EATING YOUR FEELINGS AT HOME:

NUTRITION TRACKING EXPERIENCES DURING THE COVID-19 PANDEMIC

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Preface

Like many people living through 2020 and at least half of 2021 (so far), the coronavirus pandemic has become an inescapable reality for me and has had a profound effect on my overall wellbeing as well as my physical and mental health. However, I knew my experiences were not unique to me and even more so, shared by many young professionals of my generation and particularly by those living in Europe and in the Netherlands.

The topic of this thesis was inspired by conversations held with friends, colleagues and acquaintances, which all seemed to have a recurring theme: we're living in extraordinary times and life as we know it is unrecognizable. During these conversations, another topic gained dominance: food. Food, one of the few sources of pleasure that didn't require leaving the house apart from the occasional trip to the supermarket, which at times, was the only establishment that we were able to set foot into due to the government's closure of all non-essential shops. Food, therefore, is essential.

Reconciling the need to maintain the semblance of normalcy and a daily routine while trying to stay healthy, and fit into anything apart from a pair of sweatpants led me to ask myself, perhaps I should start tracking what I eat? Thinking how I could easily do this with the tools available to me, I did what any millennial would do, I typed "diet" into my iPhone's app store and found a dizzying variety of apps claiming to help me track the food I was eating. It seems, I was not the only one who used my trusted gadget to help me get through this trying time and thus, this research was born.

This is dedicated to everyone who listened to my confessions about my pandemic lockdown habit of snacking in bed and said: "this too shall pass".

1. Introduction

In 2021, typing the word “diet” into Google Play, the digital app store for Android-based mobile phones, will yield over 1.7 million results. This incredibly large selection for a category of apps aimed at helping their users achieve their weight goals is a predictive measure of their popularity and visibility in the digital space. Currently, the most downloaded app in the store is MyFitnessPal, which since its purchase by American fitness brand Under Armour in 2015, has exponentially grown and quadrupled its userbase from 50 million at the time to 200 million by 2020. Under its new ownership, it has also doubled its revenue from $64 million in 2016 to $128 million in 2020 (Curry, 2021). The rise of fitness and nutrition tracking apps does not come from a vacuum, however, and is based on years of research.

Almost 30 years have passed since a link was established between methodically tracking one’s nutritional intake and losing weight (Baker & Kirschenbaum, 1993). These researchers arrived at the conclusion after comparing and analyzing studies, which addressed journaling as part of the weight loss journey and theorized that self-awareness was the key to the participants’ success. Support for this theory was based on the importance of the role of self-monitoring to lead to behavioral change. One study (Pliner & Iuppa, 1978) that particularly influenced this assumption asked its subjects to put a mirror in front of themselves as they ate. By doing so, researchers concluded that participants reduced their food intake when they observed themselves eating and were able to reflect on this menial activity. Surprisingly, this manipulation had an effect on both normal and overweight subjects, though the former had a much smaller effect than the latter.

This theory paved the way for mobile applications to utilize technology to do the same in a more accessible manner. The latest survey of mobile health apps (Ferrara et al., 2019) estimates over 325,000 apps in current use, while nutrition tracking apps rank

amongst their most popular iteration. To date, the seven most popular apps ranked by rating and download count for both iOS and Android operating systems are MyFitnessPal, MyDietCoach, Calories Counter, Lose It!, LifeSum, MyPlate Calorie Tracker, and Argus. These apps all share similar functionalities of calorie counting, complex nutritional information and all promote self-efficacy through tracking one's diet and motivation toward nutritional goals.

However, over a decade after their introduction into the app market, heralded by an article in the New York Times (Alderman, 2010), it's clear they're here to stay and multiplying by volume and user base as the years go by. Despite nutrition tracking apps varying in function and purpose, they all share the common goal of being a daily diet companion for any user with a smartphone wishing to improve the way they eat or at least work towards a nutrition goal in their everyday life. Nevertheless, the apps' designers didn't prepare for one particular scenario of usage; a pandemic.

During the course of the COVID-19 pandemic, it became evident that apart from the stress and anxiety caused by the unforeseen reality, the low levels of physical exercise caused by stay-at-home orders in many countries have affected people's lifestyles and has been linked to both body obesity and hunger disorders (Di Renzo et al., 2020). One country where the population was particularly affected by the Ongoing health crisis is the Netherlands. Located in Western Europe, the country of over 17 million experienced one of the world's longest ongoing social restrictions to its populace including shuttering its non-essential businesses as well as imposing a strict curfew that lasted for 3 months. The country's restrictions meant to contain the virus and prevent it from spreading didn't come unwarranted; As of May 2021, the Netherlands was number 21 in coronavirus cases worldwide (Coronavirus Disease [COVID-19], 2021) regardless of population size or mortality rate. The stay at home order in the Netherlands came into effect on 15 March 2020

as businesses and places of leisure were asked to close their doors immediately via a government announcement. A day later, Dutch Prime Minister, Mark Rutte addressed the nation and said “The reality is that coronavirus is here in our midst, and for the time being it is here to stay.” (Government of the Netherlands, 2020). The aforementioned “time being” turned out to be far longer than anticipated at first and set the country on a course of several lockdowns and restrictions that to date have not yet fully ended. The coronavirus spread rapidly and increased in waves, thus prompting the world’s governments to protect their citizens and react in a way they each individually saw fit.

As in many parts of the world, Dutch residents were asked to stay home and limit social contact with fluctuating severity depending on the harshness of the restrictions throughout the course of the pandemic. Among the country’s residents and the world over, younger professionals under 40 were particularly affected by the government’s restrictions (Rudolph & Zacher, 2020) since they had finally established themselves in the workforce and began taking larger steps in their careers. Apart from becoming serious contenders in the workforce, young professionals from the Millennial Generation maintain heavy social contact in comparison to their colleagues with larger families and greater responsibilities. Absence from an office environment at the building stage of their careers and less time spent with their growing social circles as they shape themselves as adults are two major reasons why this particular populace warrants a closer look.

Apart from young professionals being especially affected by the new reality during the time they’re actualizing their (possibly) permanent careers and selfhoods, Millennials have already experienced many world-changing events at a relatively young age. From 9/11 to the economic recession of 2008, this generation can be considered unlucky (Van Dam, 2020) and denied major life milestones that were accessible to previous generations at a younger age. Social frustration aside and directly in relation to mobile apps, the interest in

studying millennials stems from their unique position of not being born into advanced mobile technology. Instead, they can be seen as beta testers for new ideas of how technology can integrate into and improve one's life. This is in contrast to the true digital natives of Gen Z, who do not need to adapt to digital platforms and regard technology as invisible and a given (Koulopoulos & Keldsen, 2016). The unique way young adults experience technology in combination with their perception, attitudes, and usage patterns of mobile nutrition apps justify the research.

1.1 Aim and research questions

Digital tools and technologies have been widely used by people as a coping mechanism during the coronavirus pandemic (Garfin, 2020). In an initial study, one researcher found that while the negative effects of constant scrolling through social media have not been alleviated during this period, using technology to get in touch with family and friends has been beneficial for mental health overall. Moreover, enlisting technology to create or maintain a daily routine consisting of generic activities such as work, leisure and exercise has been found to have a positive effect as well (ibid.). However, scarce research has been done with a specific focus on nutrition-tracking apps, which should be given more attention considering the importance of individuals' daily maintenance of their health in a global pandemic. In addition, given the aforementioned characteristics, researching young professionals specifically can give insight into how the Millennial generation copes with the pandemic's challenges in the context of health and of nutrition specifically.

To bridge the gaps in existing literature, this research aims to provide insight into the user experience of nutrition apps among millennials living in the Netherlands as they handled COVID-19's constraints, several lockdowns, and numerous restrictions by answering the following research questions:

(Research question) "How do Millennials in the Netherlands experience the usage of

diet and nutrition-related apps during the coronavirus pandemic?"

(Sub-questions) 1. What are their motivations of using nutrition tracking apps during the pandemic? 2. How do they perceive their usage of these nutrition tracking apps during the pandemic? 3. How do they perceive the impacts of these nutrition tracking apps on their general health and daily routine under lockdown?

1.2. Relevance

The Netherlands was not the only country that imposed strict measures to relieve its population of the virus, but this study will focus on its residents, particularly its young professionals whose routines and daily activities were heavily disrupted due to the stay at home orders and the restrictions that were imposed. Among the many restrictions, the lack of opportunities for physical exercise was particularly disruptive to a generation accustomed to fitness as well as the belief that following healthy eating habits is more important than fad diets, which were popular with their elders (Mattson, 2018).

Despite the knowledge that healthier eating works better in the long term, the additional time spent at home and unwillingness to cook during the pandemic have accelerated the growth in food delivery. When asked in early 2021 (Le Clercq), 50% of people living in the Netherlands stated they do not feel like cooking at least once a week. During 2020, only 35% reported the same sentiment. Food delivery and staying static led to weight growth as well. Following a worldwide survey (Ipsos, 2020), it was found that, on average, Dutch respondents admitted to gaining 5.6 kilograms of bodyweight since March 2020. Moreover, 42% of people living in the Netherlands reported trying to lose weight during the pandemic.

