Development of a fitness mobile application

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Abstract

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The aim of this thesis is firstly to find out and define what it means to live healthily in terms of diet and physical activity. Secondly, it is the development of a mobile application that can motivate and encourage people to improve their health, diet, and physical activity by providing challenges.

The first chapter introduces the thesis and the topic to the reader.

The second chapter is a literature review, where research on the meaning of a healthy life-style is done. It is described what constitutes a healthy diet, which foods are beneficial and which are not, what is physical activity, and how much is recommended for different age groups. Additionally, proper hydration is discussed as well as the implications of smoking and alcohol intake. Lastly, the weight management is covered, how can one find out if their weight is healthy as well as how to calculate proper calorie intake per day.

The third chapter analyses existing fitness and health mobile applications that are available for free in Google Play Store. These apps are reviewed in terms of the features, as well as their UI and UX.

The fourth chapter is summarizing the requirements for the application which are derived from the previous sections.

The fifth and sixth chapters focus on prototyping and user testing respectively. The theory of both topics is presented, which is then utilized for creating own prototyping and holding user testing sessions.

The seventh chapter presents the implementation of the mobile application. Every main feature is presented with screenshots from the app and explanations on how the app works.

The eighth chapter is focused on the final testing, which is when users were using the app for more than a week, after which the users have completed a survey that gathered the results. The theory of survey is also presented.

The last chapter presents the results of the thesis and the connected discussion, where the next steps are also reviewed.

Keywords
Healthy lifestyle, diet, physical activity, mobile development, android development

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1   Introduction

Health is a very important aspect of human life. It is the second most basic level in
Maslow's Hierarchy of Needs. Especially now, in the year 2020 with the global pandemic
around us, being physically healthy can make a lot of difference. Even though living
healthy is a popular trend, there is still a large part of the population that is experiencing
health problems, which can lead to death. In 2015, over 40 million global deaths were due
to such diseases (WHO, 2020b). Some of them could be avoided or even reversed
through everyday choices that serve us well rather than harm us. World Health Organisa-
tion (WHO) states that 80% of premature death could be prevented (WHO, 2020b).

The aim of the thesis is twofold. Firstly, it is to find out what it means to be physically
healthy and how to lead a healthy lifestyle. This is done through a literature review. The
results of this research are the basis for the second part of the thesis, which is the devel-
opment of an application that encourages people to change their bad habits, make healthy
choices, and live more healthily overall. To gain more perspective on the fitness app in-
dustry, some of the currently existing apps in this category are reviewed, which provides
knowledge about the features that are implemented in one of the best apps in this cate-
gory, as well as presents how the topic of a healthy lifestyle is handled by different compa-
nies. At the same time, it serves as an inspiration and help for the design of the applica-
tion in terms of UI and UX. Based on all of the previous parts, the main features of the app
are devised and presented. Afterwards, the prototype for the app is designed and tested
with users. The results of the user testing are evaluated with the mindset that any valuable
insights or positive feedback are a beneficial outcome. Later, the development phase
takes place. When the app is fully implemented, it is again tested by the users for a week.
After that time, the users return feedback, which is analysed based on how well did the
app serve its purpose, that is helped and pushed the users to live more healthily. Also, as-
pects such as how well it worked and what parts or features could be improved are taken
into account. The whole thesis and its results are then summarised and possible next
steps are presented.

2   Healthy lifestyle

Health is defined by WHO as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Lifestyle by the definition of Merriam-Webster Dictionary is a "typical way of life of an individual, group, or culture". Therefore, a healthy lifestyle is a way of life that ensures that a person is fit physically, mentally, and socially. At the same time, it prevents diseases, especially heart diseases and premature death (WHO, 1999).

Physical health means that the body is working properly, the risk of diseases and injuries is low. In order to maintain good physical health, a person should eat healthily, engage in regular physical activity, as well as rest enough (Felman, 2017).

The focus of this thesis is the development of an application that helps maintain physical health, therefore, the recommendations for that will be now discussed, while the other types of health will not be discussed further.

2.1   Physical health

The main threat to a person's physical health is noncommunicable diseases – NCDs. These chronic diseases include heart attack, stroke, asthma, diabetes, and cancer to name a few. Around 70% of deaths each year are a result of NCDs. There are many factors that combed can result in an NCD (WHO, 2018b).

An unhealthy diet and lack of physical activity can lead to being overweight or even obese, high levels of glucose and fat in blood as well as high blood pressure. These in turn can be a cause of NCDs, especially cardiovascular diseases (WHO, 2018b). To lower the risk, people should follow a healthy diet and an active lifestyle, while avoiding smoking and excessive alcohol drinking (WHO, 2018b). Physical health is connected to preventing illnesses and ensuring the body works correctly most importantly by having a balanced diet and active lifestyle.

2.1.1   Healthy diet

A healthy diet is based on fruits and vegetables, whole grains, nuts, and legumes. The basis of each day should be fruits and vegetables. It is recommended to eat at least five portions a day, which is about 400 grams. However, the more the better. The best is to take

advantage of seasonal fruits and eat fresh produce as much as possible. Colour variety in vegetables is also important, and it is advisable to eat more green vegetables as they are full of iron (WHO, 2018, 1999 p.11-12).

The next important group is carbohydrates, which are divided into sugar, whole grain, starchy foods, and fibre. In general, around 50-65% of total calories should come from carbohydrates (Menza & Probart, 2013, p.75). However, sugar intake should be limited, as it causes dental problems, weight gain, and influences blood pressure. Sugar should not constitute more than 10% of total calories, and for gaining more health, it should be less than 5% (WHO, 2018). On the other hand, starchy foods and whole grains are processed by our bodies longer, therefore keeping us full for a longer period of time. This group includes potatoes, bread, rice, oats, peas, beans, etc. They also contain a lot of fibre, which is very good for digestion (Menza & Probart, 2013, p.76; WHO, 1999, p.11). One gram of carbohydrates has 4 calories (NAL USDA).

Another crucial element of a healthy diet is protein, which, most importantly, is used to build and repair muscles, bones, blood, skin, and other tissues. It also strengthens the immune system and contributes to the growth and regulation of hormones. Protein comes from two sources: animal (meat, fish, dairy, and eggs) and plant (soybean, beans, peas, lentils, nuts, legumes, and pumpkin seeds) (Menza & Probart, 2013, p.79-80). By the Dietary Reference Intakes, an adult should include protein as 10-35% of total calories. It relies on many factors such as age, health, activity level, and so on. The personal goals relating to weight loss, weight or muscle gain, also have an impact, as protein can improve metabolism and, as already mentioned it is building muscle (Gunnars, 2020). Similar to carbohydrates, one gram of protein accounts for 4 calories (NAL USDA).

Nonetheless, meat should be eaten in moderation. Especially cow, pig, and sheep meat as they contain saturated fats, which is bad for our heart and can cause weight gain. Chicken, turkey, and fish are more preferable as they contain unsaturated fat. Eggs also fall into that category (WHO, 1999, p.12). The same concerns milk and dairy, as they contain animal fat as well. It is good to involve them every day but not too much. Choosing milk that contains less fat is advisable (WHO, 1999, p.13).

In total fats should not be more than 30% of persons' total calories. It is important to take notice if we consume saturated, unsaturated, or trans-fat. Ideally, for additional health benefits, saturated fats should not be more than 10%, and trans-fat should be less than 1% of total calories. In addition to the products mentioned above, butter, cream, cheese, coconut, and palm oil should be avoided, whereas, nuts, avocado sunflower, and olive oil

can be incorporated into the daily diet in small portions. Trans-fat can be found in pre-made meals, frozen pizzas, cookies, and pies (WHO, 2018). Any type of fat has 9 calories per gram (NAL USDA).

Salt intake also needs to be monitored, as it is very easy to eat too much of it. The daily portion of salt should be around 5 grams per day in total. This includes not only kitchen salt but also products like cheese, salty snacks, ham, and even bread (WHO, 2018).

Moreover, staying hydrated is very important for human bodies. A common recommendation is to drink 8 cups of water per day. Nonetheless, there is not one specific number of water intake for a person. For example, by the European Food Safety Authority we should consume approximately 2 litres of water each day (EFSA, 2011, p.2). Another recommendation is 3,7 litres for men and 2,7 litres for women (IOM, 2005, p.73). However, the water needs depend on many factors, such as the climate we live in, level of physical activity, diet, and health conditions (IOM, 2005, p.86). It is important to note that drinking water is not the only source of daily water intake. Food and other fluids also include water and help us in staying hydrated (IOM, 2005, p.157). For example, spinach, watermelon, and berries contain a lot of water (Marcin, 2018). At the same time, there are some misconceptions about hydration popular on the Internet. Many people believe that when we are thirsty, we are already dehydrated and we should not allow that feeling (Benson, 2015) While the fact that thirst means dehydrations is true, it is only small dehydration that is not yet life-threatening and it is a good indicator to drink some water (Klein, 2014). Another good indicator of hydration is the colour of urine. Light yellow means we are well hydrated, and the darker it gets the more dehydrated we are. However, contrary to the popular belief, clear means we are overhydrated, which may also be dangerous (IOM, 2005, p.99; Klein, 2014).

In order to remain healthy, it is also strongly recommended to avoid smoking and drink alcohol in moderation. Cigarettes not only can cause cancer, heart and lung diseases for the person who is smoking, but they are also extremely dangerous to the people around and children especially (WHO, 1999, p.2). Alcohol in itself does not pose grave threats, as long as it is used with caution. Small amounts every now and then can even be beneficial, as it can lower the chances of heart diseases. Nevertheless, drinking too much alcohol can lead to many health problems, such as stroke, cancer, hepatitis, and depression. It is advised not to drink more than two units of alcohol per day, which is, for example, two average beers (WHO, 1999, p.16).

At the same time, it is important to consume an appropriate number of calories – energy intake should be more and less the same as calorie expenditure, to maintain a healthy weight (WHO, 2018; FAO, 2001, p.4).

WHO recommends the Body Mass Index (BMI) calculation to measure healthy weight. BMI is derived by dividing weight by height squared (FAO, 2001, p.9). The result between 18,5 and 24,9 indicates a healthy weight. Below that range means underweight, while above means overweight and over 30 is obesity (WHO; WHO 2020a; Menza & Probart, 2013, p.259). However, BMI is not a perfect indicator, especially that it does not differentiate between fat and muscle. The weight of muscle is higher than fat, therefore a muscular person may have a similar BMI to a person with no muscles and high body fat (Nordqvist, 2013). Therefore, BMI should be used as a rough estimate.

Nonetheless, consuming an appropriate number of calories daily is crucial, to prevent becoming underweight or overweight. Every day, our bodies use energy not only for physical activity but also for life functions such as brain functions, work of heart and lungs, cell replacement, digestion of food and nutrients. Basal metabolic rate (BMR) specifies the energy we use to function (FAO, 2001, p.7). Estimated BMR can be calculated by using the Harris-Benedict formula:

- For women: 655 + (9,6 × weight in kg) + (1,8 × height in cm) – (4,7 × age in years)
- For men: 66 + (13,7 × weight in kg) + (5 × height in cm) – (6,8 × age in years) (Frothingham, 2018)

In order to calculate how many calories we should consume each day, we need to calculate total energy expenditure (TEE), which is based on BMR and the level of physical activity (FAO, 2001, p.9). Food and Agriculture Organization of the United Nations (FAO) proposed three levels of physical activity:

- Sedentary or light activity – people on this level do not engage in physical activities often and their work is not physical. For this level, BMR multiplied by 1,55 is the TEE.
- Active or moderately active – those are people who either have more physical jobs or spend their free time in an active way, for example, moderate activity of one hour per day. Here BMR is multiplied by 1,75.
- Vigorous or vigorously active – this level is mostly connected to people with physical jobs and vigorous daily activities. Their TEE is calculated as BMR multiplied by 2,2 (FAO, 2001, p.38-39).

When losing or gaining weight, it is important to adjust the daily calorie intake. The recommended amount of progress in both cases is around 0.5 – 1 kg per week of loss or gain. To lose or gain weight, a person needs to achieve a calorie deficit or surplus respectively. There are around 7000 calories in one kilogram of fat. Therefore, this amounts to 3500 – 7000 calories per week, which gives 500 – 1000 calories per day. Depending on the goal, the TEE is then decreased or increased by that number of calories (Steen, 2017).

2.1.2 Physical activity

Physical activity is as important for health as an appropriate diet and should not be overlooked. Everyone should engage in some kind of physical activity regularly, as it improves health by minimising the risk of diseases such as diabetes and heart and bone diseases. It also contributes to maintaining a healthy weight, while enhancing the condition of the heart, lungs, muscles, bones, and joints. Additionally, physical activity also improves flexibility and movement and takes care of our mental health. Exercising makes us feel better by relieving anxiety and stress, giving more confidence and self-esteem, and improving the quality of our sleep (Menza & Probart, 2013, p.276).

Physical activity means moving in any way that is using up energy, for example walking, running, cycling, dancing, yoga, etc (Menza & Probart, 2013, p.276; WHO; 2018c, p.6). It can be divided into three dimensions:

- Stamina – with better stamina, the heartbeat is slower and more powerful, allowing for better circulation of blood to the heart and lungs. This improves the ability to deal with longer exercise without losing breath. Activities such as walking, running, and swimming improve stamina.
- Strength – focuses on developing the muscles to be able to perform physical work. Lifting weights is the primary exercise for building muscles, but any activity that involves carrying some kind of weight is good.
- Suppleness – means better mobility, flexibility, and balance, which reduces pains and chances of injuries. Stretching activities such as yoga or dancing increase suppleness (Menza & Probart, 2013, p.276 -277; WHO, 2001, p.6).

The best way to keep active is to incorporate more movement into daily life, for example, using the stairs instead of the lift, walking to work, or doing more household work. It is important to adjust the exercises to our fitness level. If we are only starting, we should do so slowly and build up steadily (WHO, 2001, p.7). The recommended level of activity for adults is at least 150 minutes of moderate intensity or 75 minutes of vigorous intensity activities per week. However, doing more gives additional health benefits. Moreover, it

should be remembered to work on muscle strength at least 2 days per week (WHO, 2010, p.25). Moderate intense activity is a type of activity that increases heart rate and makes it a bit harder to breathe and talk (WHO, 2001, p.8). Adults over 65 should engage in physical activities that are allowed based on their condition. It is also beneficial for them to work on balance and mobility 3 days per week, in order to reduce falling (WHO, 2010, p.31). The recommended goal of physical activity per day for children is at least 60 minutes of moderate or vigorous activity. Exercises that strengthen bones and muscles should not be dismissed and should be performed at least 3 days per week (WHO, 2010, p.20).

3   Analysis of the most popular fitness and health mobile applications

The health and fitness app industry is all the time growing. In 2019, the revenue was over $2 billion for the paid apps and services, while the total number of users for free and paid apps was 822 million. At the same time, the industry is being complemented by the rise of the popularity of wearable sports trackers. In 2019, there were 320 million users of wearables and the revenue was over $14 billion (Statista, 2020).

