DESIGN FOR HEALTH AND WELLBEING:
AN INVESTIGATION INTO DIET CONTROL
BODY-MONITORING APPLICATIONS FOR SMART DEVICES

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

DESIGN FOR HEALTH AND WELLBEING: AN INVESTIGATION INTO DIET CONTROL BODY-MONITORING APPLICATIONS FOR SMART DEVICES

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The advancements in information and communication technologies (ICT) lead innovative changes in various areas as well as health and wellbeing. Many people use their smart devices for monitoring their body. Since inactivity and unhealthy eating are amongst the biggest problems of our era, weight monitoring applications are becoming favoured options. However, in order to ensure people's wellbeing, not only their physical state but also mental and social states should be supported by these applications. 'Positive Technology' is relatively a new research area, and the use of body monitoring applications for weight control has not been studied in detail in this context up to date. For this reason, a study is conducted with three different weight control body-monitoring apps with 15 participants who had an interest in weight losing and/or healthy eating. The study aimed at understanding the strengths and weaknesses of weight control apps and to explore which features should be supported for enhancing the wellbeing of people. Consequently, suggestions are presented for improvement of weight control body monitoring apps with the aim of enhancing people's wellbeing.

Keywords: health and wellbeing, positive technologies, weight control apps

ÖZ

SAĞLIK VE İYİ OLUŞ İÇİN TASARIM: BESLENME KONTROLÜNE YÖNELİK BEDEN TAKİBİ İÇİN AKILLI CİHAZ UYGULAMARI ÜZERİNE ARAŞTIRMA

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Bilgi ve iletişim teknolojilerindeki gelişmeler farklı alanlarda olduğu gibi sağlık ve iyi oluş alanında da innovatif değişimlere önderlik etmekte. Birçok insan akıllı cihazlarını sağlık ve iyi oluş durumlarını takip etmek için kullanmakta. Hareketsizlik ve sağlıksız yemek zamanımızın en büyük problemleri arasında olduğu için, kilo kontrol uygulamaları tercih edilen seçenekler haline gelmiştir. Ancak, insanların iyi oluşunun sağlanması için bu uygulamalar insanların fiziksel durumlarının yanı sıra zihinsel ve sosyal durumlarını da desteklemelidir. 'Pozitif teknolojiler' görece yeni bir araştırma konusudur ve bu bağlamda son zamanlarda kilo kontrolü uygulamaları detaylı olarak incelenmemiştir. Bu nedenle, zayıflamak isteyen ve/veya sağlıklı beslenmeyle ilgilenen 15 katılımcıyla ve üç farklı kilo kontolü uygulaması kullanılarak bir çalışma yapılmıştır. Çalışmanın amacı, kilo kontrölüne yönelik uygulamaların zayıf ve güçlü yönlerini öğrenmek ve insanların iyi oluşu için hangi özelliklerinin desteklenmesi gerektiğini anlamaktır. Sonuç olarak, bu tarz uygulamaların insanların iyi oluşunu destekleyecek şekilde geliştirilmesi için öneriler sunulmuştur.

Anahtar kelimeler: sağlık ve iyi oluş, pozitif teknolojiler, kilo kontrolü uygulamaları

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CHAPTER 1

INTRODUCTION

1.1 Problem Definition

The choices in life have a great effect in individual's health (Lane et al., 2011). Studies show that the activities that are carried out and the way that people think have big affect on people's wellbeing. Particularly, malnutrition and inactivity; people's lifestyle choices affect most of the body systems like endocrine, cardiovascular, autoimmune, gastrointestinal, genitourinary and musculoskeletal systems and psychological status of people (Uchino et al, 1999; Ministry of Health of Turkey, 2010). Therefore, increased control on people's lives can lead positive health outcomes (Lane et al., 2011). Here, health should not be conceived as only being physically healthy but as Serino et al. (2013) suggested it should be taken as a holistic state that includes social, cultural and psychological aspects together with physical aspects. For that reason, health promotion is emphasized as the process of increasing human's control over their health for reaching a state of complete physical, mental and social wellbeing (Ottawa Charter for Health Promotion, 1986) because an increase in control and choice over one's life is proved to positively affect their wellbeing in different ways (Thompson and Aked, 2011).

According to Handel (2011), self-management has been a significant issue on the studies for over 30 years because of the low rates of sustainability in treatment, decreased quality of life and lower psychological wellbeing.

Recently, studies indicate the power of mobile devices in promoting health and wellbeing by emphasizing the multifunctional features of mobile devices that provide usage of complex and combined stimuli with the help of applications (Serino et al., 2013).

The use of software applications running on mobile devices (will be referred to as ‘apps’) for weight control becomes widespread lately because of the alarming rate of obese and overweight population in the world; and that keeping a close eye on diet and exercise levels as wellbeing indicators can lead to positive health effects (Lane et al., 2011). Yet, despite the availability of extensive research about online interventions (Webb, Joseph, Yardley, and Michie, 2010; Kelders, Kok, Ossebaard, and Van Gemert-Pijne, 2012; Kohl, Crutzen, and Vries, 2013), there are limited studies on mobile applications (Fiordelli, Diviani, and Schultz, 2013; Free et al., 2013).

Design is one of the most accessible mediators for reaching people (Desmet, Pohlmeyer, and Forlizzi, 2013). For this reason, in order to bring people together with the technologies for enhancing wellbeing design for wellbeing studies gained importance (Desmet, 2012; Desmet & Schifferstein, 2012; Ruitenberg & Desmet, 2012; Van de Poel, 2012).

Consequently, in this study, mobile diet apps are examined in the context of design for wellbeing within a broader perspective of Positive technologies. Summary diagram showing the relation between research areas that are covered in this research can be seen in Figure 1.1.