Confined to their homes, the usage of mobile phones skyrocketed during the pandemic (Pratt, 2020) and their technology became even more imperative for social interaction and to keep a resemblance of normalcy, particularly for Millennials, who had just

settled into adulthood and stability. Overweight and mobile-dependant, this study examines the millennials who chose to find an alternative way to keep off the corona kilos while stuck at home: food management.

Managing one's calories through digital assistance has been one of the cornerstones of the Quantified Self movement which legitimized the tracking of mundane daily activities and environmental factors intending to create beneficial habits and to increase productivity towards the achievement of personal goals. The term "quantified self" dates back to 2007 and was coined by two Wired magazine editors, Kevin Kelly and Gary Wolf (Lupton, 2016). In the following years, Wolf continued to develop the manifest of the movement through talks and publications while a new generation was emerging into adulthood: Millennials.

There have been numerous papers researching users of nutrition-tracking apps and what motivates them to make use of the tool, particularly in connection to the Quantified Self movement (Gimpel et al., 2013). However, to date there are few studies that put the focus on Millennials in this regard. One recent study (Okumus, 2021) aimed to capture Millennials' understanding of what constitutes healthy eating, their eating behavior and the possible impact of stress on eating. One of many emerging studies within the lens of the coronavirus pandemic, this research can provide academic insight into the millennial psyche, their coping mechanisms and the effect that prolonged confinement and uncertainty have on young adults using an app to improve and control their diet.

1.3. Synopsis of the research method

The research method selected for this study consists of a inductive thematic analysis on the collected semi-structured in-depth interview data. The author interviewed 10 millennials who use nutrition tracking apps living in the two largest cities in The Netherlands—Amsterdam and Rotterdam—during the coronavirus pandemic lockdown. The nutrition-tracking app users who agreed to be interviewed were found through the

researcher's personal LinkedIn post calling for participants to sit for an online interview. The recruiting criteria were: living in the Netherlands for at least 3 years, between the ages of 24 and 39, an employee with a full time job, uses or used a mobile app with a prevalent nutrition-tracking feature in 2020-2021 and earlier if applicable. The semi-structured in-depth interviews were used to gather the data about the participants' user experience with the apps and understand how Millennials in the Netherlands experienced the usage of diet and nutrition-related apps during the coronavirus pandemic

1.4 Overview of the thesis structure

This first chapter of the thesis introduces the rationale for the study, which examines the user experience of nutrition tracking with apps through the eyes of young professionals living in the Netherlands during the ongoing coronavirus pandemic. The nutrition apps' features are therefore scrutinized through the context of this population as its members were heavily affected by the environmental changes to their lives and are considered digital natives accustomed to following healthy eating habits. The second chapter establishes the theoretical framework of this thesis by reviewing relevant literature related to millennials, nutrition tracking, the Quantified Self movement and the unique characteristics of life during the COVID-19 pandemic.

The third chapter explains how and why semi-structured interviews were used for the study's data collection and delves into the analysis method of Inductive Thematic Analysis. The analysis of the interviews utilizes the "bottom-up" method of meaning making to reach specific observations on the experiences and motivations of the participants who used the app during the aforementioned time period. The fourth chapter presents the main themes uncovered by the interviews and identifies the patterns of apps' user experience.

The final chapter discusses the main findings presented in the fourth chapter by applying the theory of Quantified Self, key motivational factors and the benefits behind the

app usage. This chapter also discusses the main challenges faced by the app users during the pandemic and considers the theoretical implications of the research. The author also proposes directions for future research concerning nutrition apps and studies related to the coronavirus.

2. Theoretical literature and conceptual framework

2.1 Literature review on various approaches to nutrition-tracking behaviors and apps

In 2010, the New York Times published one of the first articles (Alderman, 2010) that recommended nutrition tracking apps as a new way to watch one's diet with an easy, human approach to controlling their users' daily nutrition intake. By that time, a pioneering app named Lose It! had been available for download for over a year and had already attracted over 5 million users. Despite the mobile revolution of having a nutritionist in one's pocket, the link between tracking personal nutritional intake and losing weight was already established in a behavioral study two decades earlier. This study (Baker & Kirschenbaum, 1993) proved that self-monitoring was a leading factor in consistent weight loss amongst its participants. During that period of research, using pen and paper to track nutrition was the main method to track food consumption. However, researchers eventually questioned the effectiveness of this method and tested the same theory with the new mobile nutrition tracking apps as they became more readily available. In the first large clinical trial between the two methods (Burke et al., 2011), these self-styled pocket digital assistants showed higher adherence to nutrition tracking and a more realistic tool for weight monitoring or weight loss.

As this new technology emerged, its effects and effectiveness were being held under the scrutiny of research. An initial study (Breton et al., 2011), which examined the diet apps' content concerning evidence-informed practices raised serious doubt about their effectiveness in assisting in successful weight management and advised their users to seek additional sources of self-help, preferably those that have received professional input and evaluation.

Another study (Peng et al., 2016) in the field attempted to measure the perceptions of mobile health and diet apps' users and discovered that there was (at the time) low awareness,

lack of app literacy, and consciousness of cost when deciding whether or not to make use of them. Moreover, users were reluctant to adopt long-term usage of the apps due to the low motivation and discipline that were associated with them. Furthermore, later research (Goldstein et al., 2017) even suggests that using mobile technology exclusively for the purpose of tracking users' successes in association with weight-related behaviors is not enough to pinpoint any particular advancements in said behavior.

The common thread between the studies that arises suggests that participants were not asked about which features they find more useful and mostly focus on behavioral change addressing whether or not the participants were successful at maintaining or losing their weight while tracking their food through the apps. This gap in research can be addressed in the main theory of the research, which maintains that users of mobile diet and nutrition-related apps use them more frequently and with higher commitment during the pandemic due to their emotional state.

Because the level of one's food consumption has been strongly linked to one's emotional state (Canetti et al., 2002), examining this relationship is key to learning more about users' motivations for using the apps and increases the need to measure whether or not the apps' characteristics play a part in their long-term usage by consumers under changing environmental conditions. Because mobile apps are generally developed for users under typical circumstances, it is reasonable to suggest that a global pandemic can affect how they are used and perceived.

Pandemic-related stress and a negative emotional state were already being researched in real-time during the first few months of the coronavirus pandemic. One particular study (Birditt et al., 2020) examined emotional well-being in relation to age and found that younger adults displayed higher rates of anxiety and depression due to job insecurity, a major decrease in social interactions and even being forced to move back home with their

parents as its contributing factors. In comparison, older adults are believed to be more equipped to regulate their emotional responses to stressful periods and events with less need for external aid (Neubauer et al., 2019).

Additional research addressing generational differences in coping mechanisms (Anderson et al., 2016) suggested that Millennials are open to the benefits of self-care and generally receptive to the idea of seizing opportunities to improve their health by using health apps but struggle to continue using them after meeting initial milestones. A major environmental change with severe restriction of movement could shed light on this generation's motivation to use these particular apps. A changed environment, stress, and their link to health habits were already examined in studies such as Ball & Bax's (2002) research on first-year medical students adjusting to their newfound mental stress during the start of their studies. The structure of educational intervention in the students' lives proved promising in its ability to change negative health patterns, but the study was still undecided on whether or not self-care needs to be further examined in its relation to dealing with long-term stressors. Acute observation of what one eats as an act of self-care suggests the contrary and is worthy of closer inspection.

2.2. Conceptual framework of quantified self

This promise of dietary agency through knowing the almost exact intake of one's nutritional values is just one promise of the Quantified Self (QS) movement. Swan (2013) defines a QS participant as "Any individual engaged in the self-tracking of any kind of biological, physical, behavioral, or environmental information" (p. 85). Meaning, the movement believes in a proactive approach to gathering data and acting on it. A cording to the philosophy of QS, weight, energy level, emotions, time consumption, sleep quality, health, cognitive function, sports, and learning techniques are just a few of the areas that may be watched and analyzed. This proactive stance contrasts what would be an otherwise

passive attitude towards acquiring knowledge regarding what dwells in the background of one's daily routine, regardless of its perceived importance. By partaking in the act of tracking, members of the movement hope to improve their ability to notice the impact of seemingly insignificant events on their attitudes and decisions.