According to AppBrain, as of 29th April 2020, there are 97603 apps in the Health & Fitness category on Google Play Store. Many of these apps are specializing in catering for a certain need, such as tracking physical activity, educating on good nutrition, or taking care of sleep and mental health. For example, Home Workout – No Equipment[1]; Headspace: Meditation & Sleep[2]; YAZIO Calorie Counter, Nutrition Diary & Diet Plan[3]. There are also apps for more general use that can track and analyse many aspects of our lives. These apps are usually designed for syncing with wearables, but some can also function without. Examples include Samsung Health[4], Garmin Connect[5], and FitBit[6].

Seven mobile applications have been chosen for analysis, based on the ranking on Google Play Store as well as the number of opinions and popularity. For that purpose, a list made by Android Rank was used. Then, the applications were installed on a smartphone and used for a while. The analysis focused on the free aspects of the app. After that, the results were written along with a short description of the application. Table 1 presents the chosen apps along with their ratings, number of opinions, number of downloads, and focus.

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[1] https://play.google.com/store/apps/details?id=homeworkout.homeworkouts.noequipment
[2] https://play.google.com/store/apps/details?id=com.getsomeheadspace.android
[3] https://play.google.com/store/apps/details?id=com.yazio.android
[4] https://play.google.com/store/apps/details?id=com.sec.android.app.shealth
[5] https://play.google.com/store/apps/details?id=com.garmin.android.apps.connectmobile
[6] https://play.google.com/store/apps/details?id=com.fitbit.FitbitMobile

Name of the app	Rating	Number of opinions	Number of downloads	Focus
Calorie Counter - MyFitnessPal	4,5	2 259 895	more than 50 million	Nutrition, weight management
Samsung Health	4,3	952 941	more than 1 billion	Nutrition, weight management and physical activity tracking
Google Fit: Health and Activity Tracking	3,8	357 526	more than 50 million	Physical activity tracking
8fit Workouts & Meal Planner	4,5	144 474	more than 10 million	Nutrition, weight management and workouts
Lifesum - Diet Plan, Macro Calculator & Food Diary	4,4	232 261	more than 10 million	Nutrition and weight management
YAZIO Calorie Counter, Nutrition Diary & Diet Plan	4,5	217 117	more than 10 million	Nutrition and weight management
Noom: Health & Weight	4,2	199 728	more than 10 million	Nutrition and weight management

Table 1. Analysed applications with ratings, number of opinions, number of downloads, and focus.

3.1.1 Calorie Counter - MyFitnessPal

MyFitnessPal is a calorie and nutrition tracker. It is one of the most popular apps in this category - the average score on the Google Play Store is 4,5 with 2 259 895 opinions and over 50 million downloads. The primary focus of the app is losing weight, however, other goals can be specified, for example maintaining a healthy weight. The user can either specify their own calorie and nutrients goals or let the app calculate them. The app allows for logging what we eat every day while calculating the calories and all nutrients. We can add products by using the barcode scanner and there are over 11 million global foods in the app's database, therefore finding a specific item should not be a problem. Additionally, it is possible to create personalised products, meals, and recipes. At the same time, the

user can log what physical activity they participated in daily, which are divided into cardio and strength training. Own workouts can also be created. Moreover, the app can connect to many other apps, which include dedicated wearable apps such as Garmin Connect or FitBit. The app also includes a social side, meaning users can share posts, photos, and add friends (MyFitnessPal, Inc.).

MyFitnessPal can be used for free, however many features are only included in the premium option. For example, registering the time when a specific meal was eaten, deeper analysis of the eating habits, or setting even more specific goals for calories and nutrients. Additionally, the free version includes ads, which makes the user experience a lot worse.

The UI of the app is simple, with white and blue as the main colours. The app opens to the main page that includes the calorie count left for the day, as well as posts shared by friends. At the bottom, the user can switch to the food journal and their profile. There is also a drawer available from any screen that contains the previously mentioned links as well as many other items. Getting to know the app and navigating around may feel a bit overwhelming. There may be many different ways to go to a specific screen, which may be useful but also may create confusion for the user. Sometimes it is also not clear what a particular feature does or is about.

A very good advantage of this app is that it shows all the nutrients in the foods for free, whereas in many other apps only the macronutrients are available. Additionally, tracking the progress of measurements is not only limited to weight in the free version. It also compatible with multiple apps, therefore various users will find it useful.

Disadvantages include previously mentioned UX, which makes the app difficult to use at first. The simple UI may also be seen as a minus. Moreover, the app does not educate the user about what is healthy, it is only focusing on the goal of daily nutrients and calories. In the description on the Google Play Store it says that the app is "almost like having a nutrition coach right inside your pocket", but it does not actually specify what is good and what is not, so the user can eat whatever as long as it fits into their goal of calories and nutrients. Another small issue could be that the graphs for measurements are a bit vague. Firstly, it is not possible to see the details, but rather a general view of the changes and progress. Secondly, it is not indicated what is the number on the starting point, which also changes when the user hits lower and lower numbers. This can exaggerate the differences between points on the graph. However, it may be beneficial to some to see small progress as bigger progress. For others, it could be good to mark the starting point at the weight axis as the goal weight, which would show how far or close they are to their aim.

3.1.2 Samsung Health

Samsung Health is an app that helps users to keep a healthy and balanced lifestyle by recording and tracking diet and physical activity. The Google Play Store average rating is 4,3 with 952 941 opinions and over 1 billion downloads. Users can log their daily diets, as well as record their weight and sleep. Samsung Health also offers workouts and fitness plans, that are delivered by other companies such as BeneFit, Keep, and Skimble. The user can specify their weight goal, whether it is to maintain, lose, or gain weight. Based on that the daily calorie intake will be calculated as well as how many calories need to be burned. Samsung Health can also track steps and the user can take part in challenges with other users. Additionally, it offers meditation programmes for dealing with anxiety, stress, focus, and relaxation as well as for better sleep. There are also sleeping stories that help fall asleep. The app can connect to many other apps such as MyFitnessPal, Endomondo, Noom, etc. As it is a product of Samsung, it only connects to Samsung wearables and activities tracked by other smartwatches need to be added manually (Samsung Electronics Co., Ltd.).

Samsung Health is free to use, but a Samsung account is needed to use all the features. The UI is simple but pleasing, with white and grey as the main colours and various accent colours for specific features. There are three tabs – the main tab, which contains information about the user's day, such as steps, calorie intake, exercises, water intake, etc; the together tab, which shows the analysis, comparison against others, and challenges; and the discover tab, where meditation, sleep and workout programmes can be found. There is also a side drawer with additional features and analysis. The UX is good and the logical flow of the app is quite easy, so it doesn't take too much time getting used to and learning all the features and settings.

There are a couple of flaws in the app. First of all, similarly to MyFitnessPal is does not educate about the food choices, it just tracks the nutrients. Also, there is no barcode scanner, so finding the right item may take time and sometimes it may actually be easier to input all the information manually. In this case, the user needs to know the details about the meal. When following a plan to reach a target weight, the number of calories are divided by intake and expenditure. The app seems to assume that the person is going to work out and burn a lot of calories every day, while still lowering their intake. For example, the app indicated that I should burn about 400 calories per day, which is very hard to achieve, even if the steps are taken into account. Moreover, the feature that shows how well we are following the diet and calorie intake/expenditure plan is confusing. After logging a couple of meals of the day, the app already shows that the user ate more calories than they

should have and it recommends activities to burn that surplus. But it is unclear how that amount is calculated, the app does not indicate the division of the calories among meals, so there is a lot of guesswork. Lastly, when logging in the physical activities, the burned calories are calculated automatically and it is not possible to change them.

3.1.3 Google Fit: Health and Activity Tracking

Google Fit is an activity tracker. It has 357 526 opinions, over 50 million downloads, and the average score of 3,8 on the Google Play Store. The app calculates "Heart Points" from different activities, and encourages the user to achieve the goal of 150 Heart Points per week. The Heart Points are basically minutes of intensive activity and 150 minutes is recommended by WHO. The app also keeps track of steps and it can automatically start an activity when it detects enough movement. The user can manage their Heart Points and Step goals. Activities can be tracked from the app or can be added manually. Sleep, weight, and pulse can also be monitored, but the data has to be added by the user. Other apps can also be connected, such as Lifesum, Strava, MyFitnessPal, Mi Fit, etc (Google LLC).

The UI is mostly white with some accent colours. There are three tabs and an "add" button for adding activities or measurements. It is an easy app to use, with no problems in the UX.

The app is quite limited and doesn't have a lot of functionality, the main feature is the achievement of the Heart Points. However, when the user adds a physical activity, they have to specify the number of Heart Points themselves. Therefore, the app does not seem very useful, unless used with wearables that have Wear OS.

3.1.4 8fit Workouts & Meal Planner

8Fit is a "mobile personal trainer". It includes workout and diet plans. The average score of the app is 4,5, it has 144 474 opinions and over 10 million downloads. The user can specify their goals – lose weight, gain muscle, or get fitter in general. It is also possible to set weekly workout goals and reach achievements. Based on the current fitness level, the workout plan is designed. However, even though it is stated that "8fit is free for everyone", without paying the user has only access to a limited amount of workouts. Meal plans, recipes, and more personalized workout plans are only available after subscription. Articles are available for everyone, and they contain tips, stories, and recipes. The user can also

read nutrition and fitness guides, which give a general view of both of these subjects. The app also offers sleep meditation. It can connect to Google Fit for tracking steps (Urbanite Inc).

The UI looks very professional and the app is not difficult to use, as every feature can be easily found from its tab.

The advantage of this app is that it is the two-in-one kind of application, as it features both the meal plan and workouts plan. However, the user has to pay for that.

Nonetheless, when using for free the app is limited, as only a couple of recipes and tips are available and a very basic workout plan.

3.1.5   Lifesum - Diet Plan, Macro Calculator & Food Diary

Lifesum is an app that provides diet plans, calorie and nutrients calculators, food diary as well as healthy recipes. It has 232 261 opinions, over 10 million downloads, and the average rating of 4,4 on the Google Play Store. Users can specify one of the three goals – lose weight, maintain weight and eat healthily, or gain weight. Based on that, the daily calories and macronutrients are calculated. Logging food can be done with a barcode scanner, users can also create their own meals. For every product, the user can see the macronutrients information. The user can add exercises, which can influence the number of calories for that day. There is also a possibility to take a health test to see how a balanced diet and lifestyle one has. The app works with other fitness applications (Lifesum).

For free the user can get a limited version of the app. For example, diet plans and recipes are not available for free. Also, only the main macronutrient data is shown to the user, and the rest is restricted to premium. The health test only shows the score, but for more information and analysis the user has to pay. The same is with a deeper analysis of daily habits, which are restricted. Additionally, there is a nice feature that shows the rating of a product, indicating of how healthy the product is, however, to see the justification of this, a premium subscription is needed. Finally, free users can only sync Lifesum with Google Fit and Samsung Health, while paying users can choose more apps. The free version is just a calorie and macro tracker, with a little feedback on the healthiness of the food.

Lifesum has a very pleasant and fun UI, which makes the UX easy and enjoyable. There are five tabs – food diary, profile, plans, premium, and recipes. The latter three are only available after paying.

One of the benefits of Lifesum is that it gives a food rating. Although in the free version without explanation, it is still educating the user about food choices, instead of encouraging them to just follow the calories and macronutrients. Another plus is that the user can specify additional goals, for example, daily portions of fruits and vegetables, which again shifts the focus also to the quality of food. Additionally, there is guidance about the division of calories per each meal. The app also gives tips and advice throughout the day or the week to support and motivate the user to stay on track, even if the progress is slow.

On the other hand, as was the case with some of the previous apps, the weight graph exaggerates the progress, which can be both good or bad. Also, when setting the vegetables and fruit goals, the amounts are specified in portions and the size of the portion is not known, so that is given to the user to interpret.

3.1.6   YAZIO Calorie Counter, Nutrition Diary & Diet Plan

Yazio is another app for counting calories and nutrients as well as for diet plans. It has 217 117 opinions and over 10 million downloads, with the average score of 4,5. It is similar to Lifesum, not only in numbers but also in features and the free and premium versions. The user can specify whether they want to lose, maintain, or gain weight. Every day the user can log their meals, and the calories and macronutrients will be calculated. Physical activity can also be added by the user, however automatic syncing is only available with Google Fit and for other apps, the premium version is needed. Free users can take up challenges, such as no chocolate, no alcohol, no pizza, etc. The user can follow the challenge for as long as they want, but it is said to maintain them for at least 21 days (YAZIO).

The premium version offers recipes and meal plans, food ratings, more detailed analysis and statistics about user's habits, daily tips and guidance, as well as full-body measurements.

The UI of Yazio is clear and nice. The main colour is white, but there is an option for switching to the dark mode which is a plus. It was quite straightforward to use the app, at least in the free version, with fewer features available. There are tabs for diary, recipes, coach, profile, and premium version.

The app has a feature of generating a shopping list based on the recipes the user has saved, which is not included in any other previous apps. The total calories are also divided by meals to give more guidance to the user. There are notifications when it is time to eat.

As for the cons of the application, the food rating is only available for premium users. Also, there are four default meal categories, that cannot be changed. These are breakfast, lunch, dinner, and snack. For the snack category, the recommended amount of calories seems to be only for one snack, and if the user eats more snacks all of them will be saved in that category.

3.1.7   Noom

Noom is an app that helps users with changing their lifestyle into a healthy, balanced one, at the same time with the aim of losing weight. It has the average score of 4,2 with 199 728 opinions and over 10 million downloads. The app is supposed to train and "trick" the user to build healthy habits, by daily tasks, support, feedback and guides, as well as identifying the user's weak spots and acting on them. With the app, the user can track and monitor the daily foods, exercise but also blood pressure and blood sugar (Noom Inc.).

The premium version contains meal and workout plans, that are customised based on responses to a couple of questions. For free, the user can still track their diet and get feedback on it. The app contains information about nutrients in the food, however, it does not count them and only focuses on the calorie intake. The foods are divided into three categories – green, yellow, and red. The analysis of the daily diet is done based on these categories, where the app informs which groups should be limited and which can be eaten freely. The yellow and red foods are also given a calorie limit in the day. The green category is foods that are low calorie and very nutritional. The yellow category foods contain more calories and fewer nutrients per serving. Red foods have the highest number of calories and the lowest of nutrients.

Noom has a simple UI, which at first glance may seem a bit empty. The main screen shows the calorie count, with the number of calories left, the daily tasks which usually involve logging in the meals, walking a particular amount of steps, and "do more", which encourages to do or log a workout, log weight, blood pressure or blood glucose. If there is a scheduled workout, there will be a task to do it. There is also a side drawer, with a weight graph, history, settings, help, and upgrading.