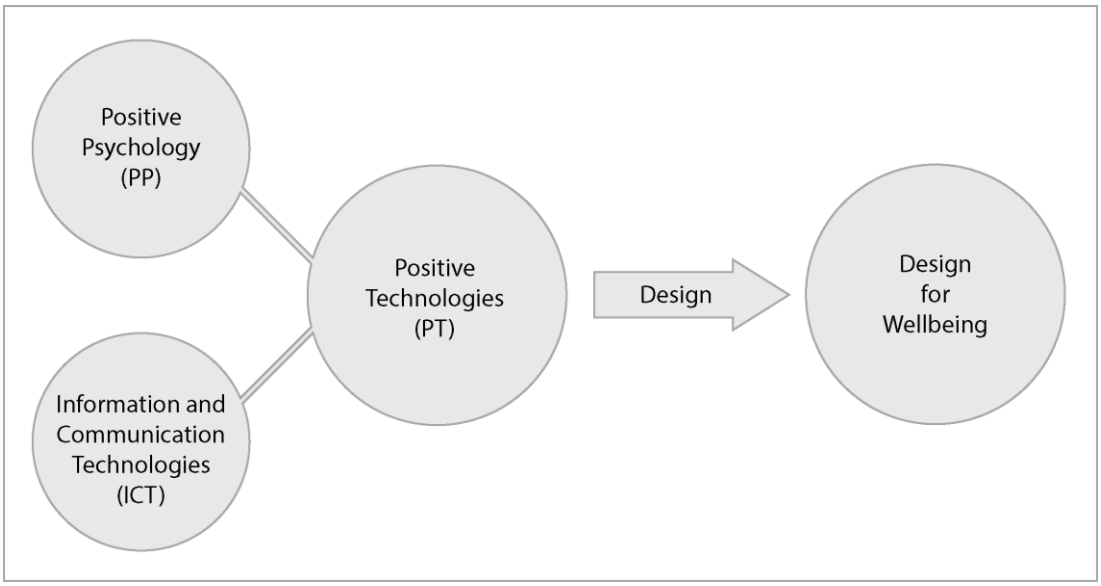


Figure 1.1 Relation between research areas

1.1.1 Positive Technologies

Positive Technology is defined as the scientific approach (Wiederhold and Riva, 2012) in the usage of technology for enhancing emotional, psychological and social wellbeing (Argenton et al., 2013). Positive technologies based on positive psychology, which is defined as the scientific study of human functioning and try to use Information and comuniation technologies (ICT) for empowering human functioning so its goal is to understand how ICT can be used for increasing the quality of personal experience with both theoretical and applied studies (Serino et al., 2013). Therefore, positive technologies can have an effect on not only personal but also social experiences by promoting positive emotions, engagement and connectedness (Argenton et al., 2013).

1.1.2 Design for Wellbeing

A product that does not make at least one person happy is hardly exists because all design somewhat contribute wellbeing of a person (Desmet and Pohlmeyer, 2013). However, design for wellbeing aims at creating happiness or positive feelings in users unlike trying to solve the problems in user experience such as eliminating the problems in usage or decreasing users' complaints as most of the design in human

computer interaction and cognitive ergonomics often aims (Kanis, Brinkman, and Perry et al., 2009).

With design for wellbeing it is offered to exceed the quality of life that is offered by mere assistive technology and promised to move from actual state of being to desired state of being without taking ability level into consideration (Larsson, Larsson, and Kassfeldt, 2005).

Desmet and Hassenzahl (2012) suggest that design can both form and promote positive experiences or transform existing experiences into more pleasurable ones and make people aware of their abilities, direct users acting or thinking in a better way and lead happiness. In other words, design can promote hedonic happiness with pleasure attainment and eudaimonic happiness with self actualisation. With this aim, *possibility driven design approach* leads wellbeing for designing with the help of technologies.

The possibility driven approach concentres on enhancing existing possibilities and innovates instead of solving the problems of existed ones. In other words, the aim is inducing excellence rather than eliminating the deficiencies (Desmet and Pohlmeyer, 2013).

Very recently, Desmet and Pohlmeyer, introduced the term "Positive Design". It is defined as the activity of designing aiming to help people in reaching a pleasurable and satisfying life, and, more importantly in flourishing (Desmet and Pohlmeyer, 2013). Thus, together with pleasure, Positive Design also aims at flourishing. In other words, Positive Design supports both hedonic and eudaimonic happiness or wellbeing in general.

Consequently, the use of positive technologies by using possibility driven design approach, design for wellbeing or Positive Design is possible. mHealth devices, especially health and wellness apps are the best examples of this approach. In consideration with the obesity alert, diet control apps are under the spotlights.

1.2 Aim of the Study and Research Questions

The aim of the study is to present suggestions for improving diet apps designed for enhancing people's wellbeing by understanding the effects of apps (in terms of their features and characteristics) on people's thoughts, moods and feelings.

With this aim, i) (existing) moods and emotions of users, ii) their weight control preferences, iii) features and characteristics of diet apps, and iv) changes in moods and emotions of users' (post apps usage), and general assessments of apps will be investigated with the following main and supportive research questions in mind.

* How can diet apps be enhanced in order to positively influence wellbeing? *

- What is wellbeing and how can it be enhanced?
- What are the effects of diet control apps on people's moods and emotions?
- How do diet control apps change the weight control preferences of people?
- What are the strengths and weaknesses of current diet apps and how can they be further developed for enhancing users' wellbeing?
- What is the effect of the diet apps on the aspects of optimal experience?