The actual term "quantified self" was first publicly used in 2008 by a hobbyist group of self-tracking enthusiasts in California founded by journalists Gary Wolf and Kevin Kelly who developed and shared tools to gain insight into various aspects of their lives through numbers. The group eventually gained popularity and grew into multiple national chapters and expanded into additional countries, which all practiced personal science. Personal science is defined by Wolf and De Groot (2020) as the use of empirical methodologies to investigate personal matters relating to one's life and follows these five steps:

1. **Questioning** - Queries are raised regarding the individual's private life, experiences, emotions and at their own discretion according to what they see fit; including which methods are used and what observations will be made.
2. **Designing** - Depending on the complexity of the question, the empirical techniques are customized to meet the goals, requirements, and abilities of the researcher.
3. **Observing** - The process of intentionally gathering and organizing observations about one's own life, using a wide range of instruments to measure them, such as smartphones. Nonetheless, the control and free will of the individual researching themselves outweighs the importance of the tool used to observe.
4. **Reasoning** - The individual maintains control over the research's reasoning and decides which questions will be asked, what research methods will be employed and any additional contributing environmental factors that can affect the data.
5. **Discovering** - This refers to the practical implications derived from the research that have the potential to improve one's daily life. As is customary in research, this final

step also leads to a discussion of the insights gained and the further questions that have come forth with recommendations for further research.

As a general concept, the Quantified Self school of thought regards any personal behavior, activity or metric as trackable. This practice is not new and likely has been happening for longer than it would have been historically recorded, but the technology to allow it to evolve is what has launched its modern evolution into the popularity it has today. In effect, the number and types of self-tracking technologies accessible today, particularly new digital devices and software, are enormous and today counts hundreds of different ways to record one's personal information. Some of the trackable elements in practice today range from behavioral variables such as social interactions and work productivity to biological parameters, including sleep quality, blood pressure, heart rate, body weight and diet (Lupton, 2016).

According to Foxcroft (2012), who chronicled the history of dieting in her book "Calories & Corsets", diet, or tracking one's nutrition is likely one of the most commonplace physical metrics to track personal health in modern Western for over a millennia. In fact, the Greek term *diaita*, from which the word "diet" is derived, refers to an entire way of life rather than a specific weight-loss plan, giving a holistic approach to mental and physical well-being, which is regarded as essential for one's survival. This is the understanding that how a person's body functions is heavily determined by what they eat, and that different nutrition can have different effects on individual people. Therefore, following a certain dietary regime and having a body that is not too fat or thin became ingrained as the first sign of health overall in Western medicine and culture.

This belief of nutrition maintenance as a cornerstone of personal health lends a strong argument that tracking one's diet through the meticulous observance of one's food intake would be a popular metric to track (Gimpel et al., 2013). Moreover, the familiarity of

food as a source of health, even with a lack of nutrition knowledge, is conducive to the assumption that keeping a food diary is an approachable activity for those interested in the field of personal science, the backbone of the Quantified Self movement (ibid). Coinciding with the introduction of the iPhone in 2007, the QS movement increasingly became a worldwide phenomenon of health-conscious and self-efficient people with access to mobile applications at a growing rate (Swan, 2013). During this period of rapid growth, the first years of research attempted to understand its members' motives through studies such as holding an exploratory survey amongst a sample of global fans of self-tracking. This study (Gimpel et al., 2013) measured motivation on a psychometric scale encompassing five different factors of motivation:

1. Self-entertainment - Refers to what people find enjoyable and fun about self tracking. The pleasure can derive from their concern with the technology involved in tracking or from having access to figures and statistics relating to one's own physical health.

2. Self-association - This factor is concerned with one's own self, but in connection to a community and others, and suggests a self-tracker's need to define their uniqueness by comparing themselves to others within a certain society.

3. Self-design - Relates to self-optimization in relation to health. The trackers are attracted by the prospect of taking control of their lives by taking responsibility and improving themselves, driven by a need to be remarkable in the eyes of others.

4. Self-discipline - This type of motivation addresses the rewarding and motivating features of self tracking. For some, the possibility of achieving a goal, receiving a reward, or managing to abstain from a bad consequence are what could drive one to track their nutrition. Therefore, the increased possibility of gaining weight can understandably lead one to fundamentally discipline their food intake.

5. Self-healing - Driven by the need for humans to understand their uniqueness, this motivational factor relates to seeking out alternative methods of self care that may not be communicated by traditional healthcare establishments. By empowering themselves and taking matters into their own hands, trackers can practice self care with the tools available to them.

Although the notion of collecting and analyzing personal data is not new and examined by Swan (2012) in relation to the QS concept, the technology to do so while navigating the obstacles of the modern world is the important novelty that this research will explore. With the help of smartphones and their accompanying mobile apps, ordinary people who wish to track their personal habits and activities now have access to quantitative methods normally reserved for scientific research. Personal science and reducing one's self to figures within the framework that was laid out by the Quantified Self movement has, according to scholars, many benefits to individuals such as:

1. Using knowledge as a tool for change - Humans are able to rationalize the ability to change an aspect about themselves through the power of knowledge (Lupton, 2016, pp. 51-52). This operates under the notion that in order for something to be improved, it must first be measured, learned from and ultimately changed to better it.

2. Asserting control over a chaotic life experience - People have long attempted to utilize knowledge about themselves to better their lives and cope with the complexities that are their bodies. Therefore, using self-tracked data can be seen as a way of obtaining control or keeping the status quo in life from changing or deteriorating further when faced with the unknown (Selke, 2016).

3. Motivational feedback from data - In comparison to social feedback, for example, it is an easier task to evaluate one's behavior and habits by seeking informational feedback from an objective source such as hard data and performance measures (Hassan et

al., 2019). For this reason, an app that provides its users with historical logging, statistical summaries and data visualization will likely help people track their progress and inspire them to achieve their goals.

Despite helping individuals use knowledge as a tool for change, making sense of chaotic tasks and providing them with constant feedback based on objective facts, there are limitations that should be noted and as with any theoretical framework, the Quantified Self movement has its challenges. Firstly, the notion that one indeed has complete agency over themselves through the act of self-quantifying is put into question by Lanzing (2019, pp. 1-10) who argues that in a more modern context, there is a significant moral tension between what the apps promise (better control over oneself) and what the companies behind them ultimately do with their users' data (use it for their financial gain). Apart from non-transparent data usage, the act of self-tracking and tracking nutrition, an important aspect of one's health, may also have the potential to cause people to become too focused on their health, leading to anxiety, feelings of failure and self-hatred (Lupton, 2012).

Additionally, there is the limitation of the nutrition apps' accuracy and the possible misinterpretation of data by their users. Despite the option to use a kitchen scale or to scan a product's barcode, it is not possible to be 100% precise when tracking food into a nutrition app. This could be for a few reasons: (1) Generic products may not always have the same nutritional value. (2) Many store-bought products are not configured into the apps' databases. (3) The food was prepared at home from multiple ingredients and there was no effort to input the accurate nutritional value at precise level to reach the desired accuracy; Or (4) The food eaten arrived from a delivery service, which doesn't necessarily list the nutritional value of its offerings. The last two reasons will prove to be especially relevant to this study's participants who were largely confined to their homes.

Measurement inaccuracy and perceived data uselessness were identified as the main reasons for the abandonment of tracking personal metrics through apps in an earlier study (Attig, 2020), which attempted to understand why self trackers opted to stop their usage of a tracking device or app. Moreover, disruption to users' tracking routine due to changes in priorities or life circumstances proved to be another key reason to quit and will be addressed in this study's discussion section. The study also suggested that the abandonment caused by the perceived data inaccuracy and lack of monitoring motivation proved to develop poor views toward tracking personal metrics in general.

It is also imperative to critique the motivations to track one's self to begin with, particularly for everyday nutrition trackers with experiences who may not match with those who identify as members of the QS community. One study (Didžiokaitė et al., 2018), for example, challenges the belief that people track their nutrition in order to help them form a new self or identity. Despite having a new view of food and acquiring meal-preparation skills based on their new understanding of calorie content and additional nutritional values, tracking one's food, according to their research, may not encourage a new, "data-driven" way of living. In fact, many of the study's participants self-tracked their nutrition in the short term solely in order to achieve the goal of losing weight and gave up on using the nutrition tracking app, eventually returning to their previous habits. This finding argues with the idea that tracking one's nutrition in the framework of personal science and the metaphor of the Quantified Self is part of an all-encompassing lifestyle with the potential to acquire and change habits at a larger scale. Nonetheless, the theoretical framework of the QS movement that reducing oneself to numbers can improve agency is a key factor and a guiding principal for how researchers can perceive a person's motivations, the level of control over their daily routines, and their personal health.

3. Method

3.1. Research design and justification

In order to address the study's research questions, the qualitative approach is taken to explore the feelings, perceptions, and motivations of the nutrition apps' users. Since qualitative research utilizes an interpretive, real-life approach to the study's subject matter, the app users, it is imperative that they're reached in their own element. This approach keeps the subjects in their natural settings, attempting to make sense of and understand the research question's phenomena in terms of the actual meanings that people bring to them. This particular type of research accepts that there is a wide range of and difference in how one makes sense of the world and its mission is to reveal the meanings of the people who are being researched and from their own standpoint, not from the perspective of the researchers (Jones, 1995).

