reinforced (Adam & Epel, 2007).

There are a number of limitations to this research that should be taken into account. The first being, that the surveys were conducted in the United Kingdom. Although the data

was gathered within a large, diverse set of British participants, findings in this research are not representative for all nationalities. Future research could potentially look into the researched relationships across different nations and perhaps even compare these different nationalities. Especially when considering that governments imposed different measures to cope with the negative effects of nationwide lockdown. A cross-national research could then in fact test whether these different policy measures would lead to different outcomes.

The sample size, however, also was a huge advantage in this research. Due to the enormous sample size, results were statistically more reliable and overall very generalizable. Unfortunately the data did not provide us with perfect versions of key variables. Most notably, the variable of loss of income was most difficult to operationalize. This due to the absence of concrete figures regarding the participants' incomes. Another key variable that could have been more representative of its property was that of stress. It was asked on a 3 point scale in the survey whether respondents experienced an increase, decrease or no change in stress levels. If respondents had been asked both before as after the outbreak of the crisis what their levels of stress were from 1 to 10, for instance, this would have given a more precise measurement of stress levels.

Due to these different limitations, the results of this paper should be taken lightly. However, the importance of a healthy diet, especially when obesity seems to affect the severity of this disease, should be emphasized. When significant evidence can be found on the different influences of HEB, governments can focus part of their energy on these influences. It should be taken into account that an overall healthy population would have been more resistant than the obesity-prevalent societies that seem to emerge. Future policies could be focused on reducing or eliminating taxes on healthy foods, such as fruits and vegetables. Also, an implementation of a sugar tax has the potential to reduce unhealthy diets and improve overall health (Mytton et al., 2012).

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