As mentioned before the app categorizes food into three categories, rather than counting the limits of carbohydrates, fats, and protein. This can educate users on which foods are the healthiest, but at the same time, it is not completely clear why some products are in a particular category. A plus is that the app gives feedback after the user adds a meal, for example, if the user ate fruits, there is a message "fruit, good choice". There is also a possibility to create a workout schedule, however, the option is hidden in the settings, rather than on the main screen. Additionally, the portion sizes are not only in grams but also other measurements, for example, tablespoon, handful, etc. The weight graph is better than in other apps, as it also shows the goal weight and estimated time of achieving it.

However, there is a limited number of apps supported by Noom. It can connect to Google Fit, which is used for step tracking. Samsung Health can also be connected, but it just shows daily tasks from Noom in Samsung Health.

4 Summary of the requirements

The last sections discussed the healthy lifestyle and what actions are needed in order to remain healthy, as well as some existing apps were presented and analysed. Based on that, the requirements for my application can be derived.

Firstly, a healthy diet is important. This includes:
- eating at least 400 grams of fruits and vegetables per day;
- including whole grains and starchy foods in the daily diet as 50-65% of total calories;
- including protein as 10-35% of total calories;
- limiting the intake of meat; cow, pig, and sheep meat should be avoided, instead eating poultry and fish;
- eggs, milk, and dairy products should be included, however also in limitation;
- fat intake should be limited to 30% of total energy intake, with saturated fat constituting less than 10% and trans-fat less than 1% of total energy intake;
- sugar should not exceed 10% of total energy intake, and people should strive to limit it to 5%;
- the daily portion of salt is 5g;
- water and fluids intake depends on many factors, but generally drinking when thirsty is good. The popular norm of 8 cups per day or 2 litres is also a good estimate, remembering that this number includes all the fluids, which are also in foods;
- the right amount of calories should be eaten per day to maintain a healthy weight. BMR and TEE calculations help in finding out the appropriate number of calories. The healthy weight can be checked by calculating BMI, treating it as an estimate rather than a strict result;
- alcohol should be consumed in moderation, 2 units per day maximum;
- smoking should be completely avoided.

Secondly, engaging in physical activity is also crucial. The recommendations are:
- incorporating more movement throughout the day, by for example walking the stairs or walking/biking rather than driving;
- adults should aim for 150 minutes of moderate intensity or 75 minutes of vigorous intensity of exercises per week, and working on muscle strength 2 times per week;
- adults over 65 should exercise in a way that their conditions allow, as well as work on balance and mobility 3 times per week;

- children should have 60 minutes of moderate or vigorous activity every day and strengthen their bones and muscles 3 times per week.

Application review provided more insights, thus some additional requirements can be listed:

- tracking calorie and macronutrient intake;
- scheduling and adding workouts;
- meal planning, saving meals and recipes;
- registering the time of eating and reminders when it is time to eat;
- tracking weight and other measurements;
- goal setting and progress tracking;
- educating about health and diet;
- health test, to analyse the current lifestyle.

4.1 Features of the application

Based on the literature and application review, a number of requirements have been derived for the application. To present the features better, user stories are utilized as the description.

User stories are a way of explaining a feature from the user's point of view. They are the smallest part of work and represent the end goal, as well as how the software will provide value to the user. The main advantage of user stories is that they concentrate on the user and their problems and needs. Usually, user stories are comprised of a few simple sentences in a structure of: "As a user, I want to do something, for a reason of…". They can be a part of larger, higher level items, like epics or initiatives (Rehkopf).

4.1.1 Goals and measurements

The core part of the app is the goal setting and the calculation of indices and ratios, such as BMI. The user stories connected to this feature are as following:

- "As a user, I want to calculate my BMI, to see if my weight is healthy";
- "As a user, I want to calculate my BMR and TEE, to see how many calories I should be eating every day";
- "As a user, I want to manage my weight, so that I feel better and I am more healthy";

- "As a user, I want to set how many calories to eat daily, so that I can manage my weight";
- "As a user, I want to log in my weight, to keep track of my progress";
- "As a user, I want to move more, to improve my fitness";
- "As a user, I want to set a goal for physical activity, so that I am motivated to move more".

Therefore, this part of the app is going to contain a feature where the user can set their goals pertaining to weight management as well as calorie intake and weekly physical activity. Additionally, there will be a weight tracking component, with a graph to showcase the progress. Lastly, the user will be able to calculate their BMI, BMR, and TEE.

4.1.2   Diet tracking and planning

The next feature is the food diary and planning. The user stories for this part are:
- "As I user, I want to keep track of my calorie intake, so that I can see if I eat accordingly to my goal";
- "As a user, I want to log in my daily meals, so that I can keep track of my calories";
- "As a user, I want to log in my meals, so that I can keep track of how much carbs, protein, and fat I am eating";
- "As a user, I want to log in my meals, so that I can keep track of how much salt and sugar I consume";
- "As a user, I want to plan my meals ahead, so that I consume an appropriate number of calories as well as other nutrients".

Here, the user will be able to add their meals, as well as plan their daily menu according to the calorie goal set in the previous feature. The user will be able to see the accumulated number of calories and nutrients for the specific day.

4.1.3   Physical activity tracking and planning

Physical activity is another part of the app. Here, the user stories would be:
- "As a user, I want to log in my sport activities, so that I can achieve my physical activity goals";
- "As a user, I want to log in my activities, so that I can keep track of how much I am moving throughout the week";

- "As a user, I want to plan my activities, to make sure I will complete my goal and to be more motivated to do them".

In this part, the user can add the activities that they have done and track how much of the physical activity goal they have completed. The user can also create a schedule for the week.

4.1.4 Challenges

The last feature's user stories are as follows:
- "As a user, I want to eat more fruits and vegetables, so that I improve my health";
- "As a user, I want to eat less candy, so that I lower my sugar intake";
- "As a user, I want to drink less alcohol, so that I can improve my health";
- "As a user, I want to quit smoking, so that I don't get sick in the future";
- "As a user, I want to exercise more, so that I can improve my fitness and health";

This part provides the user with challenges that encourage and help to lead a healthier lifestyle, whether it comes to diet, physical activity, or healthy habits in general. The user will be able to take on pre-existing challenges or create their own. Then, the progress can be measured by marking when the requirement for the challenge has been completed.

4.2 Structure of the application

Based on the main features and their components, the structure of the application was drawn out, which will be later used in the prototyping as well as the development phase. Figure 1 presents the structure of the app.
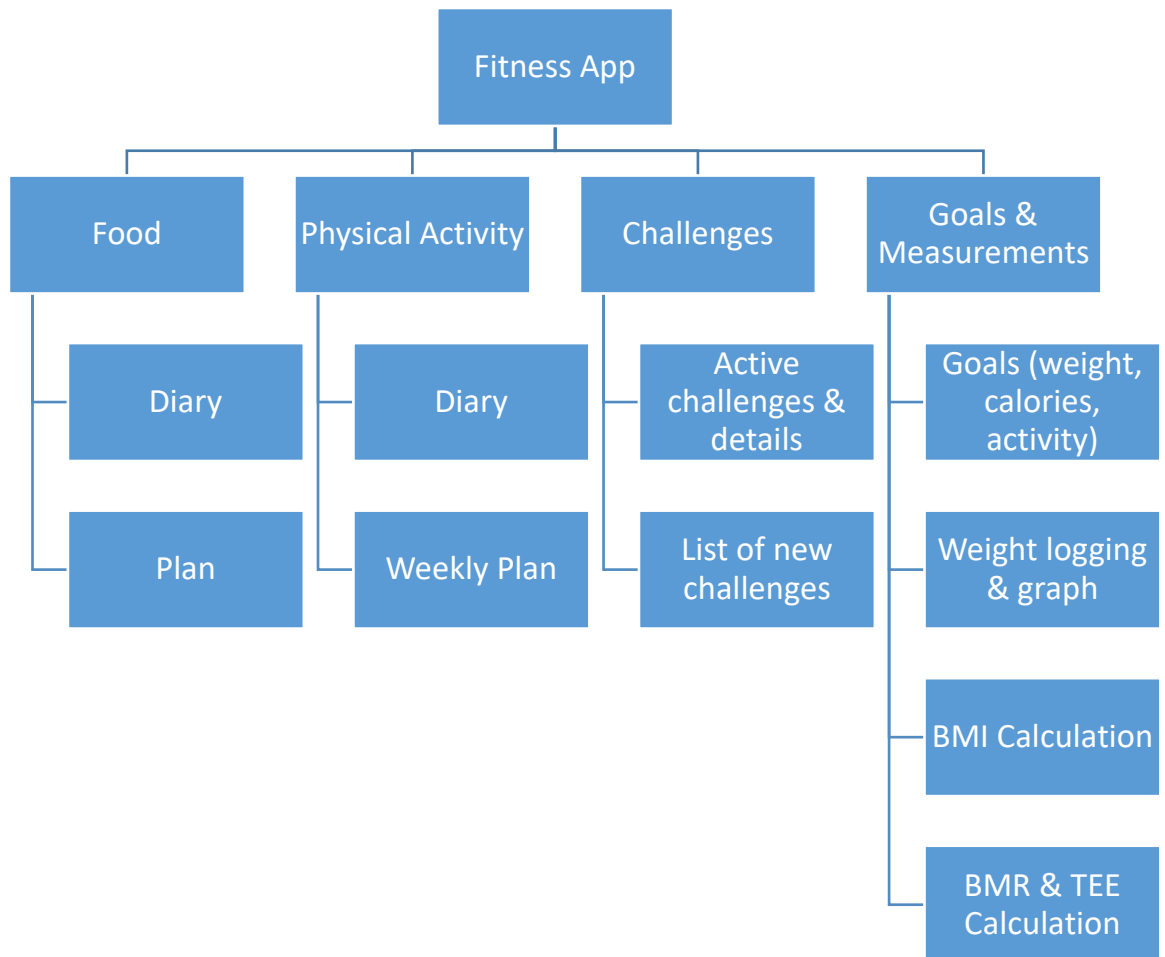
Figure 1. Structure of the fitness app.

5   Prototyping

Techopedia defines prototype as "an original model, form or an instance that serves as a basis for other processes." More specifically, a prototype is a representation of an idea, that is created for testing, exploring, and communicating, as well as improving that idea. What is considered a prototype varies, depending on the product and the people involved. For a mobile application, a prototype can be in a form of a sketch, wireframes, or a group of them, either clickable or not. It can also be an early coded version of the product. At the same time, a functional proof of concept can also be viewed as a prototype (Goodwin & Coleman, 2017; chapter 1, McElroy, 2016a, chapter 1).

There are many purposes for creating a prototype. First of all, the prototype can be used in the user testing phase, which shows the user interface design to the users. Involving users in the design process is another benefit as problems and challenges of the design can be identified earlier and improved on. Moreover, this leads to saving time and money (Goodwin & Coleman, 2017, chapter 1). Additionally, prototyping can be useful for searching and analysing how a certain problem can be solved. For example, in the case of a mobile application, one functionality can be designed in many different ways, and with prototyping and testing, we can see the options, as well as the pros and cons of each one. Prototype makes it easier to see and understand the flow of the application, and how the user will navigate through it, to achieve their aim, which in turn helps in creating a better user experience and interface. Last but not least, we can use prototypes for communicating our ideas to others, ensuring that one vision is shared (McElroy, 2016a, chapter 2).

Prototypes can be divided by their fidelity, which is mainly connected to how finished the product looks or behave. There are five dimensions of fidelity– visual, breadth, depth, interactivity, and data model; as well as three levels – low, mid, and high (McElroy, 2016a, chapter 3).

The visual dimension of fidelity is usually the main aspect of prototyping. It is connected to how much the design and interface are finished. For example, a visually low fidelity prototype could be just sketches that focus the attention on the flow of the product rather than the look of it (McElroy, 2016a, chapter 3).

The breadth dimension of fidelity is connected to the number of main features and functionality included in the prototype. Here, a low fidelity pays attention only to a specific feature, for example, creating a playlist in a music player app, whereas high fidelity would include more features (McElroy, 2016a, chapter 3).

Similarly, the depth dimension means in how much detail a particular feature is developed. A prototype that focuses on main features but does not build onto them is low fidelity in depth. A high fidelity prototype would focus on one feature but with a lot of functionality (McElroy, 2016a, chapter 3).

The interactive dimension is connected to the interactive aspects of the product, such as buttons, user input, animations, loading, etc. Low fidelity prototype in this dimension would not react to the user's actions, such as a paper prototype. The higher the fidelity the more interactive the prototype would get (McElroy, 2016a, chapter 3).

The data model dimension is connected to the content of the product, whether the real data or dummy data is used. Lower fidelity prototypes usually include a lot of placeholder text, like the lorem ipsum (McElroy, 2016a, chapter 3).

In general, it is good to use lower fidelity prototypes at the beginning of the process, where there are a lot of ideas but also challenges. It is easy, fast, and cheap to create such a prototype. However, they are limited in interactions, do not provide the full context as well as cannot test details. Sketches, wireframes, and paper prototypes are examples of low fidelity prototypes.

Later on, mid fidelity prototypes are used, which are closer to the final product. Usually, at least one dimension of fidelity is at the focus. The benefit of mid fidelity prototypes is that they are more interactive and better for testing. An example is a clickable prototype (McElroy, 2016a, chapter 3).

In the end, there are high fidelity prototypes, which look like the finished product. They are interactable, contain real data, and have most of the features and functionalities working (McElroy, 2016a, chapter 3).

The main techniques for creating prototypes are paper prototyping, online tools and software, as well as coding in case of higher fidelity prototypes.

Paper prototypes are easy to create and their cost is low. They are especially good for exploring ideas and solutions for a problem. When used in user testing, every screen should be drawn on a piece of paper, with each state on different paper and clickable elements in different colours. The user can "click" the buttons and the interviewer transitions to the piece of paper with the next screen (McElroy, 2016a, chapter 5).

It is easy to turn the paper prototype into a clickable one with the help of online tools and software, which improve the interaction and testing. The papers with the screens can be scanned and added to the program, where hotspots can be created for clickable elements. Then, the hotspots are linked with the next screen or state. These tools also offer the possibility of making a higher fidelity prototype, that can have better visuals and animations. Examples of such tools are InVision, Marvel, Proto.io, and Axure (McElroy, 2016a, chapter 5).

5.1 Creating the prototype

The aim of creating the prototype is twofold. Firstly, it is for the designing of the interface of the app, which later on will be used as a blueprint for the development phase. Secondly, it is for the testing with the users, in order to check the validity of the interface and the interactions, as well to make sure that the app is easy to understand and use.