The methodology of this research analyzes the experiences of the young professionals living in the Netherlands through an in-depth approach with the intention of understanding their perceptions of how they use nutrition apps during restrictive stay-at-home orders. Moreover, this qualitative method permits the discovery of unforeseen parameters that the researcher may have not accounted for when they pre-established their theoretical framework. Therefore, the qualitative research tool of semi-structured in-depth interviews will be the focal point of the research design for this study. Conducting in-depth interviews is an effective way to discover more about a population's attitudes and behaviors regarding a specific subject, using their own terms and in a non-threatening, open setting (Boyce & Neale, 2006).

Additionally, attempting to answer the research questions using in-depth interviews will help bridge the gap of participants not being asked about which of the nutrition-tracking apps' features they found more useful since the prior research mostly focused on the

behavioral change regarding whether or not the participants were actually able to maintain or lose weight through the course of the studies conducted. Since this research theorizes that people will use the nutrition-related apps more frequently and with higher motivation during the pandemic as a result of their emotional state, in-depth interviews take a meaningful approach to understand the perspective of the users in their own terms and jargon. When approaching interviewees regarding their lifestyle and diet, it was suggested by a study (Tapsell et al., 2000) that oral collection of their food history would be helpful in order to get more accurate and dynamic reporting of their behavior.

The reason why a focus group, another commonly used method in qualitative studies, was ruled out and not adopted in this research design is because the study involves one's health and habits and the research subjects might feel uncomfortable sharing this kind of information in a group setting. Moreover, complete honesty about their social distancing practices is asked for in order to assess how deep their feeling of isolation is and if their emotional state is affected by how often they're able to make social contact during a time when it is mostly forbidden in the Netherlands.

Because of the study's real-time lockdown restrictions and social distancing safety measures, physically asking participants to share the same physical space would be unethical and illegal without the proper authorization from authorities. There is also the possibility of manipulation by other participants if they were asked the same questions with others present. This could be due to peer pressure or using someone else's experience to complete their own. Another downside to a focus group would be the low level of control that the researcher would have over the interaction between participants and their focus on the topic at hand (Smithson, 2000).

There is an additional advantage of conducting in-depth interviews at the particular time of research, spring 2021, the pandemic is still an ongoing situation and the interviewees

have, by now, already acquired a familiarity and learned intimacy with one-on-one conversations using online video or audio communication. The deeply personal research topic demands this level of comfort and safety with interpersonal communication from the interviewer, a stranger. Moreover, there are also certain conveniences that come with recording the interview session for the analysis phase. For example, one is able to overcome geographical challenges or time constraints with an online-based interview and can even speak to a researcher from the comfort of their own home.

3.2. Sampling and data collection

In order to collect the data needed for the study, 10 semi-structured interviews were held with the volunteers who agreed to participate. The recruiment criteria include the following qualifications:

1. They were born between 1980 and 1995, which makes them belong to the generation of Millennial: interviewees belonging to this defined generation presumably share similar characteristics as other members of the generation and can be better defined as a group with shared beliefs and;

2. They have lived in the Netherlands for at least three years, giving participants enough time to settle into their geographic living situation and familiarizing themselves with the lay of the land. The study is explicitly of Millennials who are residents of the Netherlands, regardless of their citizenship status. The reason behind this is twofold. 1) Most millennials living in the Netherlands share similar socio-economic characteristics and have a relatively stable life in the country, and experienced similar conditions under the country's multiple lockdown periods throughout the coronavirus crisis; 2) The country's population has one of the highest rates of people born abroad in comparison to the rest of the European Union (Vasileva, 2010). Therefore, by making the call for volunteers open to anyone living in the country, regardless of their original national background, there is less research bias

and the sample has a higher chance of accurately representing the intended cross section of this specific population.

3. They are employees with full time jobs: The study examines Millennials who are settling into their careers and growing as young professionals and aims to capture the experience of nutrition-app users who had just begun to settle into stable routines. Therefore, it was important to select volunteers who have stable living situations, economic prospects and a career ahead of them, but still young enough to be digital natives and rely on technology to assist with daily tasks.

4. They have used a mobile app that tracks their daily nutrition at least from March 15th 2020 up to the time of the study's research period in spring 2021, if still in use. This is perhaps the most important criteria to qualify for research since participants are asked to share their experiences in the context of the coronavirus pandemic, which had reached a critical level in the country from that date. There was no requirement to have used nutrition tracking apps before the global health crisis started since the study doesn't specifically compare the experience of the apps in both situations. However, if a participant did happen to track their nutrition beforehand, they were prompted in the interview to observe the differences in experience, if any, to add additional background about their motivations and to understand if they changed as a result of the pandemic.

The recruitment procedure started in April 2021 with an initial LinkedIn post shared with the researcher's professional network and personal acquaintances on the platform. The post called for study participants who have used nutrition-tracking apps in the last year and didn't specify what precise intention of the study was or mention that the research will examine their motivations to use the apps. The post was shared by the researcher's wider network, which increased its visibility on the platform and prompted the interviewees to send the researcher private messages on the platform and to submit themselves as potential

participants. As it turned out, all willing participants lived in the Netherlands' two largest cities, Amsterdam and Rotterdam, during the coronavirus pandemic. Due to their population size, both cities, at certain points during the pandemic, were under stricter lockdowns than other smaller towns, ensuring the effects of living through the crisis that were identified in the literature applied to them as well. The in-depth qualitative interviews were used to gather the data about the participants' user experience with the apps and understand how this usage may have been affected by the pandemic and the major habitual changes that accompanied it.

As requests to participate in the study started to come in, the interviews were eventually held in spring 2021. During this time, the Netherlands was still under lockdown restrictions and had full closure of non-essential shops. However, in May, when a number of the interviews were conducted, some of the coronavirus restrictions in the country started to lift, including non-essential shops, outdoor cafes and restaurants. By the end of the month, gyms opened their doors at a limited capacity for the first time in over 6 months. This is a key factor, which will be raised in the research analysis section. Each interview was recorded using a secure Zoom call and interviewees had the option to use the audio only feature, but none ended up choosing and felt comfortable with adding their video image to accompany the call. Each participant was made aware of the anonymous nature of the interview and their freedom to answer the questions as they saw fit. Additionally, before each interview began, all participants were informed that they will be asked to sign a consent form, which would allow snippets and quotes from their session to be recorded and shared in the analysis of the study.

In order to guide the research's participants and understand their user experience of the nutrition-tracking apps during the pandemic, the interview was divided into themes that would address each aspect of the study. The first group of questions were introductory and

meant to establish the type of person they are, what their educational background is, what they do for a living, etc. Additionally, some of the first questions established their current work environment and their current social contact to measure how much they interacted with other people throughout the day and whether or not they were under heavy isolation during the period of the pandemic. This was important to establish as this study examines the effect of isolation on their usage of the apps and in order to measure their answers against their pre-pandemic conditions if relevant.

The next group of questions examines attitude towards health and nutrition. These queries were meant to establish their knowledge about the topic of health and to understand if the apps also possessed the potential to greatly affect their nutrition know-how if there was a minor baseline of prior knowledge about the topic. The interviewees were also prompted to share their relationship to food at this point and to get an initial idea about their history of nutrition tracking, using any method. A selection of these questions included the following:

1. How deep is your knowledge about health?
2. What is your level of physical activity?
3. How much do you feel you know about nutrition?
4. When thinking about your personal health, where does nutrition rank in importance and why?
5. Have you ever used food as stress relief?
6. Have you ever tracked nutrition before? If so, using what method and for how long?
7. Why and when did you start using a nutrition tracking app?
8. If you quit tracking, why did do so and how does it make you feel?

The third group of questions address attitudes towards apps and technology to assess how tech-savvy the interviewees were, how they relied on technology on a daily basis, if they associated Quantified Self ideals of personal science, and how using the app affected

their mood. They were also asked to share if using the nutrition app had a social aspect for them as well. Some of the questions asked in this question were:

1. How would you describe your daily usage of your phone?
2. What are your preferred methods to access information and perform digital tasks?
3. Does tracking your nutrition intake affect your relationship to food? Please explain.
4. How does using the app affect how you purchase food? Which food items are you buying more of and which less?
5. How do you feel about the change (if any)? Do you feel more in control/disappointed in yourself?
6. How are you using the communal features of the apps such as keeping up with other users' progress (if at all)? If not, explain why.
7. How are you sharing information that you are using the app? (If sharing at all). Are you posting on social media or talking to friends directly about it? Why?
8. Do you use any other tracking apps or devices? If so, what are you tracking and what is your motivation to use them?
9. How does using the app affect your daily mood? Please explain how it makes you feel throughout your day and when you use and don't use it.