In order to answer listed questions,

- Literature reviews on wellbeing and positive technologies are presented, and mHealth tools – especially diet control in relation to obesity – will be examined;
- Three-phase study (Phase 1: Pre-Interview, Phase 2: Usage and Phase 3: Post-Interview), will be presented along with its results and analysis. The study aims to fill the gaps in literature for understanding the effects of the diet app on users' wellbeing.

1.3 Structure of the Thesis

As the detail explanations can be found in Table 1.1, the thesis consists of five chapters.

Chapter 1 (current Chapter) lays out the problem definition, introduces the terms relevant to study, presents the aim and research questions.

Chapter 2 presents an overview of wellbeing and positive technologies. Besides, mHealth devices and health and wellness apps in relation with the alarming health problems are discussed.

Chapter 3 introduces design of the fieldwork, data collection tools and methods.

Chapter 4 puts forward the results and analysis of the fieldwork, and discussions on fieldwork in relation with the literature are covered.

Finally, Chapter 5 illustrates the conclusions, contributions and future studies.

Table 1.1 Structure of the thesis

	Content	*Aim*	*Questions to be answered*
Chapter 1	Introduction to the literature review and the fieldwork	To lay out the problem definition, introduce the terms and present the aim and research questions	○ What is the problem that led this study? ○ What is the aim of the study? ○ What are the research questions?
Chapter 2	Wellbeing	To review the concept of 'wellbeing'	○ What is wellbeing? ○ What are the different approaches to wellbeing?
	Positive Technologies	To review 'Positive Technologies'	○ What are positive technologies and what do they base on?
	Positive Psychology	To review 'Positive Psychology'	○ What is positive psychology? ○ What are the terms that are introduced for reaching the aim of positive psychology? ○ In which levels do technologies support the aim of positive psychology?
	Information and Communication Technologies (ICT)	To introduce 'ICT' along with example apps for health and wellbeing	○ What is ICT? ○ What is mHealth? ○ What is the importance of smart phones and apps? ○ What are health and wellness apps? ○ What should be the aim of diet control mobile apps considering the current situation of obesity?
Chapter 3	Design of the Fieldwork	To present the methods used in the fieldwork and offer justifications for various criteria used	○ What are the data collection tools and methods? ○ How are the mobile apps selected? ○ How are the participants selected? ○ What is the description of the study protocol?
Chapter 4	Result and Analysis of the Fieldwork	To understand the effects of diet apps on people, and to explore the ways for developing these apps to better support health and wellbeing	○ What are differences in weight control preferences lead by app usage? ○ What are the differences in moods and emotions lead by app usage? ○ What are the strengths and weaknesses of diet apps? ○ How can app features be enhanced?
Chapter 5	Conclusions	To conclude on the research outcomes, offer reflections and future recommendations	

CHAPTER 2

WELLBEING, POSITIVE TECHNOLOGIES, MOBILE HEALTH SYSTEMS AND RELATED APPS

This chapter introduces the concept of wellbeing and continues with the approach of positive technologies to wellbeing. After discussion on positive psychology and information communication technologies (ICT), as two sides of positive technologies, the current trends in relation to mHealth devices, smart phones and mobile applications, health and wellness applications, and diet apps are presented.

2.1 Wellbeing

In this section the term of wellbeing will be introduced and three different approaches to wellbeing, i.e. hedonic wellbeing, eudaimonic wellbeing and self-determination theory, will be discussed.

World Health Organization defines wellbeing as a state of "complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization [WHO], 1948). The definition of WHO was introduced in 1946 and has not changed after 1948. Since then, there has been a growing research interest on wellbeing (Mukhopadhyay and Postolache, 2012) and different studies brought different definitions. According to Shin and Johnson (1978) wellbeing is "a global assessment of a person's quality of life according to his own chosen criteria" (p. 478) Felce and Perry (1995) think that wellbeing originated in the perception of individuals about current situation and their aspirations, Shah and Marks (2004) describe wellbeing as "developing as a person, being fulfilled and making a contribution to the community" (p.2), Ryan and Deci (2011) mention wellbeing as "a complex construct that concerns optimal experience and functioning" (p. 141), and recently Keinonen, Vaajakallio and Honkonen (2013) explain

wellbeing as “something that is experienced subjectively and individually, but is at the same time fundamentally social and dependent on the man-made environment” (p. 10). Additionally, wellbeing has been used interchangeably with ‘psychological wellbeing’ or ‘positive mental health’. For example, Ryan and Deci (2001) claims that wellbeing “is not the absence of mental illness” (p.142) and in a study wellbeing is discussed as “positive mental health, and not only the absence of mental illness but also the presence of positive psychological functioning” (Thieme, Balaam, Wallace, Coyle, and Lindley, 2012, p.789). Despite, most of these definitions are propounded by psychologists, the differences may stem from the multifaceted structure of wellbeing. Besides, as Thomas (2009) argues, wellbeing is “intangible, difficult to define and even harder to measure” (p.11).

These definitions take the reasons of wellbeing differently such as individual perception or optimal experience but, they all indicate that the absence of negative aspects of health is not enough for defining wellbeing. Therefore, in this study other then absence of negatives in human life, enhancing positives was important while concerning wellbeing.

2.1.1 Hedonic View

The roots of the hedonic view date back to forth century B.C. A Greek philosopher claimed that happiness is the entire hedonic moments in one’s life (Ryan and Deci, 2001). From that time, different hedonism expressions have come up but Ryan and Deci (2001) indicate that psychologists have a common point in that hedonism should consist subjective happiness and pertain pleasure.