The first step was to create a low fidelity paper prototype, with the previously mentioned structure of the application (Figure 1) as a model. Wireframes of the main features were sketched out with limited details, therefore the breadth dimension of this prototype was in the mid fidelity level. Additionally, different solutions for the navigation were drawn. This was helpful for deciding on the type of navigation, that fits best. There could be three solutions: the side drawer, bottom tab, and main screen with tiles. Below, Figure 2 shows the sketches of the solutions for the navigation of the app. The wireframes presented how different types would feel, behave, and look. Moreover, the whole prototype serves as a basis for further development.
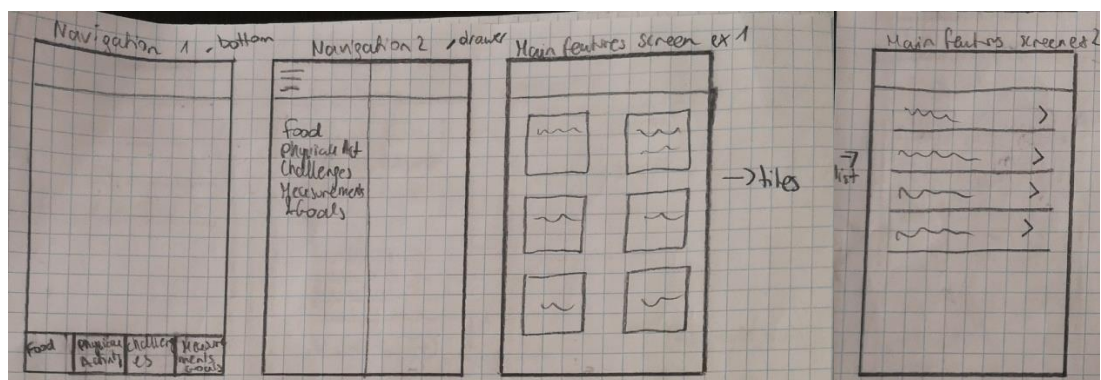
Figure 2. Sketches of the solutions for navigation.

Later, the second prototype was created. It is a higher fidelity prototype with a focus on interactivity, as well as depth. Every feature has all of the functionalities as well as it is fully interactive. However, the data dimension is on the low fidelity level, as placeholder texts

are used. The main purpose of this prototype is to test with users the design, interface, and interactions. Figure 3 presents the main wireframes of the prototype. It was created with Proto.io, as it is a good tool for creating interactive prototypes, as well as low to mid visual fidelity (McElroy, 2016a, chapter 5). Additionally, the prototype can also be shared and shown on the phone, which has a feel of an actual finished application.
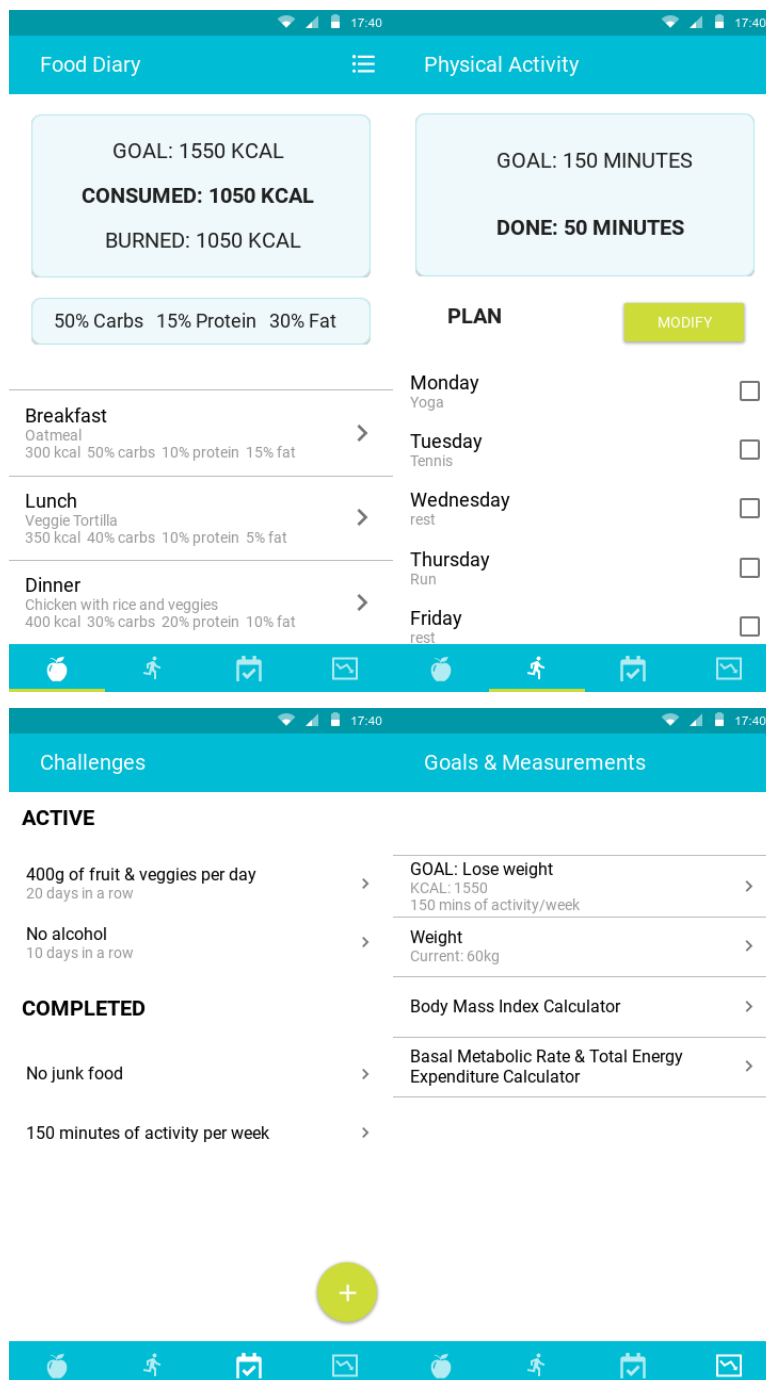

Figure 3. The prototype of the main screens of the application.

6   User testing

User testing, which is also referred to as usability testing, is a session in which a user interface is tested by users who are completing specific tasks given by a researcher. The goal is to collect feedback as well as observations about the user's behaviour while using the given interface. These results can help in identifying problems in the design, provide more information about the target users and their preferences, as well as discover areas to improve (Moran, 2019). Typically, the user testing includes a facilitator, who conducts the test, a set of tasks to complete, and a participant, who is performing the tasks. The tasks are given to the participant by the facilitator, who is then observing and listening while the participant describes what they are doing, their thoughts, and feedback. The structure of the tasks depends on the type of user testing and can be specific or open-ended. It is important for the facilitator to guide the participant, at the same time without affecting the user's behaviour to ensure the data collected is authentic. Similarly, the tasks have to be written carefully, as they may also affect the user or can be misunderstood (Moran, 2019). The instructions of the tasks should be specific enough without giving away any tips, such as using label names from the UI. The tasks should also be similar to what the users will do in reality with the product (Moran, 2018).

The user testing can be quantitative or qualitative. Quantitative testing focuses mostly on benchmarking data, such as time spent on a particular task and its success. Qualitative testing aims to gather data about how the product is used, what are the problems with the interface and the user experience (Moran, 2019).

The tests can be conducted in-person or remotely. A remote test can be either moderated or unmoderated. Moderated tests are standard and similar to in-person testing, where the facilitator gives the tasks to the participants, while in unmoderated tests the tasks are given by the tool used and the participant performs them on their own (Moran, 2019).

The number of users that need to be tested is recommended to be five. The results of the test with the first user give a lot of new feedback about the design. Afterwards, the information learned will repeat itself with a decreasing number of new information with every test. Therefore, testing with more than five users is not giving much more new insights. Instead, it is more worthwhile to test iteratively, for example, conducting a couple of tests with 5 users every time, where the results from the first round are used to improve the design, which is then tested again. In this way, the solution to the discovered problems are also being tested (Nielsen, 2000).

Before facilitating the user testing session, the plan for the test should be written down. This plan should explain what is going to be tested and how will be the results measured (Roose). Additionally, when preparing the tasks, it is good to think of a scenario that can be presented to the user, which is connected to the state of the prototype. For example, hardcoded data can confuse the user. With the help of a scenario, this confusion can be avoided. The testing session should be started with an introduction to the product, as well as an explanation what is being tested. It is important to assure the user that they are not the ones being evaluated. The users should be asked to talk out loud (Thomas, 2018).

6.1 User testing sessions

The user testing sessions tested the design and the implementation of features and functionalities. They were remote moderated sessions, with the aim of gathering qualitative data about the user experience and interface. The interview started with a short description of the application so that the participants had the needed background. They also had time to familiarize themselves with the app. Next, the users were asked to perform a number of tasks, while explaining their thoughts and feedback. The facilitator gave the tasks as well as noted all the comments, in order to analyse the results later on. Any positive feedback is measured as a success, as well as the lack of problems with completing the tasks. However, at this stage, any feedback and opinions about improvements are considered very valuable.

To test all the main features, two short tasks have been created per feature, giving in total eight tasks. All the tasks with their respective features are listed in the table below (Table 2).

Tasks	Feature
Find out what is your BMI.	Goals and Measurements (section 4.1.1) – calculating BMI
You weighed yourself today. Add your weight.	Goals and Measurement (section 4.1.1) – logging weight
You just finished your breakfast. Add a food product to your breakfast.	Diet tracking and planning (section 4.1.2) – logging meals
You are going grocery shopping. Check what you planned to eat on Monday.	Diet tracking and planning (section 4.1.2) – planning menu
You came home from the gym. Log in the workout session you just completed.	Physical activity tracking and planning (section 4.1.3) – logging physical activities
Today is the end of the week, you want to make a schedule for workouts for next week.	Physical activity tracking and planning (section 4.1.3) – scheduling activities
You want to improve your health and fitness. In order to motivate yourself you take up a new challenge.	Challenges (section 4.1.4) – taking up a challenge
You are currently trying to eat more fruits and vegetables every day. Update your progress in that challenge.	Challenges (section 4.1.4) – marking progress in a challenge

Table 2. List of tasks for the user testing session.

6.2 Results of user testing

In total there were five user testing sessions. Each session provided interesting results. This section presents the results summarised by the main features.

6.2.1 Goals and measurements

The first feature, which is the goal setting and calculations of measurements, was the most straight forward to all of the users. There were no problems with completing the tasks, as well as everything was easily understandable. One major suggestion was to include more informative text, both for BMI and BMR/TEE calculations. For BMI, users proposed that the text with index ranges should include all of the ranges (healthy, underweight, overweight, and obese). Also, the information about BMI being only an estimate could be positioned on the top, so that it is not missed, as it is an important message. Ad-

ditionally, one user mentioned that it could be useful to have a differentiation between children and adults since the index calculation varies between these age groups. Figure 4 present the prototype for the BMI calculation screen. As for the BMR/TEE calculation, all users agreed that more information is needed to explain these ratios. Another suggestion was that the calculations could be automatic when the weight is updated. Lastly, one user was wondering whether the "Goal" in the main screen of this feature is a bit out of place and that maybe it should be separated more from the others.
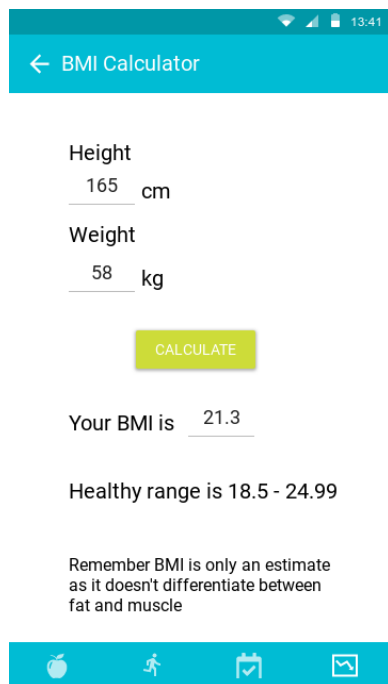
Figure 4. The prototype for the BMI Calculator.

6.2.2   Diet tracking and planning

The second feature is the food diary and planning. The users were able to complete the first task connected to this feature. It was suggested for the products that are added by the users, to be saved, so that later on adding the same products is easier and faster. Also, there should be the ability for changing the meal items and their details after adding. The second task, which was checking the plan for the next week, was a bit more challenging. Few users had problems with finding the button for the food plan, which was located in the upper right corner of the screen. Some were not sure about what the icon means, others did not realize it is a button right away, however, the rest of the users was not confused at all, it was the first thing they noticed and also the first thing they clicked. Figure 5 presents this screen with the planning icon in the upper right corner. Additionally, users pointed out that there should be a button for saving the whole plan, the plan for the day, or the meals, as otherwise, it is not clear the information is saved. Another recommendation

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for the whole feature was to indicate the day, which is being shown, both in the diary and the plan. The header could include the word "daily" to clarify the timespan. Also, some users were thinking if a calendar view would be useful here, to be able to see the previous days.
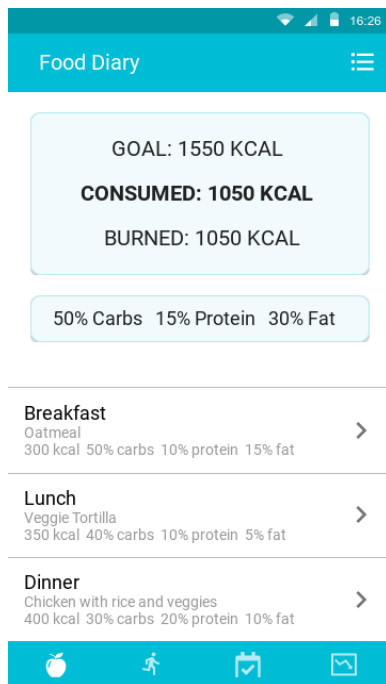

Figure 5. The prototype of the Food Diary screen, with the planning icon in the upper right corner.

6.2.3 Physical activity tracking and planning

In the case of the third feature, concerning the physical activity, the biggest issue was with the visibility of the two sections (plan and list of completed activities), as well as with the confusion about these two. Firstly, many users did not realize that they could scroll down, making the list of activities invisible to them, which in turn made the task with adding a newly completed activity quite difficult. Figure 6 presents the first view when the user comes to the screen, with only one part visible. Secondly, it was sometimes not clear what is the difference between plan and activities. This also made the scheduling of activities harder, the lack of dates in that part was also confusing. Therefore, it was implied these sections could be separated more. Additionally, similarly as in the previous feature, there could be a history view. Also, the buttons connected to each section should be under the headline instead of next to it. Few users were confused about the checkboxes in the plan section and did not realize they could be checked as done, so this should be made more clear. Moreover, this functionality could be automatic when the user adds the required activity for that day. Another issue was with the intensity of the activities, which is mentioned

in several places of the app. Explanation about the different levels of intensity should be made available to the users. What is more, the headline of this feature should imply the context of the physical activity, therefore it should be "Weekly Physical Activity". Lastly, one user mentioned that in the plan, not all text is written in the same way – "rest" was written starting with a lower case letter, while everything else is starting with a capital letter. This should be unified.
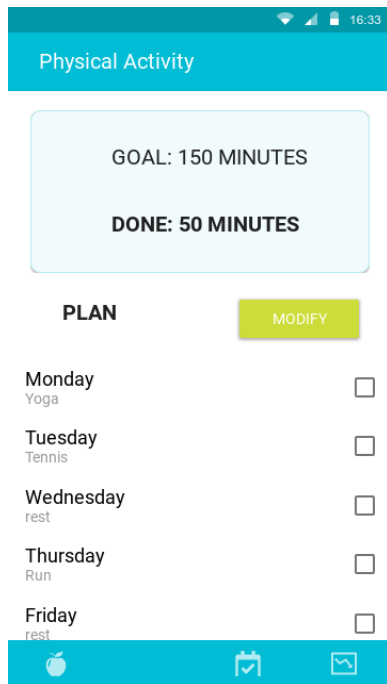

Figure 6. The Physical Activity main view.