The final cluster of questions address the pandemic directly and their experience of using the app during this period. Therefore, these questions took precedent over others if pressed for time. Even though the interview had a basic structure and guiding questions, the researcher also factored the semi-structured aspect of the qualitative research method and followed the interviewees' answers while adding in spontaneous follow-up questions. This flexible interview structure was important to the sensitivity and possibly emotionally charged aspect of the questions that were directly related to the pandemic. Some of these questions were as follows:

1. How would you describe your daily routine since the coronavirus pandemic began? How have you adjusted yourself and changed your routine?
2. How would you describe your main coping mechanisms during lockdown? Are these more active or passive actions?
3. Do you view nutrition/health/life in general differently because of the pandemic? If so, how is this change coming into play?
4. How would you describe your level of control over your health and life?
5. What factors are affecting your current mental health?
6. Has your weight or body composition been affected by the pandemic? If so, please elaborate.
7. Physical exercise is limited at the moment, how do you feel this affects you during this period?
8. How does tracking your nutrition make a difference in that respect?
9. Do you find food tracking easier or more difficult under lockdown? Please explain why.
10. How is the lockdown affecting your food purchase choice? (healthy vs unhealthy, perishable vs. nonperishable).
11. How are you finding preparing your meals and tracking them while having more time to be at home to prepare them?
12. What is your overall motivation level like during lockdown? Which areas/tasks has it gone up and in which areas has it gone down?
13. Do you think the food tracking app helps you or harms you in any way?
14. How has the lockdown affected your usage of apps and devices?
15. How would you describe your stress levels during the lockdown period? Are you experiencing any other negative emotions?
16. Has tracking your food intake affected your current mental health in any way? If so,

how?

17. When the pandemic is over will you use the nutrition tracking app?
18. If there was an app that was specifically designed for the current situation, how would you describe it?

3.3. Operationalization

This thesis examines the motivations leading millennials living in the Netherlands to track their nutrition during the coronavirus pandemic and how they experienced using the apps to do so. Therefore, through semi-structured interviews, this research attempts to understand the users' decision to track their food intake using mobile apps and employs the concept of Quantified Self, which was mapped out in the theoretical framework. The specific drives to track nutrition will be examined through the five-factor framework of self tracking motivations that was identified by three researchers from Karlsruhe (Gimpel et al., 2013), which utilized a psychometric scale to measure individual motivations for self tracking. These motivational factors are (1) **self-entertainment** (2**) self-association** (3) **self-design** (4) **self-discipline**, and (5) **self-healing**. They are presented in the table below and give insight into the theoretical concepts, their meanings, and links to the motivational principles that can be identified in millennials who used the nutrition tracking apps during the pandemic.

Motivational Factor	**Definition**	**References in the interviews**
Self-entertainment	This factor refers to the aspects of self-tracking that people find pleasurable and entertaining. The pleasure may stem from their interest in the technology used in monitoring or from having access to numbers and statistics about their own physical health.	Usage of words like "fun", "bored", "interesting", "enjoy' "play" or "new".
Self-association	This factor is concerned with one's own self, but in relation to others and a larger community, and	Usage of words like "inspiring/helping

	implies that a self-tracker has the need to define their uniqueness by comparing themselves to others within a certain culture.	others", or "present myself to others" or "compare myself with other people".
Self-design	This factor has to do with self-optimization in terms of health. The idea of taking control of one's life by taking responsibility and improving oneself attracts the trackers, who are motivated by a desire to stand out in the eyes of others.	Usage of words like "taking control of my health", "improve myself" or "I decide how I will eat".
Self-discipline	The rewarding and motivating aspects of self-tracking are addressed in this motivation factor. For some, the prospect of accomplishing a goal, obtaining a reward, or avoiding a negative consequence may be enough to motivate them to keep track of their diet. As a result, the increased risk of gaining weight might lead to a fundamental rethinking of one's eating habits.	Usage of words like discipline, "reward myself with _" or "I am trying to lose weight/gain muscle".
Self-healing	This motivating factor has to do with looking for alternate self-care approaches that aren't often presented by established healthcare institutions. Trackers may exercise self-care using the resources available to them by empowering themselves and putting issues into their own hands.	Usage of words like "I don't agree with the government" or "I am trying to find my own solutions"

In addition to the five motivation factors, which will examine the drive behind the interviewees' reasons to track their nutrition, the theoretical framework of this study identified three personal benefits to tracking that map out the individual satisfactions associated with doing so. They are (1) **Using knowledge as a tool for change** (Lupton, 2016, pp. 51-52) - the rationalization that learning is a precursor to change. (2) **Asserting control over a chaotic life experience** (Selke, 2016) - using personally collected data about the body to control a complex experience. (3) **Motivational feedback from data** (Hassan et al., 2019) - being driven by data from an unopinionated source. These three benefits build on top of the motivations and can be used as an extra lens to explain the inner workings of the participants' state of mind and why they understand they will benefit from tracking their

nutrition, regardless of whether they are motivated to do so or not.

QS Benefit	Definition	References in the interviews
Using knowledge as a tool for change	This benefit rationalizes that through the power of information, humans are able to reason the ability to change an element of themselves. This is based on the idea that in order to improve something, it must first be assessed, learnt from, and then modified to make it better.	Usage of related words such as “learn”, “change” and “modify”.
Asserting control over a chaotic life experience	This benefit theorizes that people have long strived to use self-awareness to improve their lives and cope with the complexities that their bodies represent. When confronted with the unknown, employing self-tracked data can be perceived as a way of gaining control or preventing the status quo in life from altering or degrading further.	Usage of related words such as “control”, “maintaining”, ”routine”, “dealing/coping” (with change).
Motivational feedback from data	This refers to benefit of obtaining informational feedback from an objective source, such as hard facts and performance metrics, which makes evaluating one's behavior and habits much easier. As a result, an app that offers historical logging, statistical summaries, and data visualization has the potential to assist users in tracking their progress and motivating them to reach their objectives.	Usage of related words such as “data”, “accuracy”, “information transparency”, “the app shows me my progress” or “I can see how I’m doing”.

Understanding the motivation to track nutrition amongst millennials living in the Netherlands during the COVID-19 pandemic is laid out through the aforementioned motivational factors defined by the theoretical framework in relation to the Quantified Self movement. Nevertheless, this thesis examines the motivational factors through the specific lens of the sample group and uses the dataset retrieved from the semi-structured interviews. Therefore, these factors are subject to the inductive thematic analysis method used to code the data from the interviews with the aim to comprehend the unique motivation to track

nutrition under the lens of the specific setting it examines.

3.4. Analysis framework and process

Following each interview, the audio file was saved on a local drive and immediately transcribed using an audio-based artificial intelligence service called Temi. Once the rough draft of each transcription was produced, it was manually transcribed through a second listen of the recording with the rough text within a week to ensure its accuracy while the conversation stayed fresh in the researcher's memory. To aid the analysis process, quotes and any initial speculations were noted down during the second listen and transcription process. The final transcriptions were then added to a qualitative data analysis program called ATLAS.ti to initiate the coding process of Inductive Thematic Analysis.

Inductive Thematic Analysis has a "bottom-up" method of conclusion. Meaning, specific observations of the research are examined first and later on general theories are developed from them. The process starts by examining the research text and simultaneously assigning codes and comments based on recurring patterns. Based on the themes that surface, broader conclusions or ideas related to the research are laid out and then evaluated in a meaningful way pointing to specific phenomena (Javadi & Zarea, 2016).

While using ATLAS.ti, the qualitative data analysis program, the researcher struggled to find meaningful codes with the aid of the software. Instead he opted to manually code the themes by searching all ten of the interview transcripts (using the "ctrl + F" feature available in word processors) for the keywords of the motivational factors and the perceived benefits of the QS movement that were set out in the study's framework. This was only possible since the dataset was relatively modest. Once the data was coded with the context of the QS movement's motivations and benefits, it was divided into themes and prepared for the results section.

4. Results and analysis

This chapter presents the results of the analysis on the motivations behind the usage of nutrition apps during the coronavirus pandemic and finds that many people tracked their nutrition during this period as a way to stay productive and fit, as a source of control and out of the need to try something new and alternative to what they experienced in relation to nutrition before COVID-19.

Following the sub-questions, the author presents relevant findings in three sections: users' motivations of using nutrition-tracking apps, perception of their usage during the pandemic, and the perceived impacts of the usage during the pandemic. The first section identifies four different motivations of using nutrition-tracking apps: (1) An alternative to other health regimens. (2) Staying productive during the pandemic. (3) Maintaining control during a time of powerlessness. (4) Something new and exciting to do.

The second section presents three positive benefits of nutrition app usage: (1) Helps users take ownership and retain a sense of control over their bodies. (2) Assists with maintaining a routine and positive thinking. (3) Can help lose weight while physical exercise is limited. In addition to the positive, there were also four main negative perceptions of app usage: (1) Not useful as an independent method to maintain a healthy lifestyle and doesn't show results as quickly. (2) Conflicts with environmental conditions of life during the pandemic and could appear pointless. (3) Points a mirror at themselves and can cause feelings of failure and guilt. (4) Lack of motivation to prepare meals and input food makes the app hard to use.