In literature, hedonism is mentioned as pleasure or happiness. According to Kubovy (1999) hedonism should include the pleasures of both mind and body. In other words, physical pleasure cannot be enough for happiness. In 1999 Kahneman, Diener, and Schwarz define hedonic psychology as the study of things that makes life and experiences pleasant and unpleasant and suggested that well-being and hedonism is basically the same.

To sum up, it can be said that wellbeing equals to hedonism, and hedonism equals to happiness, therefore wellbeing equals to happiness. This equivalence is valid for

subjective wellbeing (SWB) that most of the hedonic psychology used for evaluating pleasure pain continuum in human life (Diener and Lucas, 1999). SWB is defined as "the experience of joy, contentment or positive well-being, combined with a sense that one's life is good, meaningful and worthwhile" by Lyubomirsky (2007, p. 32). According to Eid and Diener (2004), SWB is the multifaceted assessment of life with cognitive evaluation of satisfaction and affective measurement of moods and emotions. That is to say, SWB comprises not only the feelings but also the meanings of these feelings. Ryan and Deci (2001) define "life satisfaction, the presence of positive mood and the absence of negative mood" (p. 144) as the three components of SWB and indicated that they are summarized as happiness.

Everybody wants to live a good life (Desmet, Pohlmeyer, and Forlizzi, 2013) and although the meaning behind good life may vary from person to person happiness is a fundamental condition. It is even declared in Millennium Development Goals by United Nations (2011). Although literature is dominated with SWB approach, there is also objective wellbeing (OWB) approach for wellbeing studies. It seeks external requirements for quality life (Desmet and Pohlmeyer, 2013). According to Doyal and Gough (1991) there is a requirement list with eleven categories including adequate nutrition and water, housing, work and home environments for OWB.

In SWB happiness depends on the person's perceptions. It is linked to the good life perception of the person leading it. However, in OWB there are universal requirements for happiness. Desmet and Pohlmeyer (2013) said that "OWB is considered to be a determinant for SWB." and despite the differences SWB and OWB, they are interrelated approaches.

2.1.2 Eudaimonic View

Unlike hedonic view, eudaimonic view does not find adequate equating wellbeing and happiness per se. Most of the ideas about eudaimonic view are based on Arsitotle. It is about the potential of humans that can be understood through exercise of merits which are meaningful for both the individual and the society (Serino, Cipresso, Gaggioli, and Riva 2013; Delle Fave, Massimini, and Bassi, 2011). Ryan and Deci (2001) explain that all the desires cannot give happiness when they are achieved, despite the fact that they produce pleasure the outcomes may not be good

for people and would not promote wellness. While Ryff (1995) is explaining eudaimonia, wellbeing is not seen as simply pleasure attainment but it is defined as seeking perfection for realization of one's true potential. Ryff and Singer (1998) suggest six aspects of human actualisation for promoting emotional and physical health. They define psychological wellbeing with *autonomy, personal growth, self-acceptance, life purpose, mastery and positive relatedness*.

Argenton, Triberti, Serino, Muzio, and Riva (2013) explain that *autonomy* as the capability of people in being determinant, in authority and independent; *personal growth* as seeking for sustained personal development, *self-acceptance* as being aware of the self and having positive attitude towards all the aspects of the personal characteristics, *life purpose* as point the presence of meaningful goals, *mastery* as the capability of altering the environment according to one's needs and *positive relatedness* as the healthy social relationships with others. The evidence of Ryff and Singer (1998) is that, psychological wellbeing affects specific physiological systems. It is claimed that positive mental states lead better health (Aked, Marks, Cordon, and Thompson, 2008). For example, positive mental states reduce tendency to stroke up to six years and cardio vascular disease up to ten years (Lyubomirsky, King, and Diener, 2005). On the other hand, Peterson and Seligman (2004) introduce six merits of eudaimonic approach. They are; wisdom, courage, humanity, justice, temperance, and transcendence. According to Peterson and Seligman, with 24 more characteristics, these six virtues are playing an important role for reaching eudaimonic wellbeing.

Hedonic and eudaimonic wellbeing are separate but interrelated approaches. Despite their differences, they act in concert for wellbeing. In their study, Compton, Smith, Cornish, and Qualls (1996) find that subjective wellbeing and personal growth is not same but highly related. In another study it is claimed that happiness and meaningfulness are the two factors for mental health (McGregor and Little, 1998). Additionally, King and Napa (1998) argue that experience of meaning in life and happiness construct the good life. For that that reason, instead of explaining wellbeing with one of them, hedonic and eudaimonic wellbeing could be used as explaining different aspects of wellbeing. For that reason, Ryan and Deci (2000) come up with self-determination theory.

2.1.3 Self-Determination Theory

Self-Determination Theory (SDT) can be regarded as another perspective for explaining wellbeing that embraces both hedonic and eudaimonic views. SDT has parallelisms with Roger's idea about wellbeing, which advocates being fully functioning, and not only seeking for desires (1963). According to SDT, for wellbeing it is essential to fulfil *autonomy, competence and relatedness*. According to Ryan and Deci (2000), SDT can explain the different periods of life that support and hamper wellbeing. Ryan and Deci do not advocate that there are certain conditions for the basic needs of all people but claim that if those needs are not met negative psychological consequences will occur. In other words, fulfilling basic psychological needs promotes hedonic and eudaimonic wellbeing.

Huppert (2008) suggests that experiencing negative relationships, losing control over one's life and becoming aimless lower the level of wellbeing. The studies show that the effect is not simple. Desmet and Hassenzahl (2012) argue that happy people are more social, selfless and involved as well as they are healthier physiologically. That is to say, being happy makes people feel good and content with life. However, the situations that foster SWB may not necessarily promote eudaimonic wellbeing like in the situation of succeeding something under pressure which makes people happy but do not make them vital (Nix, Ryan, Manly, and Deci, 1999). SDT tries to explain these situations by promoting SWB measures with self-actualization, vitality and mental health (Ryan and Deci, 2000).