6.2.4 Challenges

The last feature – the challenges, was maybe the most difficult to understand for the users. Starting with the tab icon in the navigation, which does not tell specifically the user what this tab is. Secondly, all of the users said that there needs to be more feedback after adding a new challenge so that it is clear that the action was done. Also, in the list with the new challenges, it would be better to have an "add" button, instead of a plus sign, as it would be more visible. Figure 7 presents the problematic list. Similarly, in the "add own challenge" screen, an "add" button could be placed at the bottom of the screen, in contrast to the "tick" at the top. This suggestion also extends to all analogous screens. Furthermore, there should be an indication that some challenges are available already in the system and that the user can add their own. On the main screen of this feature, some users missed the headlines, were confused about the "active" and "completed" challenges and the duration of the challenges was not clear. It was suggested to make the headlines bigger. Moreover, one user suggested that the action button for adding a new challenge

should be positioned more closely to the "active" part as it is connected to it. Also, it was not completely clear what the subtitle of the challenges means. The subtitle mentions how many days in a row the challenge is currently completed, but a few users were not sure whether this means the goal. In the challenge detail view, one user was confused about the action button and did not know what it does. The action button is an "edit" button, however, this was not implemented in the prototype and it was not clickable. Another matter in here was the marking the challenge completed for the day. Users said that there should be an option for choosing between completed and not (a "tick" and an "x"), however, some were positive about the idea that the challenge would update on its own if the user did not mark it as completed. Although, in that case, the app should remind the user to update the challenge, or there should be an option to change the mark to complete after the app marks it automatically.
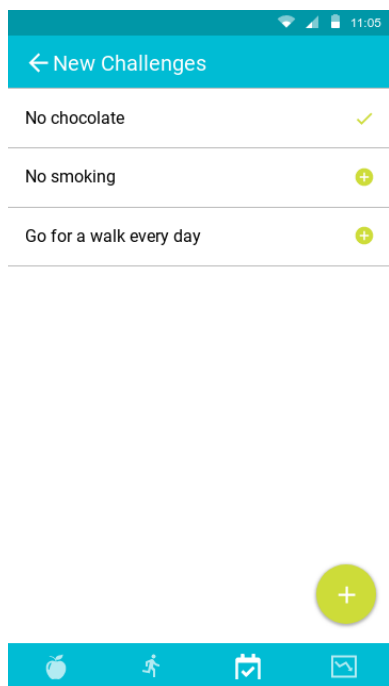
Figure 7. The list with the new challenges.

Overall, the reception of the app was positive. Users mentioned that the idea for the app is good and useful, bringing together planning for diet and sports, which is very motivating. The visuals are nice, although for some it was not the most attractive interface. Still, the app is intuitive and easy to use after the initial learning, which was also fast.

To summarize, the user testing produced valuable insights and feedback in regards to the design of the app. The biggest takeaways are the positioning of the buttons when the users are adding items, bigger headlines in particular places, more informative text about

certain aspects of the app, and better differentiation between sections of some features. The result of the testing session will be taken into account during the development phase.

7 Implementation

This section presents the implementation of the application. The app was developed in stages - the database design and programming of features as presented in Figure 1. The last stage included a final test. The app was developed in the Android Studio environment with Java and Gradle.

The scope of the app has been limited, as the whole app would be too wide to implement for a thesis project. The features of food and activity tracking and planning are not fully developed for this version of the app. Instead, the challenges are the focal point of the app, which help and motivate the user to live a healthier lifestyle. That is why, the app has several pre-existing challenges, which are based on the research conducted in the first chapter. They encourage to, for example, monitor the intake of certain nutrients, such as carbohydrates, protein, or different types of fat. Most of these challenges have a feature, that allows for tracking their respective value, such as calories or weekly activities from within the challenge. The challenges are divided into three types: basic, food tracking, activity tracking, and water tracking challenge. These types are created as their presentation and functionalities in the application differ. The list of pre-existing challenges with their descriptions and types is presented in Appendix 1. Nonetheless, the user has the possibility of adding their own basic challenges, where the user can simply mark the dates when the task has been completed. The limited version of the app is divided into three sections: Challenges, Food Journal, and Goals and Measurements.

7.1 Challenges

In the "Challenges" view, the user can see their active as well as finished challenges. In case the user has not started or completed any challenges yet, appropriate information is displayed with instructions. This is presented in Figure 8.
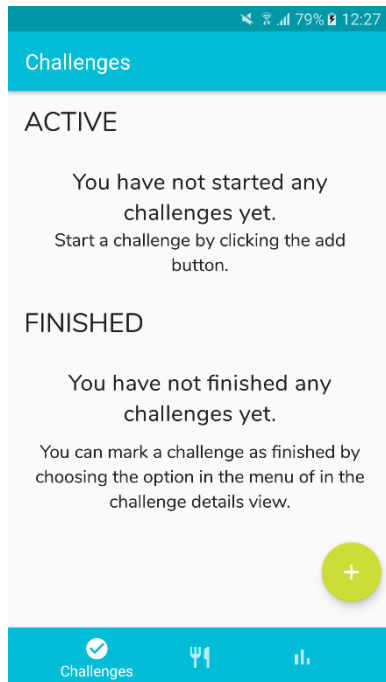
Figure 8. The empty lists of Active and Finished challenges.

In the right bottom corner, there is an action button, which takes the user to the "Add Challenge" screen, where the user can, either create their own challenge or choose from a list of pre-existing challenges (Figure 9). The list also includes challenges that have been added by the user and have already been finished. If the user chooses a challenge from the list, a dialog pops up with the information on the challenge and the possibility to start it, as shown in Figure 10. While creating an own challenge, the user has to give a name and choose the frequency, which includes: daily, three times per week, two times per week, and once per week. The challenge description is optional.
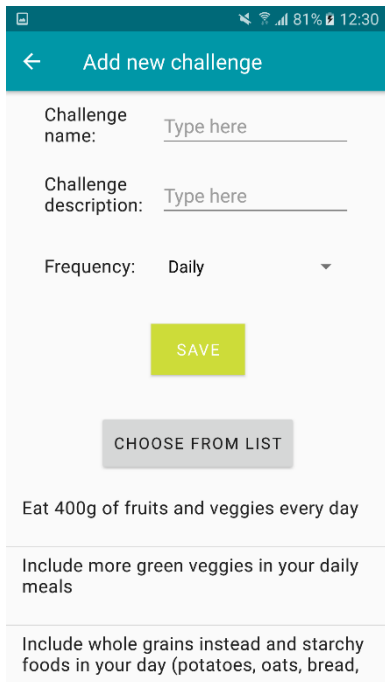
Figure 9. Adding a challenge.
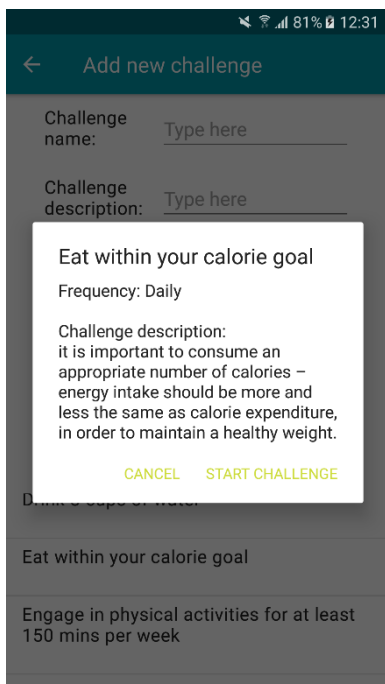
Figure 10. The dialog with the challenge information.

The newly started challenges then appear in the list in the active section, as can be seen in Figure 11.
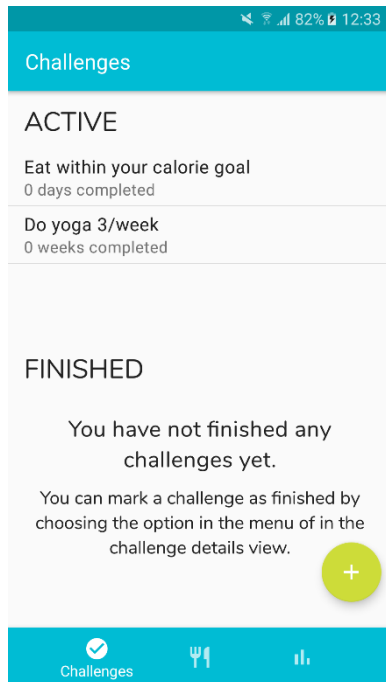
Figure 11. The list of started challenges.

Each item in the list can be clicked, which takes the user to the screen with the challenge details. This view differs a bit, based on the type of the challenge.

Firstly, the basic challenge includes a calendar, where the progress can be marked. Underneath there is information about completed days or weeks depending on the chosen frequency. These are calculated from the days marked on the calendar. Basic challenges are mostly the ones created by the user, however, there is a couple that are pre-existing, as can be seen from the list in Appendix 1. Figure 12 presents the view for a basic challenge.
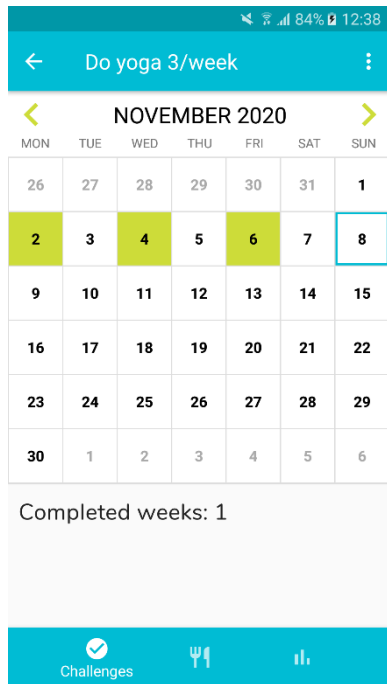
Figure 12. The basic challenge details.

Secondly, there is the food tracking challenge, which apart from the elements mentioned above, includes a summary of the total intake for the current date. This differs based on what the challenge is concerning, such as total grams of fruit, sugar, salt, and so on (Figure 13). Next to it, there is an "add" button, where the user can add what they have eaten that day. The user can, but doesn't have to, fill in all the information about the food – the name and grams are the only required ones. The checkbox for "Fruit or veggie?" is for indicating if the item should be included in the fruit/vegetable challenge. Figure 14 presents the "Add Food" view. There is an option to choose from the list of items, which shows a dialog with the list of already added food items, as can be seen in Figure 15. The user can pick one and the fields will be filled with the appropriate information. After a food item is added, the total intake is calculated and updated in the challenge details. In case of tracking the progress on the calendar, the user needs to mark the dates manually.
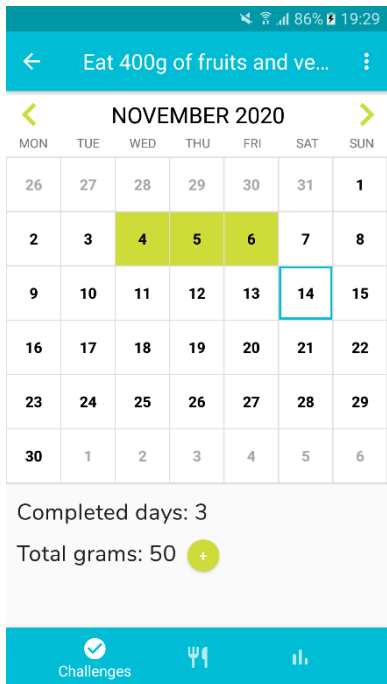
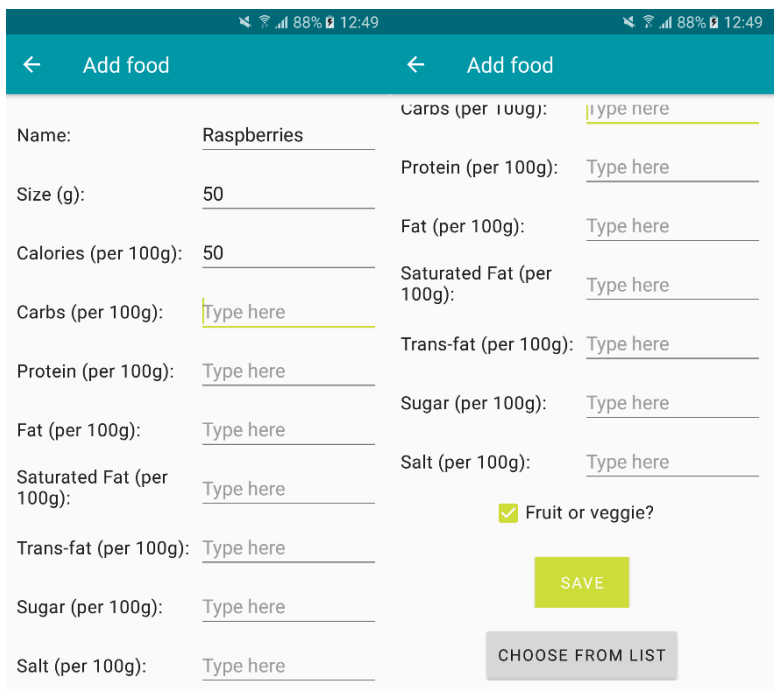Figure 13. The food challenge details.

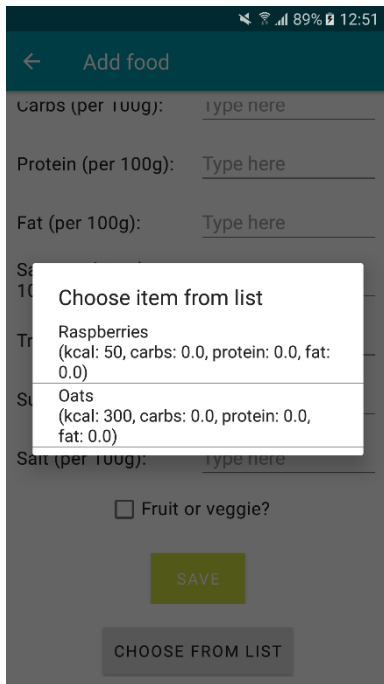
Figure 14. Adding a food item.