The third section illustrates a few ways in which the usage of nutrition-tracking apps can impact users' daily life and perceived health either in a positive way: (1) Actual weight loss and muscle gain. (2) Helped reduce or quit alcohol consumption. (3) Gave users

something to look forward to; or in a negative way: (1) Increased anxiety and damaged self-worth. (2) Actual at gain due to the additional stress to succeed when users felt they were set up to fail. (3) Frustration over the apps failing to deliver on their dietary promises.

4.1.1. Motivations to use nutrition-tracking apps

When the initial shock of the COVID-19 pandemic died down a few weeks after it took hold of Western countries in March 2020 and a "new normal" was declared, a race to stay productive seemed to be afoot. By April, many opinion pieces were published in leading newspapers about the new world order that called for people to stop trying to be productive all the time (Lorenz, 2020) and that it would be detrimental to staying sane during the difficult time that many are experiencing. Regardless of the messaging, a need to evaluate how one is spending their extra time at home was a common topic of conversation at the time. This consensus of accountability and self-reflection is an important theme that surfaced from the analysis of the interviews and it was revealed that many interviewees started using the app during corona because they felt that in the pre-pandemic times they more easily held themselves accountable for what they were eating since their routines and living situations were not abnormal at the time.

Some interviewees used the nutrition-tracking app before the pandemic, but picked it up again as the restrictions to contain COVID-19 were introduced. When I asked one interviewee for the specific reason why he started using it again after a gap of almost a decade, he noted the absence of gym and his partner's negative comments about his weight and appearance that affected him:

> "I've started to notice that since we're not going to the gym and eating rubbish food and stuff, I've completely changed. My body's physique changed completely and my partner has also been very vocal about it. And of course that makes me not happy. The way I looked before is completely different from what I look like now and I've

decided to install the same app to see if it can help me sort of see what I'm eating. The main reason was I wanted to see how many calories I'm consuming. The fact that we do not have the access to a gym and exercise as before, it just makes a whole lot more impact on the stuff that you eat because we need less calories the less we move.”. - *A, 32, Amsterdam*

Interviewees who used the nutrition-tracking app for the first time during the pandemic confirmed a similar sentiment as the reason for deciding to try it out. The reasoning ranged from reactionary to uncertainty regarding the future and when they would be able to incorporate a full health regimen that included exercise (out of the house):

“There were two moments during COVID that I used it. One was in the first wave as soon as COVID started and we didn't know how long or how it's going to be. So, I went home, I was in lockdown and I was doing nothing. And then I gained a lot of weight. Then I thought, oh my God, I need to do something. That was the first time I downloaded the app, to help me at least to control the calories I'm eating, to not go uphill. Then I had a good result, things were open again at the end of last year. We were able to book a time in the gym, so I started doing something together and then I got (another) nice result. Then next to Christmas in December, everything closed again.” - *CA, 33, Rotterdam*

Looking to the future, when the pandemic is over or doesn’t have as many restrictions, interviewees showed motivation to start using the nutrition app again. However, for a few this was mainly because the apps were not designed to account for a pandemic situation, where many features of the app didn’t go hand in hand with the environment they are currently in.

“I loved tracking my progress and I could see that the system was working, but the system works when it's complete, not when it's parts of the system. It has ways to get

up your metabolic rates and to track your exercise. But just walking around the block in the park is not going to get you there. I think that my success with the app was based on eating healthy plus gym so I want to be able to do all of them, not just some… the app was not designed for a COVID world. The app was designed as an all-inclusive experiential world. I ended up quitting it, but it's not because it was a badly-designed app. It was just because the app did not address my current situation". - *B, 37, Amsterdam*

The study's theoretical framework employed the principles of the Quantified Self movement and outlined the five main motivations (Gimpel et al., 2013) behind the participant's drive to use the nutrition-tracking apps: (1) self-entertainment (2) self-association (3) self-design (4) self-discipline, and (5) self-healing. These motivations were used to assess the data collected during the interview process and resulted in three key motivations:

1. An alternative to other health regimens -

   This coincides with the aforementioned concept of "self-healing" (ibid.), which believes that nutrition app users may look to alternate methods of self-care, when other options are exhausted, and the user is only able to use limited resources available to them. Some of the study's participants indicated that were empowering themselves to stay healthy by literally taking matters into their own hands and using the everyday tool of the smartphone to watch what they were eating.
2. Staying productive during the pandemic -

   To many interviewees, keeping a steady routine was key to their physical and mental health throughout the global health crisis. Tracking their food intake through the app was considered an organizational tool to keep afloat and stay focused during a trying time. The QS concept of "self-design" (ibid.) plays a part here and is a method to

help take control of one's life by taking responsibility and proving that the tracker can make the most out of the time given to them. Those who claimed this this motivational factor were likely driven by the desire to stand out amongst their peers as identified by Lorenz's article on the race to stay productive (2020). This is further proven by the fact that the participants who cited this motivation only tracked their nutrition during the first wave of the virus when productivity was part of the zeitgeist. Moreover, some interviewees mentioned that the first lockdown was almost exciting and new and, therefore, they were more motivated to stay active and do tasks because they saw an end in sight. However, as virus incidence started rising again in the Netherlands during the second wave, they believed the government continued to give them false hope and left them in a state of uncertainty, causing a drop in this specific motivation.

3. Maintaining control during a time of powerlessness -

   This motivation can be distinguished from the desire to stay productive and plays into people's desire to utilize knowledge about themselves to better their lives and to maintain the status quo from changing or deteriorating further when faced with the unknown. This benefit of the Quantified Self movement is highlighted by Selke (2016) in the theoretical framework as "asserting control over a chaotic life experience". The constantly developing situation of the coronavirus pandemic stripped many people of their freedom of movement and left them with a fundamental physical aspect about themselves, which they could control: their food.

4. Something new and exciting to do –

   Some interviewees enjoyed the gamification aspect of inputting their food into the app and seeing the rewards. This ties to the motivational factor of "self-entertainment" (Gimpel et al., 2013), which believes that some people may enjoy the entertainment and gamification aspects of the apps, which provided a new avenue for

their desire to play and challenge themselves in new ways. However, study's participants didn't necessarily enjoy the challenge of restricting themselves to certain foods during the pandemic and the lockdown, which is what the app instructed them to do and is its end goal.

4.2. Perceptions of nutrition-tracking apps usage during the pandemic

Once the pandemic's second lockdown took effect in the Netherlands and non-essential businesses like the gym closed, motivation to track nutrition depleted for those who used it during the first wave, which had less strict restrictions than the second one. This was a heavily featured theme and mentioned by most interviewees as understood from the excerpt below:

> "I started with the app, I went for runs in the neighborhood. And one of those things at the start of COVID was being very excited, very productive. I could see the decline in weight. I could see the progress that I was making and it was all very good. The gyms opened, it was consistent and then everything shut. That kind of like spiraled out. So then I could see the reverse progress and that's when you quit. And that's when it just started getting like annoying (to track nutrition with the app)". - *B, 37, Amsterdam.*

This annoyance can be pinpointed to the constant readjustment to newly introduced measures lifted or being imposed. However, some interviewees highlighted the annoyance of tracking and its perceived role as a digital watchdog during a time of struggle that put them off using it. Moreover, the accompanying tasks of weighing precise amounts of food made it difficult to keep up with the food tracking.

> "When you look at the overall picture, of course it's a different feeling, but when you look at it every day, using it everyday requires extra effort and extra ups and downs,

> even mentally when you see the results… At some point it starts to be quite annoying. I mean it's a lot of work. When you track your nutrition, you track your physical activities. It's a lot of work. Quite some extra effort. So the first reason (to quit) is indeed the fact that you need to actually take all packages and then scan the barcodes, or you need to use the scale and then add on the app." - *L, 27, Amsterdam*

Adherence to tracking nutrition with the app appeared to work better when people were motivated to exercise at home during the first wave of the virus, which eventually saw the reopening of the country's gyms and the permission to exercise in group settings. Therefore, if the study's participants reported using the app during the first wave of the pandemic as a way to motivate themselves to upkeep healthy habits, the absence of the gym and group exercise during the second and third waves of coronavirus triggered them to quit using the app.

One of the additional reasons that interviewees gave up on using the app was because they felt they already created a habit of eating healthier and the inconvenience of using the app wasn't enough to keep them tracking their nutrition with it if they thought they had a reasonable alternative and they were already dealing with enough as it is.

In relation to this, another interesting topic that surfaced was the complication of sticking to the app as a result of food delivery. Despite the extra time spent at home, many interviewees reported not having motivation to use the time to cook and relied heavily on food delivery services instead. Moreover, even if they found the motivation and cooked the meal themselves, a lot of interviewees found it difficult to input food into the app based on the dish since many of the apps are geared towards scanning items and the pre-made dishes were not always accurate.