In this study, SDT is appropriated for explaining wellbeing because technologies can be used for supporting both hedonic and eudemonic aspects of wellbeing.

The increased focus on the studies about wellbeing and promotion of wellness from 1960s tries to explain a broad concept. Hettler (1976) come up with physical, social, intellectual, spiritual, emotional and occupational dimensions of wellness. The different perspectives of wellbeing studies result from this diversity of dimensions. They cannot be separated because they all affect each other, and with applying all the dimensions in one's life, they can contribute to healthy living. Physical dimension comprehends physical activity, healthy eating and self-care; social dimension consists contribution to environment and assuring better social networks; intellectual

dimension indicates creative mental activities; spiritual dimension includes improvements in belief systems; emotional dimension requires being determinant for direction and self-esteem and control and lastly occupational dimension aims enhancing life through work.

Along with these, as wellbeing is a topic that gets attention from the governments, a British organisation NEF published five ways to wellbeing for enhancing people's wellbeing: i) *connect,* ii) *be active,* iii) *take notice,* iv) *keep learning,* and v) *give* (Aked et al., 2008).

i) Connect is used for social connectedness. According to Huppert (2008) a person should be integrated into and accepted by the society for promoting social roles. It is important because social connections allow people to share joy and sadness. The emotion of the engagement in personal and social relations has a huge effect on emotional wellbeing and negative effects on emotional wellbeing may result in everyday life difficulties. Moreover, a decrease in social activity results negatively in person's social wellbeing.

ii) Be Active is used for physical activities. For all the people, regular physical activity increase wellbeing and decrease depression and anxiety (Biddle and Ekkekakis, 2005). It is also important for people's wellbeing because it creates a sense of mastery and fosters perceived self-efficacy and coping ability as well as distracting from negative thoughts (Kirkwood, Bond, May, McKeith, and Teh, 2008).

iii) Take Notice is used for mindfulness. Huppert (2008) says that being aware of sensations, thoughts and feelings improves wellbeing. Additionally, SDT argues that being aware what is taking place leads decisions for one's needs, values and interests (Goswami, 2008).

iv) Keep Learning is used for learning new things and goal setting. Adherence in learning affects people's wellbeing by increasing self-esteem, self-efficacy, purposefulness, competence and social integration (Hammond, 2004). NEF report relates goal setting with adult learning and says it is related with increased wellbeing

because aiming at being interested with learning acts in concord with being motivated (Huppert, 2008).

v) Give is used for contribution to others as well as oneself. NEF report claimed that helping to others, sharing with friends and involving in team work foster positive feelings. It is also stated that the sense of giving back was important for wellbeing of people from all ages.

The studies of wellbeing and efforts for enhancing people's wellbeing continue gaining importance. Here, technology and design is the key elements for carrying these studies to people's everyday life. The designs of the new products and systems that are created by developing technologies are the mediator for making these wellbeing improvement strategies easier to apply in life. With this aim, recently positive technologies studies accelerated.

2.2 Positive Technologies

This section introduces positive technologies and its origins, positive psychology and information and communication technologies (ICT) are presented.

According to Serino et al. (2013), Positive Technology unites the aim of positive psychology with the developments of information and communication technologies (ICT) in order to enhance wellbeing. Therefore, positive technologies can be defined as "the scientific and applied approach to the use of advanced technology for improving the quality of personal experience." (Riva, Banos, Botella, Wiederhold, and Gaggioli, 2011, p.1) In order to understand positive technologies it is clear that positive psychology and Information and comuniation technologies should be explained.

2.2.1 Positive Psychology

In this section, positive psychology is introduced and the three ways for reaching the goal of positive psychology; the pleasant, the engaged and the meaningful life are discussed. Additionally, hedonic level, eudaimonic level and social and interpersonal level will be explained as the three levels for using technologies for the pleasant, engaged and meaningful life.

The pioneer of the term positive psychology is Maslow. It was introduced in 1954 and got the attention of researchers with the studies of Seligman and Csikszentmihalyi, which were published, in the special issue of American Psychologist in 2000 (Pieter et al., 2013). Positive psychology is defined as the study of "positive personal experiences, traits and institutions" by Seligman and Csikszentmihalyi (2000, p. 5) and Snyder and Lopez (2002) explain the term as the study of circumstances that foster growth and optimal functioning. It is also defined as the study of wellbeing for understanding strength and merit of people (Ryan and Deci, 2001; Aspinwall and Staudinger, 2003; Delle Fave et al., 2011).

The discipline of psychology generally focuses on the negatives like mental illnesses rather than wellness and positive psychology has emerged for adding positive side to this discipline (Kanis, Brinkman, and Perry, 2009). Rather than focusing and trying to fix the negatives in the human life, Positive Technology focuses on the positive emotions and tries to improve it. Argenton et al. (2013) indicate that positive psychology suggests paying attention to strength, health and fulfilment of people instead of focusing on the deficits of people. However, the aim of the positive psychologists is not to deny the negative aspects of life but to deal with the whole experience (Gable and Haid, 2005). Therefore, Gable and Haid try to explore the things that made life worth living and the conditions for wellbeing (Desmet and Pohlmeyer, 2013).