Figure 15. Choosing a food item from the list.

Next, there is the water tracking challenge, which is very similar to the food challenge. The difference is that the total number of cups of water is edited by clicking the "minus" or "plus" buttons on the sides of the "cups" text. This number is saved in the app for the day and it reset on the next one. The water challenge is presented in Figure 16.
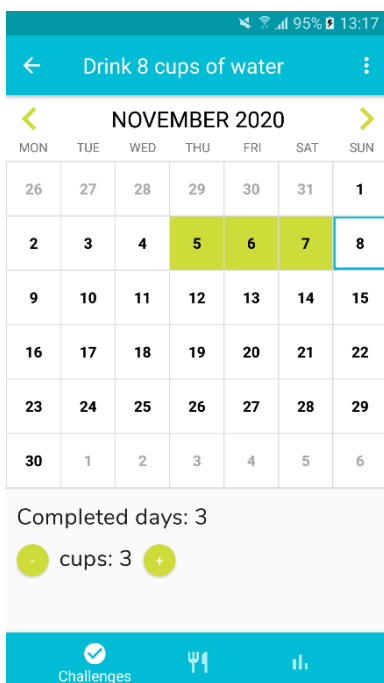

Figure 16. The water challenge details.

Lastly, there is the activity challenge, which is different from the others. The calendar is not visible, however, there is the "Completed weeks" text at the top. Below is the information about the week with start and end dates, as well as arrows for changing between the weeks. Afterwards, there is the total number of activity minutes, which are calculated from the duration of the added activities. In case there are no activities, there is an appropriate message, as presented in Figure 17.
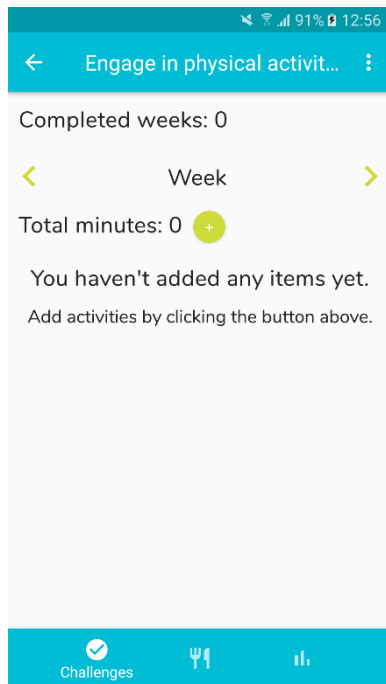

Figure 17. The activity challenge details with the empty list.

There is an "add" button for adding an activity, where the user gives name, date, and duration (Figure 18).
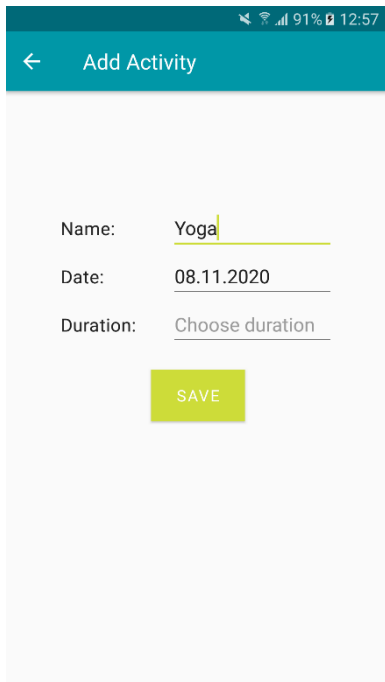
Figure 18. Adding an activity.

The activities are shown in the list, with all the information, which can be seen in Figure 19. The number of completed weeks is updated when the total minutes for a week reaches 150 minutes (Figure 20).
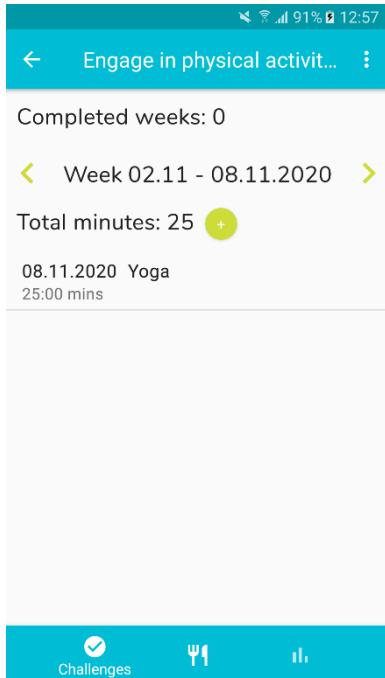

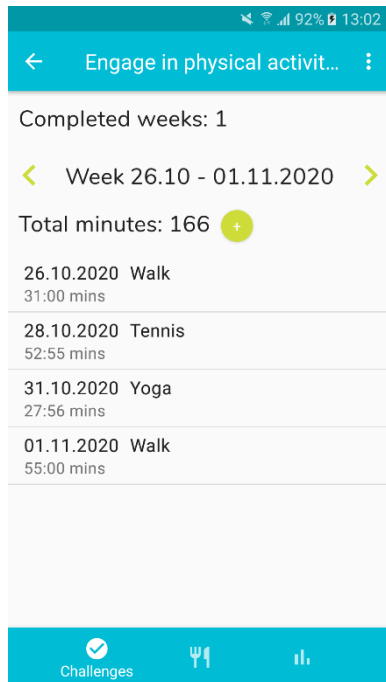Figure 19. The activity challenge details with a list of activities.

Figure 20. The activity challenge details when 150 minutes of activities have been reached.

In all of the challenges, there is an options menu in the upper right corner, which differs based on the type of the challenge. As can be seen in Figure 21, the basic challenge has an option for showing a dialog with the challenge information (frequency and description), editing, or finishing the challenge. The edit option takes the user to the "Edit Challenge" view, where the challenge can be edited or deleted from the database. The finish option shows a dialog, where the user confirms that they want to, indeed, finish the challenge. This challenge then appears in the "Finished" section of the "Challenges" view.
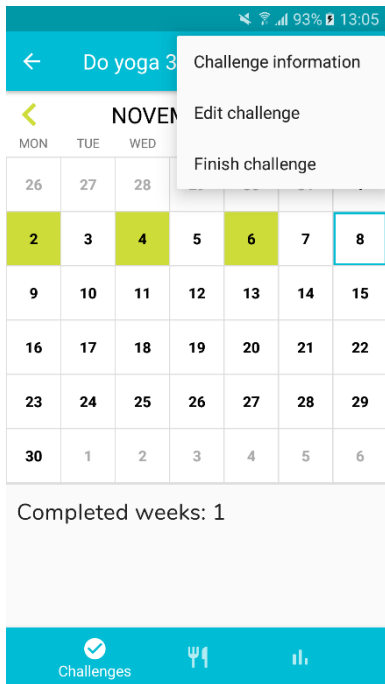
Figure 21. The basic challenge menu options.

Other challenges do not have the option for editing, however, the food challenge has an option for showing the food journal, which takes the user to the "Food Journal" activity. This is presented in Figure 22.
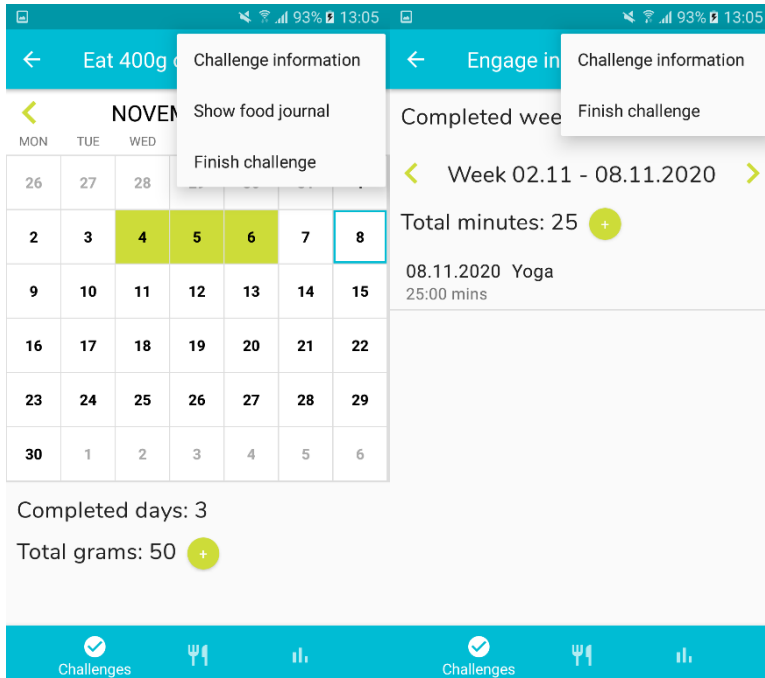

Figure 22. The food and other challenges menu options.

Additionally, the user is reminded by the app to update and mark their progress on the challenges. This is done with a notification that is sent every evening. Figure 23 presents the notification.
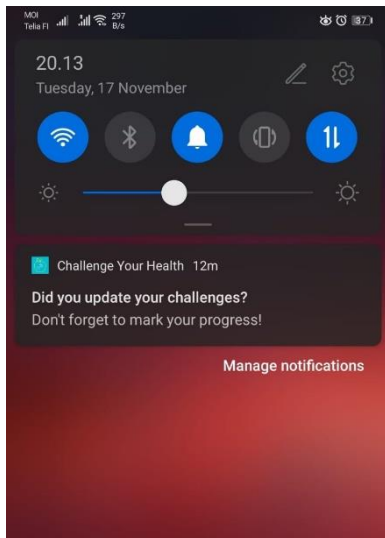

Figure 23. The notification reminding the user to update the challenges.

7.2   Food Journal

The Food Journal section displays the food items added for a specific day. At the top, the user can choose for which date the items are shown. Next, there is a summary of the main elements - calories, carbohydrates, protein, and fat, followed by a list of foods. This is presented in Figure 24.
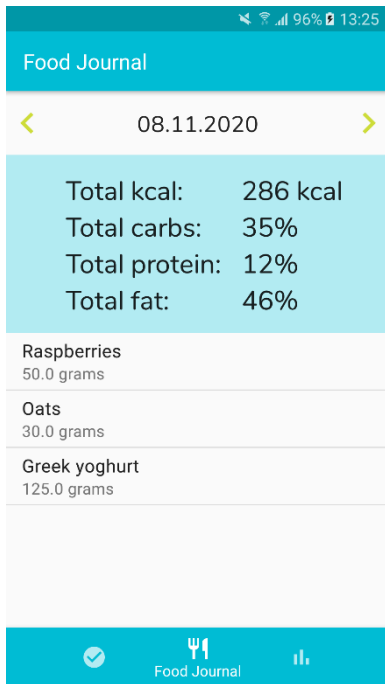
Figure 24. The Food Journal summary and list view.

The items in the list can be clicked so that they can be edited or deleted, as seen in Figure 25. If the list is empty, information is shown to the user on how food can be added (Figure 26).
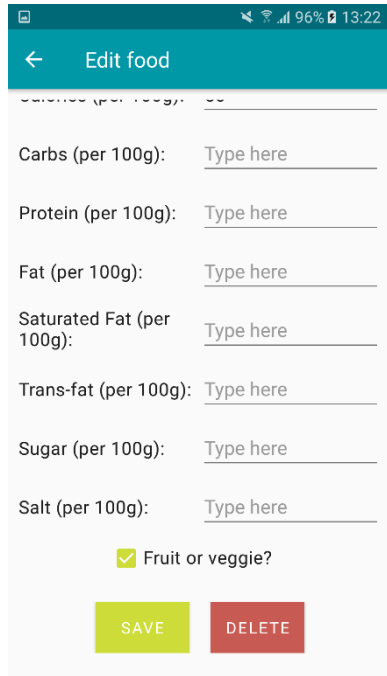

Figure 25. Editing a food item.
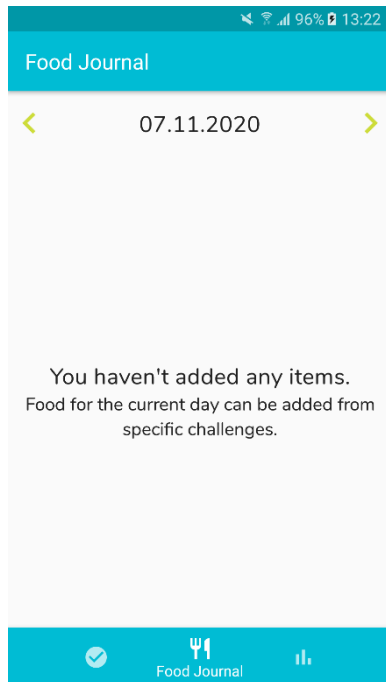
Figure 26. The empty list in the Food Journal.

7.3   Goals and Measurements

The last section of the app is Goals and Measurements, where the user can set their goal, track their weight, and calculate their BMI, BMR, and TEE.

Firstly, there is the goal-setting feature, presented in Figure 27, where the user decides if they want to lose, maintain, or gain weight, as well as what is their goal weight. Also, the user can set how many calories they should consume each day. This value can be based on the TEE calculation, therefore, in case the user has not counted this value yet, there will be appropriate information displayed. Otherwise, the field will be filled with the latest TEE result (Figure 28). Lastly, the user can indicate how many weekly activity minutes they want to achieve.
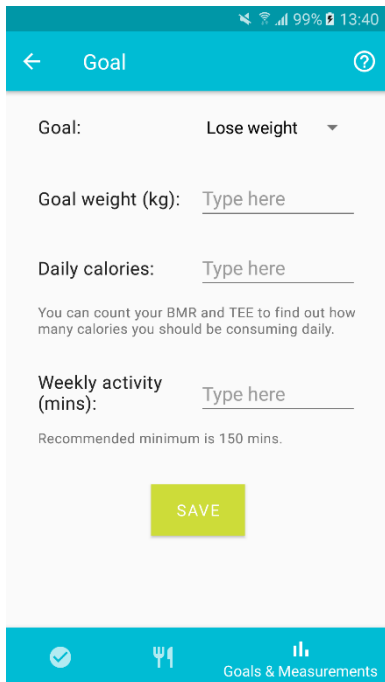
Figure 27. Setting the goals.
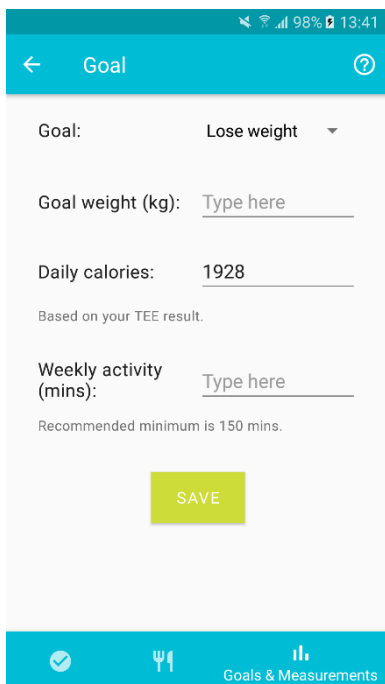
Figure 28. Setting the goals with available TEE result.