> "It was more difficult (to track food with the app). What I was doing was when you order the food and the description of what is inside that food, if it's a hamburger with

> this and that, I was trying to create meals in the app, with the ingredients I found there. Of course the amount of salt and the oil they use to fry something will be missing, but anyway that was the closest I could get. Sometimes you even say, like, okay, this one, I don't know how to input. So you don't put in the data for that day and then tomorrow you start it again". - *CA, 33, Rotterdam*

Some interviewees also expressed frustration and loss of control over their nutrition intake while using the app. This directly comes in conflict with "asserting control over a chaotic life experience" (Selke, 2016), one of the QS Benefits outlined as the reasoning behind the positive effect the users thought they'd have by tracking their nutrition with the app.

> "After a little bit, I just stopped using it (the app) because it's so demotivating, instead of giving you the sense of control, it just shows you how you did not... succeed, it shows you if you don't, because if you have this baseline of control, then you can basically finetune the other aspects, but here (in the Netherlands) everything was so out of control that even this seems pointless. And then it's just negative reinforcement." – *T, 36, Amsterdam*

4.2.2. Positive benefits of nutrition app usage

The comments given by the interviewees regarding the benefits they perceived from tracking their nutrition during the pandemic are varied:

Positive:

- Helps users take ownership and retain a sense of control over their bodies.
- Assists with maintaining a routine and positive thinking.
- Can help lose weight while physical exercise is limited.

4.2.3. Negative perceptions of nutrition app usage

On the other hand, the study's participants also had negative perceptions of their app usage during the pandemic:

Negative:

- Not useful as an independent method to maintain a healthy lifestyle and doesn't show results as quickly.
- Conflicts with environmental conditions of life during the pandemic and could appear pointless.
- Points a mirror at themselves and can cause feelings of failure and guilt.
- Lack of motivation to prepare meals and input food makes the app hard to use.

4.3. Perceived impacts of nutrition-tracking apps usage and health during the pandemic

Apart from the aforementioned examples of various benefits and negative aspects of using the nutrition-tracking apps, the data collected suggested another theme that seemed to preoccupy the interviewees during the pandemic; their health. The concept of health during the coronavirus pandemic is inescapable and prevalent in every type of communication, be it interpersonal or mass communication, it is constantly discussed. The nature of a global health crisis logically put the conversation surrounding health at the forefront and on the top of people's minds. Apart from physical health, mental health was identified as a prevalent conversation that will be discussed and examined throughout the pandemic. Literature published as early as May 2020 (Mezzina et al.) already stressed the importance of this component of health as something that should be examined and discussed.

In the context of this study, some interviewees even stated that they believe there is a direct link between mental health and nutrition, and they both affect one another. For

example, one interviewee who, despite speaking extensively about his physical health during the interview, even ultimately ranked his mental health above it as a result of the pandemic, its ever-changing restrictive measure and inconsistent communication coming from the Dutch government:

> "I think mental health is more important, but nutrition also helps with that of course. If you eat really bad you're also gonna feel really bad… It's also become a topic everybody's talking about. About depression, about burnout, about how everybody is struggling and it's around you. So you start to think more about it. And also you see it on the TV, everybody talking about depression and that stuff. So you kind of feel forced to think about that… It was like the first lockdown was very surprising, almost exciting, like something totally new happening in the world. After like a few months you got tired from it and it's not something new anymore… It's like a wave and you're getting sick from it, from working from home and the cases go up again and then everything closes again. And then, they, the government constantly gives you hope to go to the gym next week. And then no, a week after... And the week after…". - *R, 25, Amsterdam*

In fact, the longer the pandemic progressed and the situation worsened, mental health deteriorated. If fear of the virus itself among Millennials was more prevalent in the beginning of the pandemic, worry about mental health gained more importance over time. This is in line with a growing health crisis amongst the generation. Many are suffering emotional effects as a result of the pandemic, but Millennials are particularly sensitive since they were already experiencing mental health issues and health shock (Hoffower, 2021). The new normal of living under quarantine is predicted to exacerbate the loneliness and worry that so many members of the generation already experienced.

> “I think it was very uncertain (in the beginning of the pandemic). We didn't know if you were 25 and you can die of it or not. And it was very doubtful. That was very scary, at least for me. So I was extra careful when leaving the house. More and more after that I was more comfortable with it, but then I was also like nine months into being in a lockdown - *F, 27, Amsterdam*

The way interviewees related to their health seemed to deepen as a result of the virus and prompted them to increase awareness and take care of it. The data suggest that there could be probable motivation to use the nutrition-app as a result of the increased awareness and more time on people’s hands.

> “It's bigger (the health awareness) now actually since the coronavirus. Before the pandemic, I was not very healthy. I didn't eat. There was a period in my life that I couldn't play rugby because I had an injury. So I just drank a lot of alcohol and I didn't eat that much. That shifted during the pandemic to completely healthy or home made food, a lot of biological (organic) stuff. A lot of mental health awareness as well. So at this point, at this moment in my life, I would say I'm very aware of body and mind.” - *S, 24, Amsterdam*

These comments from interviewees illustrate a few ways in which the usage of nutrition-tracking apps have the potential to impact their users’ daily life and perceived health either in a positive way:

- Actual weight loss and muscle gain.
- Helped reduce or quit alcohol consumption.
- Gave users something to look forward to.

Or in a negative one:

- Increased anxiety and damaged self-worth.

- Actual weight gain due to the additional stress to succeed when users felt they were set up to fail.
- Frustration over the apps failing to deliver on their dietary promises.

5. Discussion and conclusion

When the Dutch government recommended that employees stay home if they can on March 12th 2020, it was the first sign that drastic changes would be coming to residents' routines. Only a few days later, it was announced that any non-essential shops, gyms and places of leisure would be closed with immediate effect. The first few weeks of planned closure turned into months and then years with fluctuating solutions and ends in sight. Over time, the initial drastic order to stay home and to refrain from any unnecessary social contact took a toll on many people around the world, heavily disrupted the routines they were accustomed to and effectively removed them from what would be considered a normal state of living in the 21st century. In order to keep up a semblance of normalcy, people were encouraged to do the same things they were used to doing pre-pandemic, but at home. However, this was a task easier said than done for many.

One theme that emerged from the analysis was how disruptive the stay-at-home orders were to the interviewees' daily lives. Apart from one interviewee, a beer brewer, who reported going to work full-time outside of their house during the pandemic, the participants were left with minimal allowances to leave their homes and upkeep a similar schedule that they were used to. This disruption appeared to have overarching consequences for the study's participants who expressed that they struggled to stay positive and maintain normalcy amidst the chaos outside their homes. This feeling of uncertainty was evident amongst the Millennials who, according to the American Psychological Association (Ferri-Reed, 2013), experience higher levels of stress partly due to economic woes early on in their careers and not being set up for success as a generation of adults with standard work/life balances. This type of balance during the week includes, but is not limited to waking up, going to work, meeting friends, exercising, pursuing a hobby, relaxing and going to bed. However, one daily activity emerged as the most disruptive for the interviewees' lifestyles: going to the gym or exercising in a group sport setting.

> “I want to get back in shape as I used to before. Since we have no access to the gym, I started to try something at home, but it's not the same at all. But there is also the difference in your environment that you are in your house, you don't leave the house. Like, you know, when you go to the office, then you go to the gym and then you go to the store and then you go home. There's no such thing anymore. So it's everything in the house for me… The fact that we do not have the access to a gym and exercise, or, you know, as before, um, it just makes a whole lot more impact on the stuff that you eat because we need less calories the less we move”. - *A, 32, Amsterdam*

Not having access to a gym or additional exercise spaces like a rugby field, table tennis or a volleyball court during the pandemic’s lockdown disrupted the interviewees’ daily routines since this was a regular practice in their day-to-day lives. Additionally, as a result of this, along with staying mostly indoors, many concluded that their nutrition needed to be adjusted to accommodate the change in movement and physical lifestyle. In one preliminary study of the effects of isolation during the pandemic (Pop, 2020), it was theorized that the fewer opportunities to spend one’s energy might alter three central dimensions of well-being: physical, psychological, and social. Therefore, the lack of movement the interviewees experienced during this time was likely more consequential to other areas of their well-being apart from the perhaps more obvious physical effects it had on their bodies.

> “When you have a bad day it's nice to go there (the gym) to like, relieve stress as well. And now there's no such place. You can have a run or a walk, but I don't really like that. So, yeah. I think it also affected my mental health as well. Like it's a relief of stress, but you're still sitting in your house. That's a different environment where I still want to go”. - *R, 25, Amsterdam*

Apart from routines being disrupted as a result of not having access to exercise

spaces, many interviewees also reported elevated stress levels and admitted to having positive associations with doing sports in their intended spaces. The Dutch government communicated that going for a walk or a run (alone) was the acceptable alternative during the country's lockdown and many listened to this advice during the first wave of the virus (Voermans, 2020). However, the interviewees didn't think this was an adequate substitute in the long run. This is especially evident among the interviewees since many of them routinely practiced social sports in designated spaces.