Based on the definitions of positive psychology the aim of positive psychology can be defined as improving the overall wellbeing of people because as mentioned before wellbeing cannot be defined as the absence of negative feelings. Despite the fact that positive psychology focuses on the positive emotions, it covers whole scope of psychology. However, the additional aim of increasing human's wellbeing makes harder to explore this broad scope. For this reason, Seligman (2002) come up with three terms for reaching the complicated goal of positive psychology. They are, the pleasant life, the engaged life and the meaningful life. Then, he presented PERMA model for identifying five fundamental principles of wellbeing. It is an acronym for positive emotions, engagement, relationships, meaning and accomplishment (Seligman, 2011).

***The Pleasant Life*.** It means the life with pleasure. Therefore, it is based on the hedonic approach to wellbeing. According to Kahneman et al. (1999) there are two basic approaches to positive psychology. Hedonic psychology is one of them and it is defined as the study of "what makes experiences and life pleasant and unpleasant" (p. ix). According to positive psychologists pleasure results in experiences making us feel good (Peterson, Park, and Seligman, 2005). As mentioned before, most of the hedonic wellbeing studies based on subjective wellbeing. For that reason, hedonic psychology uses the SWB studies for evaluating the pleasurable life. Argenton et al. (2013) claim that the aim of positive psychology is enhancing "the quality of life" and higher "wellness and resilience" of all people. The positive psychology studies revealed the importance of positive emotions. According to the study of Fredrickson (2003) in long term, positive feelings can contribute mental wellbeing of people. In the study it is claimed that positive feelings lead to a mood in which people are prepared for the later problems and in the long term it results in improvement on mental wellbeing. This situation interpreted as improvement in emotional wellbeing because positive affects make people stronger dealing with stressful situations by Kanis et al. (2008). In the studies of Danner, Snowdon, and Friesen (2001) and Lyubomirsky et al. (2005) it is claimed that regular positive affect promote human flourishing and mental and physical wellness and Fordyce (2000) argues experiences of positive affect enhance social wellness. Other than these, positive emotions lead faster recovery form cardiovascular diseases, increase in immune function and lower cortisol levels (Steptoe et al., 2005). In other words, the affects of positive emotions promote wellbeing in long term.

The Engaged Life. It means the life in which people can live their potential. Therefore, it is based on the eudaimonic approach to wellbeing. It is the other basic approach to positive psychology which advocates that pleasure attainment is not enough for explaining wellbeing because it necessitates actualisation of human potential. (Ryan and Deci, 2001)

The Meaningful Life. The meaningful life is based on neither hedonic nor eudaimonic wellbeing but a more complex goal. According to Keyes and Haidt (2003) the meaningful life aims to enhance connectedness between individuals, groups and communities by mixing individual wellbeing and social wellbeing.

As a result, in order to achieve the pleasant, engaged and meaningful life; emotional, psychological and social wellbeing should be promoted (Keyes and Lopez, 2002). According to Argenton, Schek, and Mantovani (2014), in order to promote wellbeing positive psychology defines "affective quality, engagement /actualisation and connectedness" as the three components of wellbeing. In this situation, Positive technologies should support these components. Serino et al. (2013), argue how positive psychology can be categorised in Positive Technology (see Figure 2.1).

For this reason, Serino et al. present three levels for supporting the pleasant, engaged and meaningful life with technologies. They are hedonic, eudaimonic and social and interpersonal level. Botella et al. (2012) illustrate the objectives of each level and the ways of accomplishing them (see Figure 2.2).

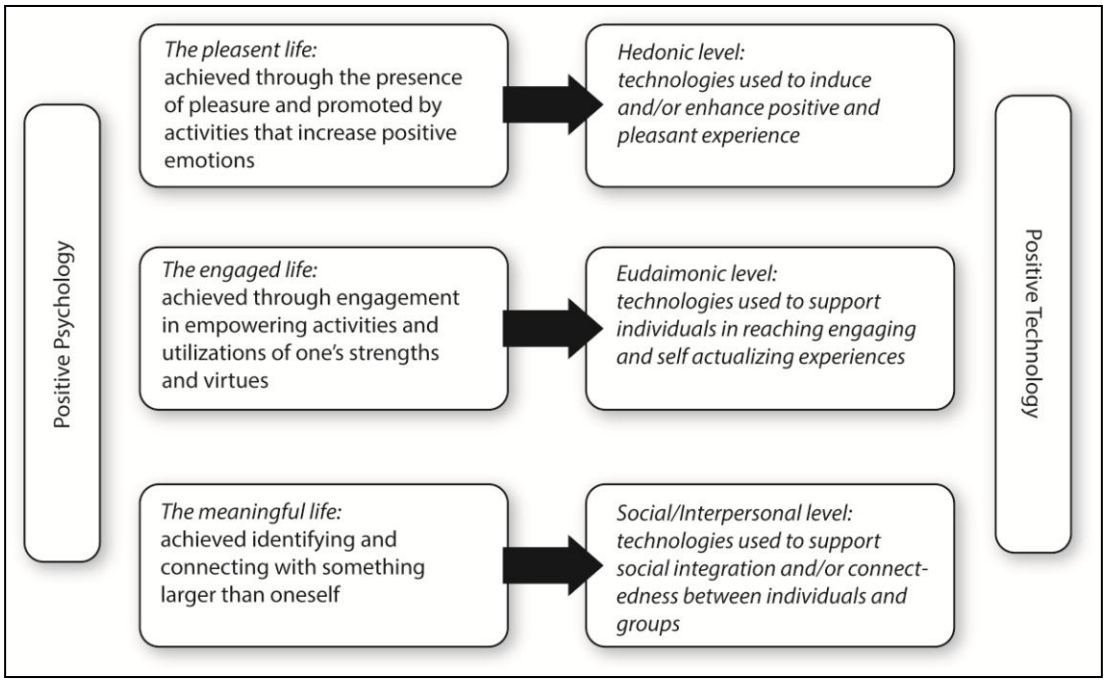


Figure 2.1 The features for developing technologies in hedonic, eudaimonic and social/interpersonal level by Serino et al. (2013)

According to Botella and his colleagues (2012) Positive technologies can be classified by their effect in these features as hedonic level which represents the technologies that foster pleasure attainment, eudaimonic level which represents the

technologies for encouraging people for engaging and actualising activities and social and interpersonal level which represents the technologies promoting socialization.