In the upper right corner, there is also a help icon, which displays a dialog with the message on the importance of healthy weight and how to adjust it based on the goal, as well as information about the physical activity. The dialog is presented in Figure 29.
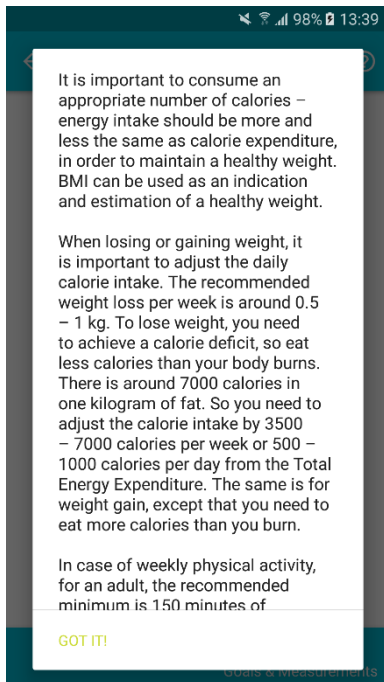
Figure 29. The dialog with goal information.

Next, there is the weight tracking feature. This view includes a graph, a list of weight entries, and an "add button". The "add" button takes the user to a screen where the weight can be added (Figure 30) while clicking on the list item shows an "Edit Weight", where it can be either updated or deleted.
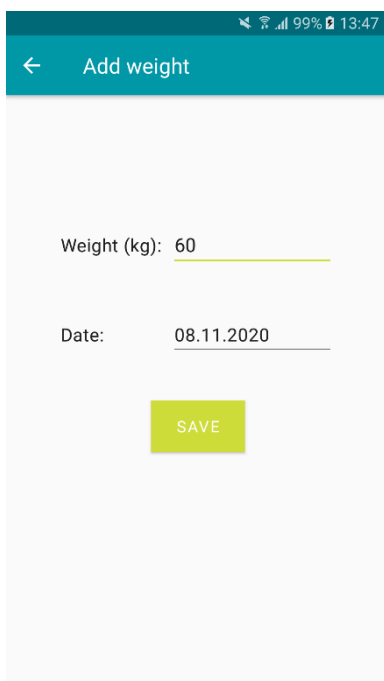
Figure 30. Adding weight.

The graph visualises the weight fluctuations and progress towards the user's goal. In the case the goal has not been set, or it is to "Maintain weight", the highest and lowest weights are the limits of the graph. Figure 31 presents this type of graph. In the case of the "Lose weight" goal, the lowest point of the graph is the goal weight (Figure 32), while for "Gain weight", the goal weight is the highest value on the graph (Figure 33). In this way, the user can clearly see how much they have achieved in regards to their goal.
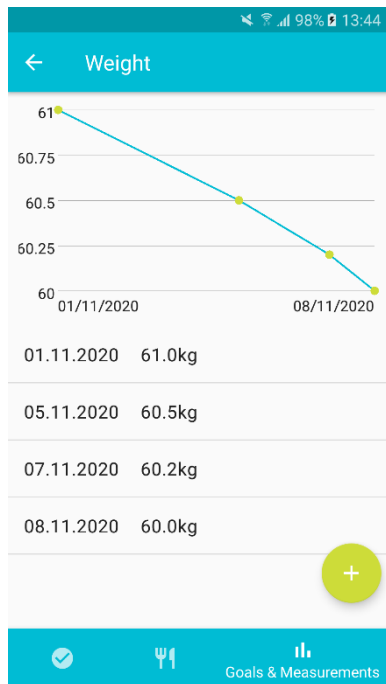
Figure 31. The weight graph for the "Maintain weight" goal or no goal.

Figure 32. The weight graph for the "Lose weight" goal.
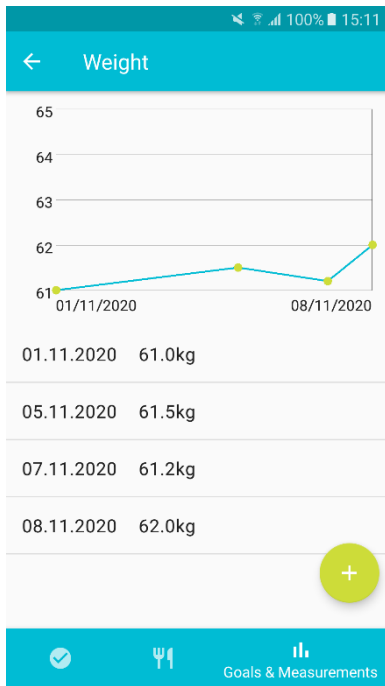
Figure 33. The weight graph for the "Gain weight" goal.

Additionally, tapping on the points on the graph will show a Toast message with the date and the weight value, which is presented in Figure 34.
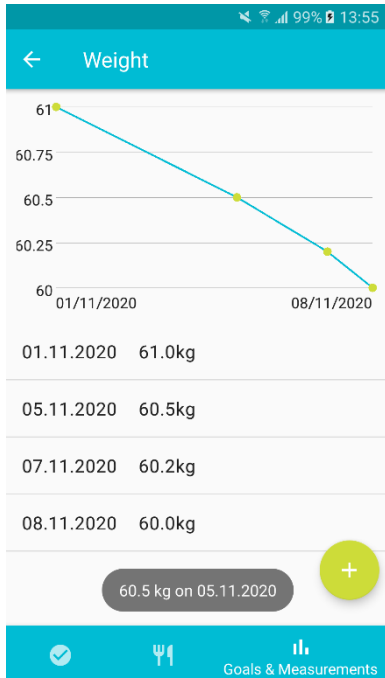
Figure 34. The Toast message after tapping a point on the graph.

If there are no weights saved in the database, there is a message with the instruction to add the first weight, as presented in Figure 35.
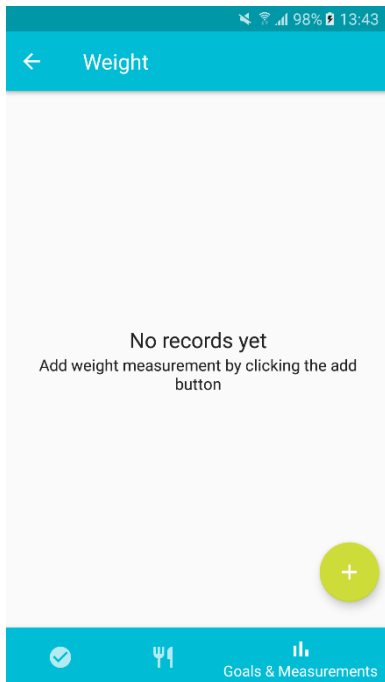
Figure 35. The weight view with an empty list.

The last two features are similar and allow the user to calculate their BMI, BMR, and TEE. In the case of BMI, there is a note at the top of the screen telling the user that BMI should be only used as an indication. Also, the index ranges are shown below the result so that the user can see in what range their BMI is qualified. Figure 36 presents the view with the BMI calculation.
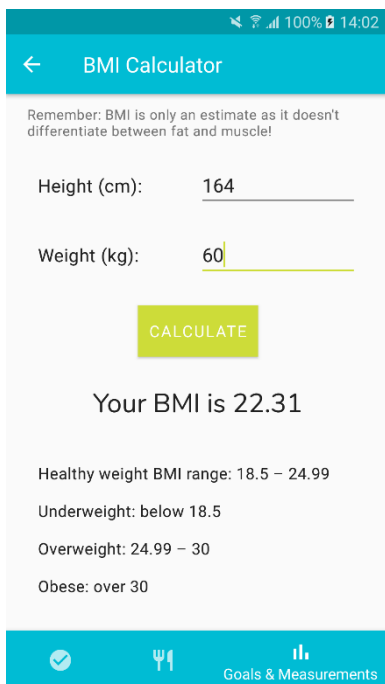
Figure 36. The BMI calculation.

On the other hand, the BMR and TEE calculations have information available in the menu in the upper right corner. This message informs the user what these rates are, what do they mean, and how to choose the right activity level. The dialog is presented in Figure 37. The results are shown at the bottom of the view (Figure 38). As mentioned earlier, the TEE result is later included in the goal view, if that goal has not been set yet.
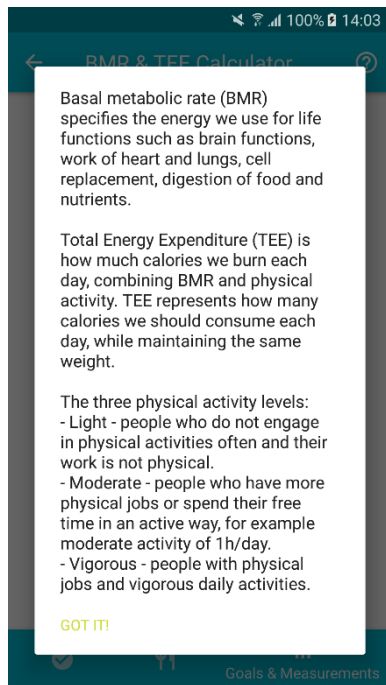
Figure 37. The dialog with information on BMR and TEE.
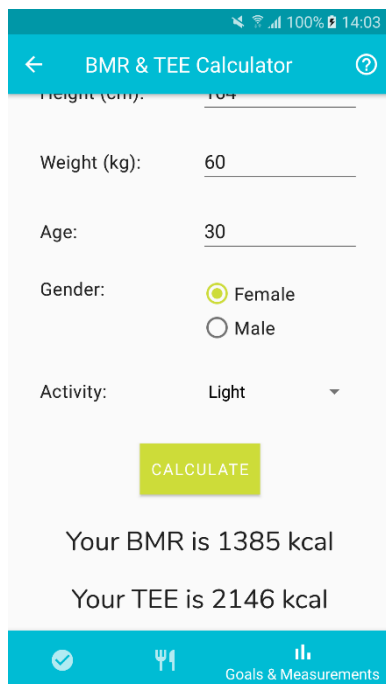
Figure 38. The BMR and TEE calculations.

8   Final testing

The final testing of the app was organised in a manner that the users have received access to the app and were told to use it for a certain period of time. In the end, the test lasted ten days and involved seven users, out of which three were the users involved in the previous test. The main focus was to find out if the app is fulfilling its purpose – helping the users to improve their health and motivate them to maintain a healthy lifestyle. The users were supposed to utilize most of the features of the app and take up some of the pre-existing challenges of different types, such as food, activity, or water type challenge. They were also encouraged to create their own challenges. Nonetheless, the UI and UX were also the topic of the test, as well as any bugs or errors that exist, however, to a smaller extent.

As a tool for gathering the results, a survey was created, which focused on qualitative data, such as comments and users' suggestions. The main type of questions in a qualitative survey are open-ended questions, which cannot be answered with a simple "yes" or "no", but rather allow the participant to give a deeper and more descriptive answer (Farrell, 2016a). However, close-ended questions can also be included, making the form a mix between a quantitative and qualitative survey (Farrell, 2016b).

The survey should not be very long, as people prefer to answer shorter questionnaires. Additionally, open-ended questions make the survey more complex, time-consuming, and tiring, therefore, in this type, it is even more important. Essential questions should be positioned in the beginning, in case the participant drops the survey in the middle. The questions should be neutral, without giving any hints, expectations, or answers so that the users' responses are not influenced. Moreover, the introduction and instructions should be concise and to the point, with the most important aspects underlined. Any terms that are used throughout the form, should be defined so that both the creator and the user have a common understanding. The goal of the survey should be chosen beforehand as well as the online tool. In the case of close-ended questions, it is better to provide multichoice answers, as well as give options such as "not applicable". The reason is that people prefer to be accurate and if there are a couple of answers or no answer that fits them, then the results are skewed (Farrell, 2016b). One possible set of options is a Likert Scale, which usually measures agreement with a certain statement, but can also be used to measure frequency, importance, or likelihood. The scale has usually five responses, with the first and the last being on the opposite ends of a spectrum. For example, in case of an agreement to statement, the responses start with "strongly disagree" and end with "strongly agree", with "neutral" in the middle (McLeod, 2019).

Based on the above-mentioned aspects, as well as having in mind the goal of the survey, which is to find out the impact of the app on the users' health and lifestyle, the questions for the survey have been prepared, which is presented in Appendix 2.

8.1   Results

After the days of using the app, the users were asked to complete the previously mentioned survey. In the end, five users gave their responses. The other two did not manage to use the application enough to give timely responses.

The first question asked the respondents about their opinions of the preloaded challenges. The users have answered that they are good, practical, versatile, and provide options for anyone. It has also been mentioned that they motivate to take action. On the other hand, users were confused by some challenges, such as "Limit the intake of sugar to 10% of your total calories", as they were thinking that they should limit their intake by 10% compared to their current situation, which is hard to measure. Additionally, it was proposed that the challenges could be categorised.

The second question asked the users to list the challenges they have taken up during the test. Table 3 presents the answers and their respective percentage results for each challenge. As can be seen, the most popular challenges were "Drink 8 cups of water" and "Engage in physical activities for at least 150 mins per week", followed by "Eat 400g of fruits and veggies every day" and "Limit the intake of cow, pig and sheep meat (instead chicken, turkey, fish)". The participants have chosen various types of challenges. It also shows that they were hesitant to try a challenge that was confusing to them, as mentioned in the previous point. Therefore, this should be addressed by giving the users more information on these problematic challenges.

Challenge name	Percentage of users
Eat 400g of fruits and veggies every day	60%
Include more green veggies in your daily meals	20%
Include whole grains instead and starchy foods in your day (potatoes, oats, bread, rice)	40%
Limit the intake of cow, pig, and sheep meat (instead chicken, turkey, fish)	60%
Include carbs as 50% of your total calories	0%
Include protein as 30% of your total calories	0%
Limit intake of fats to 30% of your total calories	0%
Limit the intake of saturated fats to 10% of your total calories	0%
Limit the intake of trans-fats to lower than 1% of your total calories	0%
Limit the intake of sugar to 10% of your total calories	20%
Limit the intake of sugar to 5% of your total calories	20%
Limit the intake of salt to 5g	0%
Drink 8 cups of water	100%
Eat within your calorie goal	0%
Engage in physical activities for at least 150 mins per week	100%
Stop smoking	0%
Lower your alcohol intake	0%

Table 3. The challenges chosen by the users.