> "The curfew, for example, was something that even though I completely understood the reason for it, I completely understand why it was very important to have, really affected my mental health. Because I really felt like all of a sudden, like my freedom was taken away from me and I was respecting the fact that it was necessary, but at the same time it was something that I felt very strongly in my mind and I needed something to manage that". - *F, 27, Amsterdam*

Out of all the routine-disrupting measures set out by the Dutch government to contain the virus, the nightly curfew in the Netherlands was the toughest on the interviewees and they reported their mental health being at its worst state during that time. Current studies (Mukhtar, 2020) are already proving that the coronavirus pandemic is leading to intense psychosocial issues and affecting many people's mental health. This is being regarded as a secondary health issue caused by the forced modified lifestyle of lockdowns, curfews and isolation.

> "I started struggling a lot with anxiety in the second lockdown. It was something that was affecting me very heavily. And I also wasn't expecting that myself either, because I guess I'm quite a self-aware type of person. I'm usually very good at managing my own emotions. I'm usually also the one in my circle of friends and close people that people come to to find confidence and reason, and they consider me

to be the reasonable person that manages this type of thing better, but actually my anxiety level skyrocketed during the second one (lockdown). Working from home was, as cool as it is to have it as an option, doing that consistently for a year is something absolutely detrimental, I think, for any human being's social and mental state". - *F, 27, Amsterdam*

"When we were in a curfew, that was terrible, because I felt that I was running out of time all the time. I have to go to the supermarket. Like, I was already crazy that I have to go now because otherwise I don't have enough time. And then you have to think, like, it's getting late and I didn't finish something, butI still need to go. I don't have time to buy what I want. So, these rules were making me crazy. And I'm a very night, not a day, person... The curfew was like messing with all of that, because I couldn't really do things I like... in my time. If I want to do something, I have to change my schedule all the time". - *CH, 33, Rotterdam*

"During the first lockdown I was pretty okay, but especially during the second one I saw a rise in my anxiety and nightmares and things like that. That's still something I struggle with. I think just with being in the second lockdown, taking so long and not really having a clue of how things will change in the near future, I think that makes my anxiety go higher". - *M, 26, Amsterdam*

When asked if they could identify when life during the pandemic started becoming more difficult for the interviewees, they unanimously named the second lockdown (December 2020) as the turning point. According to recent findings (Chodkiewicz et al., 2021) in Poland, another European country, the second wave of the pandemic had a significant impact on the mental health of the research's participants. A large proportion reported anxiety and admitted to developing anxiety-depressive disorders, as well as suicidal thoughts. Following a relatively relaxed summer with low cases of coronavirus patients,

open gyms and team sports as well as pleasant weather, the second lockdown in the Netherlands changed things for the worse. Therefore, many interviewees reported this time period as the one where they decided to start using the nutrition-tracking app.

As in any qualitative research, this study has many limitations: 1. The lengthy interviews of 40-60 minutes each made the automatic and manual coding difficult to organize and to retrieve the desired data. 2. Participants may have answered the interview questions differently since the current period left them unaccustomed to talking to strangers. 3. The research was only done on one small subsect of the world's population (millennials living in the Netherlands). However, this also justifies expanding the replicating the study to different samples. 4. The interpretation of the data can be influenced by the researcher's personal biases and idiosyncrasies since he belonged to the same population as the sample group and shared similar characteristics, thus, increasing empathy and decreasing neutrality in research. 5. 10 interviews may not be enough of sample size to make conclusive assumptions about the research questions.

The answers given by the study's participants during the interviews were, in terms of overall experience, positive and negative. However, the nature of the semi-structured interview made it difficult to pinpoint whether the participants were actually interested in sharing their experiences regarding their nutrition tracking during the pandemic. Instead, there is a reason to believe that they used the opportunity to speak about overall experience of their personal health during the global health crisis as opportunities to do so at the time were limited and the researcher was considered a neutral party and interested in what they had to say. However, there is one major finding that appeared multiple times throughout the interviews and was repeatedly linked to questions despite it not always being explicitly mentioned by the researcher: The absence of physical fitness affected nutrition tracking and appeared inherently tied to the motivations and the perceptions of success of using the app

during this period.

Future research can choose to focus on this aspect and investigate what the actual effect of gym closures and the absence of team sports had on people's physical health during the COVID-19 pandemic. Moreover, the absence of these fitness outlets likely had a sizeable effect on the participants' mental health as well, which served as focal point of demoralization and absence of motivation when using the nutrition tracking app.

As a final thought, there is a duality to positive and negative experience of using nutrition tracking apps during the pandemic and it can be understood as such: Those who used the app as an extension of what they had the capacity to do in pre-pandemic times succeeded in reaping the benefits of using the apps during the coronavirus. However, those who used the app to try something new or as a last result when other options to meet their fitness or weight goals were not available, did not feel like they successfully used the apps and even had a negative experience. It is difficult to determine if the Quantified Self movement is as far reaching as the theoretical framework implied, but when the study's participants did indeed find tracking their nutrition beneficial, all three assumptions regarding benefits of QS: (1) using knowledge as a tool for (Lupton, 2016), asserting control over a chaotic life experience (Selke, 2016) and (3) motivational feedback from data (Hassan et al., 2019) were all confirmed as plausible effects that were relevant for the experience of the specific context of tracking nutrition amongst millennials living through the coronavirus pandemic in the Netherlands.

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Appendix

Interview Question Guide

Introductory questions

- What is your educational background?

- What do you do for a living?

- What location have you been working from in the past year? (office, home, store, etc)

- How do you identify? (gender)

- What has your social circle been like in the past year?

Attitude towards health and nutrition

- How deep is your knowledge about health?

- What is your personal relationship with your health like? How would you describe it plays a role in your day to day life?

- How much do you feel you know about nutrition?

- When thinking about your personal health, where does nutrition rank in importance and why?

- Have you ever used food as stress relief?

- What is your level of physical activity?

- What would be your preferred method to eat healthier?

- Have you ever tracked nutrition before? If so, using what method and for how long?

- If you failed and quit, why? How do you feel about that?

- Why and when did you start using a nutrition tracking app?

Attitude towards apps and technology

- How would you describe your daily usage of your phone?

- What are your preferred methods to access information and perform digital tasks?

- Does tracking your nutrition intake affect your relationship to food? Please explain why it does or does not affect it.

- How does using the app affect how you purchase food? Which food items are you buying and which less?

- How do you feel about the change (if any)? Do you feel more in control/disappointed in yourself?

- Some apps have nutrition tracking features with friends, and you can keep up with their progress or do things like share recipes. If this communal feature is something you would use or not use, what would be the reason?

- How are you sharing information that you are using the app? (If sharing at all) Are you posting on social media? Messaging or talking to friends directly about it? Can you explain your choice of how you are letting others know you use the nutrition app and why?

- Do you use any other tracking apps or devices? If so, what are you tracking and what is your motivation to use them?

- How does using the app affect your daily mood? Please explain how it makes you feel throughout your day.

- Do you turn on the daily notification on the phone? Why and why not? How does that influence your use of the app and your mood?

- How would you describe your mental state while using the nutrition app? Are you excited? Feel fulfilled? Annoyed?

Pandemic Impact

- How would you describe your daily routine since the coronavirus pandemic began? How have you adjusted yourself and changed your routine?

- How would you describe your main coping mechanisms during lockdown? Are these more active or passive actions?

- Do you view nutrition/health/life in general differently because of the pandemic? How is this change coming into play?

How would you describe your level of control over your health / health

What factors are affecting your mental health

- Has your weight or body composition been affected by the pandemic? If so, please elaborate.

- Physical exercise is limited at the moment, how do you feel this affects you during this period?

- How does tracking your nutrition make a difference in that respect?

- Do you find food tracking easier or more difficult under lockdown? Please explain why.

- How is the lockdown affecting your food purchase choice? (healthy vs unhealthy, perishable vs. nonperishable)

- Most nutrition apps have a scan feature that automatically logs the food into your daily intake. How does this affect how you make food choices given that you have more time to cook now?

- How are you finding preparing your meals and tracking them while having more time to be at home?

-What is your overall motivation level like during lockdown? Which areas/tasks has it gone up and in which areas has it gone down?

- Do you think the food tracking app helps you or harms you in any way?

- How has lockdown affected your usage of these apps and devices?

- How would you describe your stress levels during the lockdown period? Anxiety

- Has tracking your food intake affected your current mental health in any way? If so, how?

- When did you quit?

- When lockdown is over will you use it?

- If there was an app that was specifically designed to be used during confinement with limited physical activity, what would that ideal app be that you could stick to even during the lockdown? What would you change about it?

- If there was an app you could use right now that would be more efficient how would you describe it

- Thank you for sharing, is there anything else you would like to add before we finish the interview?