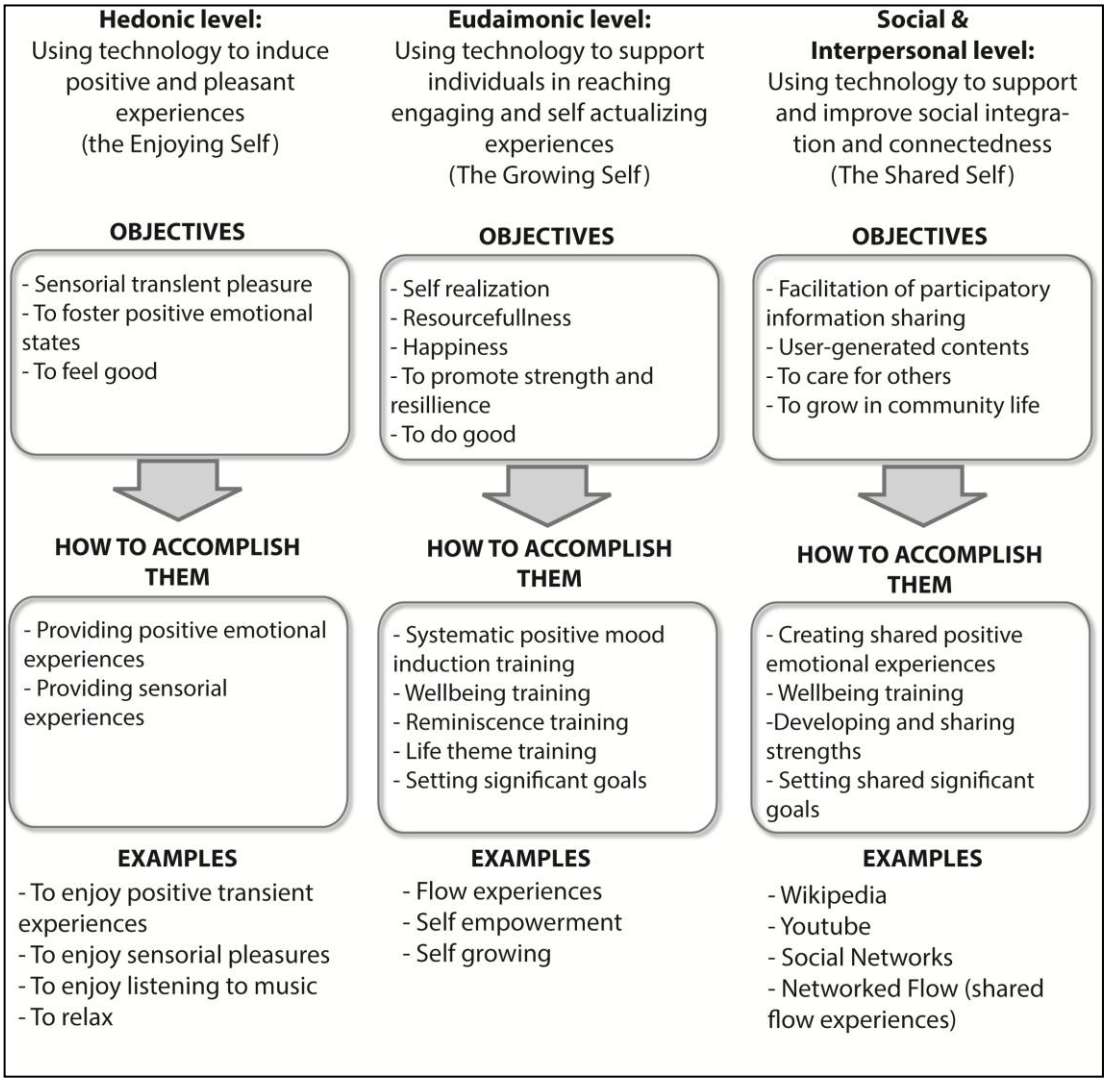


Figure 2.2 Positive Technology: Levels of positive human functioning using ICT's tools and positive psychology goals (Botella et al., 2012).

2.2.1.1 Hedonic Level:

The hedonic level of Positive Technology is about the technologies that are used to promote positive emotional states. Positive emotional states are not only the results of seeking for activities that give pleasure but they are also about enjoying these activities (Argenton et al., 2013). In other words, in order to be happy one does not need more pleasurable activities but should learn how to enjoy more his or her own activities. Many researchers used the Russell's "core affect" (2003) for investigating the technologies for fostering positive emotions. Core affect is defined as a combination of hedonic valence and heightened "core knowledge" about the emotional features of people's experiences (Argenton et al., 2013). According to Russell, the affective quality of an experience can be enhanced through the alterations in "core affect". Lots of research has been conducted about the initiation of positive moods (Gerrards-Hesse, Spies, and Hesse, 1994; Gross and Levenson, 1995; Westermann et al., 1996). According to Gerrards-Hesse et al. (1994), there are two categorisation of mood induction; one is according to the stimuli that affect the states of the people and the other is according to the things that can evoke positive emotions like music or pictures. In the first view core affect is "object-free" (Farthing, 1992) but in the second view; an emotional response leads to a change in the core affect of a particular object and positive emotion is a result of heightened valence and arousal of core affect (Riva et al., 2011). This theory is evidenced by the study of Villani et al. (2007). The study reveals that ICT causes a decrease in anxiety levels of the participants and increase in positive emotional states.