The next two questions were measuring the overall satisfaction of the progress in the challenges. The third question asked the respondents to give more details on the process, while the fourth one utilized a Likert Scale. For the most part, the users have been able to complete the tasks, while planning to take up more later on. They noticed that they have been eating more fruits and vegetables, engaging in physical activities as planned or even more, drinking more water than before, and were overall more conscious about what they were eating. Some participants have realized what they lack in terms of their diet or physical activity, for example, one user has noticed they are not active enough, as well as they are not eating enough fruits and vegetables, as it is hard to achieve the 400 grams per day. However, they mentioned that the app is helping with paying more attention to these aspects and motivates them to reach these goals. As can be seen from Table 4, most of the users have been satisfied with their progress.

How satisfied are you with your progress in the challenges?	Percentage
Very unsatisfied	0%
Unsatisfied	0%
Neutral	40%
Satisfied	60%
Very satisfied	0%

Table 4. User satisfaction with their progress in the challenges.

The next question measured if the app and the challenges have motivated the users to improve their health and to what extent. Table 5 presents the results. All of the users agreed with the statement, which means the app has helped motivate them.

The app and challenges motivated me to improve my diet and physical activity	Percentage
Strongly disagree	0%
Disagree	0%
Neutral	0%
Agree	80%
Strongly agree	20%

Table 5. The app's influence on the motivation of the users.

The sixth question has a similar format as above, however, it asks if the app and challenges influenced the users' diet and physical activity. As presented in Table 6, again most of the respondents agreed. This is in line with what has been mentioned earlier by the users, that they have included more fruits and vegetables, as well as they have been more active than what they have planned.

The app and challenges motivated me to improve my diet and physical activity	Percentage
Strongly disagree	0%
Disagree	0%
Neutral	20%
Agree	80%
Strongly agree	0%

Table 6. The app's influence on the users' diet and physical activity.

The next question asked the users about their learnings during the process of using the app. Many of the answers pointed out that the participants have gained more knowledge about nutrition, for example, they were more conscious about what they are eating, or they started to include fruits and vegetables with every meal. Also, they have found out what is their own BMR and what it is in general. The users also mentioned that they have learned about their habits, such as that they do not drink enough water during the day. The app has also helped them to be more systematic and to control their progress.

The eighth question asked about the parts of the app the respondents liked the most. Here, the most common answer was that the app improves motivation, helps to stay healthy, and shows what the person could improve upon. The users like that they can track their progress, which also makes them pay attention more to certain aspects. The weight graph was also mentioned, as well as the ability to create own weight goals and calculating the right calorie intake. Additionally, participants liked that the app was simple and clear to use.

The ninth question asked about the opposite, which is what are the weaker parts of the app. It was mentioned the app sends too many notifications. It was pointed out that it was not possible to have a goal weight as a decimal number, for example, 70.5kg. Also, the fact that the app does not automatically mark challenge progress on the calendar was problematic. Additionally, the users did not like that they could not see information about past days. For example, for the water challenge, it is impossible, while for food challenges it has to be checked from the Food Journal which is not handy. The last issue was the fact that the user has to input the data about a food item on their own, which can be trouble-some, especially in case of not having a container with the information, such as with fruits.

The next question is somewhat connected to the previous one, as it asked what could be improved in the application. Here users had different and interesting suggestions. It was mentioned that there could be an introduction to the app, where the user would fill in their information about weight, height, etc. Also, there should be more information or instruction for the challenges, especially for the ones that were confusing for the users. It should be possible to add food directly from the Food Journal. The food items are duplicating in the database, making the list very long eventually, so this has to be addressed. Moreover, while adding a food item, the calories and other nutrients could be calculated right away for the amount of inputted grams, so the user could see that before saving it to the data-base. It has also been suggested that the Food Journal could have different views, such as monthly view so it would be easier to go months or years back. Currently, the user can change the day by one with every click. The same could be implemented in the physical

activity challenge. In the weight list, the entries could be sorted from most recent to the oldest, as now it is the other way around. One user proposed that the app could encourage to add weight daily. Additionally, the BMI, BMR, and TEE calculations could be remembered by the app, as well as the measures such as weight and height, so that when the user comes back to the screen, they do not have to input these again. Another big suggestion was to allow the user to track their progress even more, such as weekly or monthly. The app could evaluate the percentage of the goals done after a certain period of time. Lastly, one user has pointed out that when inputting text into the app, the input does not start with a capital letter automatically.

The next question asked the users if they would like to continue using the app. Table 7 presents the results for this question. As can be seen, all of the users will likely use this app in the future.

How likely are you to continue using this app?	Percentage
Very unlikely	0%
Unlikely	0%
Neutral	0%
Likely	100%
Very likely	0%

Table 7. The users' likelihood of continuing to use the app.

The last question asked to mention any bugs or problems that occurred during the usage of the app, however, none of the users noticed anything, except what has been mentioned before.

9 Discussion

The goal of the thesis was to, firstly, find out what it means to be healthy, how does a healthy diet look like, and how much physical activity is needed. The results gathered by the research are very concrete and could be utilized in the development of the application. The second goal was to create an app that is helping and motivating users to improve their lifestyle and health. This aim was achieved by creating the prototype, testing it, and, finally, implementing the app, which was, again, tested by users. The final test gave great results as well as insights on how to further improve the app. The app has been useful and motivating for most of the participants, who were satisfied with it and their own progress. The users would like to continue using this app. At the same time, the respondents thought the app was clear and easy to use. Therefore I can conclude that the project was a success. There were some problems and confusion, especially with challenges about limiting the intake of a particular nutrient, however, the app has overall realised its task, which is to help and motivate to live more healthily.

The next step is to implement the improvements mentioned by the users as well as solve the problems. Some have already been addressed, such as adding food from the Food Journal, duplicates of food items in the database, allowing for a decimal goal weight, and the frequency of the notification. Afterwards, the app can be developed further and I can implement the features that were limited out of the app for this project, which are the diet and physical activity tracking and planning. The tracking part is partially done, but it can be improved upon. Even later, it would be great to create a cloud database, built up by the users with the food items and their barcodes, so that the food adding is faster and easier, however, this is something further down the line.

I have chosen this topic for my thesis, as I was previously planning to develop a similar kind of application and I was also interested to find out more about proper diet in general. In terms of my own learnings, I have gained many skills during the course of this project. Firstly, I have found out a lot about a healthy diet and physical activity and what is the danger of not living healthily. I have learned about proper hydration, which was very interesting to research, as it was different from what I have thought before. As a programmer, I have strengthened my skills and advanced in the area of prototyping, user testing, and Android development. I have been able to use different libraries and APIs in this project, which I have not used before. Also, I have learned about elements and components I have not known or developed earlier, such as how to create a notification. Additionally, I have found out how to publish an app on the Google Play Store, how the process looks like, and what is required. I have also worked on my project and time management skills,

as it was challenging to create the right scope for the app, which was the main problem of the project. In the end, I solved it by limiting the app, which in my opinion was a good decision, as I could already create a useful app that can be developed further after my studies are done. Additionally, I had to organise my tasks in a manner that I could finish the thesis in time, while simultaneously completing my internship. Overall, I am satisfied with my thesis project and its result.

The application developed is available on the Google Play Store under this link: https://play.google.com/store/apps/details?id=fi.haagahelia.android.fitnessapp, or under the name "Challenge Your Health".

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Appendices

Appendix 1. List of preloaded challenges into the app.

	Name	Description	Type	What the challenge is tracking
1	Eat 400g of fruits and veggies every day	A healthy diet includes a lot of fruits and veggies, which are the base of each day. The recommendation is 400g, but the more the better. The best is to take advantage of the seasonal fruits and eat fresh produce as much as possible.	Food	Daily grams of fruit and vegetables
2	Include more green veggies in your daily meals	Colour variety in vegetables is important. Green vegetables are full of iron, so try to eat more of them.	Basic	
3	Include whole grains instead and starchy foods in your day (potatoes, oats, bread, rice)	Whole grains and starchy foods are the second most important part of healthy diet. This includes potatoes, bread, rice, oats, etc. They contain a lot of fibre, which is very good for digestion.	Basic	
4	Limit the intake of cow, pig and sheep meat (instead chicken, turkey, fish)	Meat should be eaten in moderation and it is better to choose chicken, turkey and fish meat, as they contain unsaturated fats. Cow, pig and sheep meat contain saturated fats, which is bad for our heart and can cause weight gain.	Basic	
5	Include carbs as 50% of your total calories	Carbohydrates are an important diet group. They are divided into sugar, whole grain,	Food	Daily intake of carbohydrates (percentage in total calories)

		starchy foods and fibre. In general, around 50-65% of total calories should come from carbohydrates, keeping in mind that sugar should be limited. On the other hand, starchy foods and whole grains are processed by our bodies longer, therefore keeping us full for longer period of time. This group includes potatoes, bread, rice, oats, peas, beans etc. They also contain a lot of fibre, which is very good for digestion.		
6	Include protein as 30% of your total calories	Protein is a crucial element of a healthy diet, which, most importantly, is used to build and repair muscles, bones, blood, skin and other tissues. It also strengthens immune system and contributes to growth and regulation of hormones. Protein comes from two sources: animal (meat, fish, dairy and eggs) and plant (soybean, beans, peas, lentils, nuts, legumes and pumpkin seeds). An adult should include protein as 10-35% of total calories. It relies on many factors such, as age, health, activity level and so on. The personal goals relating to weight loss, weight or muscle gain, also have an impact, as protein can improve metabolism and, as already	Food	Daily intake of protein (percentage in total calories)

		mentioned it is building muscle.		
7	Limit intake of fats to 30% of your total calories	Cow, pig and sheep meat, as well as butter, cream, cheese, coconut and palm oil should be avoided, whereas, nuts, avocado sunflower and olive oil can be incorporated into daily diet in small portions.	Food	Daily intake of fat (percentage in total calories)
8	Limit the intake of saturated fats to 10% of your total calories	Cow, pig and sheep meat contain saturated fats, which is bad for our heart and can cause weight gain.	Food	Daily intake of saturated fat (percentage in total calories)
9	Limit the intake of trans-fats to lower than 1% of your total calories	Trans-fat can be found in pre-made meals, frozen pizzas, cookies and pies	Food	Daily intake of trans-fat (percentage in total calories)
10	Limit the intake of sugar to 10% of your total calories	Sugar should not constituted more than 10% of total calories, and for gaining more health, it should be less than 5%, as it causes dental problems, weight gain and influences blood pressure.	Food	Daily intake of sugar (percentage in total calories)
11	Limit the intake of sugar to 5% of your total calories	Sugar should not constituted more than 10% of total calories, and for gaining more health, it should be less than 5%, as it causes dental problems, weight gain and influences blood pressure.	Food	Daily intake of sugar (percentage in total calories)
12	Limit the intake of salt to 5g	Daily portion of salt should be around 5 grams per day in total. This includes not only kitchen salt but also products	Food	Daily grams of salt

		like cheese, salty snacks, ham and even bread.		
13	Drink 8 cups of water	Staying hydrated is also very important for human bodies. A common recommendation is to drink 8 cups of water per day. Nonetheless, there is not one specific number of water intake for a person. the water needs depend on many factors, such as the climate we live in, level of physical activity, diet and health conditions. It is important to note that drinking water is not the only source of daily water intake. Food and other fluids also include water and help us in staying hydrated. For example spinach, watermelon and berries contain a lot of water. For hydration indication it is good to observe the color of urine. Light yellow means we are well hydrated, and the more darker it gets the more dehydrated we are. However, contrary to the popular belief, clear means we are overhydrated, which may also be dangerous.	Water	Daily cups of water
14	Eat withing your calorie goal	it is important to consume an appropriate number of calories – energy intake should be more and less the same as calorie expenditure, in order to maintain a healthy weight.	Food	Daily calories

| 15 | Engage in physical activities for at least 150 mins per week | Physical activity is as important for health as an appropriate diet and should not be overlooked. Everyone should engage in some kind of physical activity regularly, as it improves health by minimizing the risk of diseases such as diabetes and heart and bone diseases. It also contributes to maintaining a healthy weight, while enhancing the condition of heart, lungs, muscles and bones and joints. The recommended level of activity for adults is at least 150 minutes of moderate intensity or 75 minutes of vigorous intensity activities per week. However, doing more gives additional health benefits. It is important to adjust the exercises to our fitness level. If we are only starting, we should do so slowly and build up steadily. Adults over 65 should engage in physical activities that are allowed based on their condition. It is also beneficial for them to work on balance and mobility 3 days per week, in order to reduce falling. The recommended goal of physical activity per day for children is at least 60 minutes of moderate or vigorous activity. Exercises that strengthen bones and | Activity | Weekly activity minutes |

		muscles should not be dismissed and should be performed at least 3 days per week		
16	Stop smoking	Smoking can cause cancer, heart and lung diseases, but it is also extremely dangerous to the people around and children especially.	Basic	
17	Lower your alcohol intake	Small amounts of alcohol every now and then can be beneficial, as it can lower the chances of heart diseases. However, drinking too much alcohol can lead to many health problems, such as stroke, cancer, hepatitis and depression.	Basic	

Appendix 2. Survey questions.

1. What do you think of the preloaded challenges?
2. Which challenges did you take?
    a. Eat 400g of fruits and veggies every day
    b. Include more green veggies in your daily meals
    c. Include whole grains instead and starchy foods in your day (potatoes, oats, bread, rice)
    d. Limit the intake of cow, pig, and sheep meat (instead chicken, turkey, fish)
    e. Include carbs as 50% of your total calories
    f. Include protein as 30% of your total calories
    g. Limit intake of fats to 30% of your total calories
    h. Limit the intake of saturated fats to 10% of your total calories
    i. Limit the intake of trans-fats to lower than 1% of your total calories
    j. Limit the intake of sugar to 10% of your total calories
    k. Limit the intake of sugar to 5% of your total calories
    l. Limit the intake of salt to 5g
    m. Drink 8 cups of water
    n. Eat within your calorie goal
    o. Engage in physical activities for at least 150 mins per week
    p. Stop smoking
    q. Lower your alcohol intake
3. How did you manage to progress in these challenges?
4. How satisfied are you with your progress in the challenges?
    a. Very unsatisfied
    b. Unsatisfied
    c. Neutral
    d. Satisfied
    e. Very satisfied
5. Do you agree with the following statement: The app and challenges motivated me to improve my diet and physical activity
    a. Strongly disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly agree
6. Do you agree with the following statement: The app and the challenges influenced my diet and physical activity

      a. Strongly disagree

      b. Disagree

      c. Neutral

      d. Agree

      e. Strongly agree

7. What did you learn by using the app?

8. What did you like the most?

9. What did you not like?

10. What could be improved?

11. How likely are you to continue using the app?

      a. Very unlikely

      b. Unlikely

      c. Not sure

      d. Likely

      e. Very likely

12. How well did the app work for you? What bugs and errors did you notice?

13. Other suggestions, comments