2.2.1.2 Eudaimonic Level:

The eudaimonic level of Positive Technology is about the technologies that are used to promote engaging and self-actualising experiences. In order to achieve this, literature investigates the technologies that help people to reach the state of flow (Csikszentmihalyi, 1990) and the technologies that foster self-efficacy (Bandura, 2005). Flow theory which interchangeably used as optimal experience is a framework for constituting an "engaging and self-actualizing experience" (Riva et al., 2011 p.3). According to Delle Fave (2011) and Serino et al. (2013) flow is the positive state of continuum in challenges and skills. Csikszentmihalyi (1975) argues

that flow theory based on the state of full participation, assimilation and delectation. Argenton et al. (2013) explain that the core feature of optimal experience is the balance between challenges that are faced in life and skills that the person has. The other features are indicated as; "deep concentration, clear rules and unambiguous feedback from the task at hand, loss of reflective self-consciousness, control of one's actions and environment, alteration of temporal experience, and intrinsic motivation" (Riva et al., 2011 p.4).

Flow theory is very applicable for studying user experience in Information and comuniation technologies. The internet (Chen, 2000), virtual reality (Riva, Castelnuovo, and Mantovani, 2006), social networks (Mauri, Cipresso, Balgera, Villamira, and Riva, 2011), video games (Jegers, 2007) and serious games (Bergeron, 2006) are some of the mentioned topics in literature. They all promote the occurrence in flow state because of activating users, challenging them with tasks that should be accomplished according to identified rules and providing them with clear feedback (Argenton et al, 2013). Additionally, the use of flow theory in ICT eases to study the factors that promote optimal experience (Ghani, 1995) and the different consequences occur in different areas (Pace, 2004). According to Ghani (1995), there are three factors that affect the presence of flow in ICT. They are; sense of being in control, match between challenges and skills and fun to be with. Pace (2003) identifies particular features of a website which encourage optimal experience. They are; "a balance between the challenges of an activity and the skills required to meet those challenges; clear goals and feedback; concentration on the task at hand; a sense of control; a merging of action and awareness; a loss of self-consciousness; a distorted sense of time; and the autotelic experience" (Pace, 2003, p.9).

> *Balance between challenge and skills* tells that, the challenges presented to the users should be in accordance with the users' skills. If they are too high or too low for the users' abilities, the result can be anxiety, apathy or boredom (Jackson and Csikszentmihalyi, 1999).
>
> *Clear goals and feedback* implies the importance of making people aware of their aim and giving feedback about it because in order to achieve flow

experiences people should concentrate on their goals and be able to control the consequences of their actions (Pace, 2003).

Concentration on the task at hand within flow experiences do not allow people be distracted by the things except their goals (Csikszentmihalyi, 1990) and they become able to forget the unpleasant facets of life.

Sense of control is described as the feeling of being able to do anything without worrying about failure (Pace, 2003). In flow experience, the challenges and skills are in balance and failure is beneath notice for the person in action (Csikszentmihalyi, 1996).

Merging of action and awareness is explained that the level of involvement with an activity that, the activity become an automatic action (Csikszentmihalyi, 1990).

Loss of self-consciousness, contrary to what is believed, has not got a negative meaning, because people become more devoted in the challenge when they get less self-aware (Csikszentmihalyi, 1993).

Distorted sense of time refers to the feeling in which the time passes so quickly (Pace, 2003).

Autotelic experience is explained by Csikszentmihalyi (1990) as the situations of involving in activity without expecting a future benefit because the activity itself an award for the person performing it.

2.2.1.3 Social and Interpersonal Level:

The social and interpersonal level of Positive Technology is about the technologies that can be used to foster connectedness between people and to form a common sense of awareness (Argenton et al, 2013). Short, Williams, and Christie (1976) argue social presence as "degree of salience of the other person in a mediated communication and the consequent salience of their interpersonal interactions" (p.65).

ICT is a perfect mediator for forming social presence in a community with online learning (Joyce and Brown, 2009) and e-health (Kamel Boulos and Wheeler, 2007). According to Riva, Waterworth, and Waterworth (2004), in order to be present within a group, the person should present his or her purposes and understand the intentions of other group members. Nowadays, there are technologies for assisting the presence of people within a group like systems give common tasks to the participants and expect the tasks to be achieved with interaction between group members who can communicate with the help of social networks (Borghoff and Schlichter, 2000; Ellis, Gibbs, and Rein, 1991).

In these kinds of systems, the complication of tasks does not let the users deal with the challenge by themselves but they need the help of group members, therefore the social presence is promoted. This flow between group members is explained with Networked Flow theory by Gaggioli, Riva, Milani, and Mazzoni (2013). According to Gaggioli et al. (2013), in order to achieve networked flow some conditions to be satisfied in advance. They are sharing common goals by group members, experiencing a critical state of surviving together, and matching the challenges with skills of the members. In order to support the flow between group members Sawyer (2008) suggests that there should be shared goals, listening each other, intense attention, being in control, mixing egos, equation between participants, acquaintance, flow of information and preparation for failure in group members. On the other hand, Keyes (1998) think that, in order to achieve social wellbeing the five dimensions should be secured. They are; "social integration, social contribution, social coherence, social acceptance and social actualization" (p.121)

Social integration is described as the degree of excellence in relationships between community members. Seeman (1991) claimed that cultural estrangement results in the removing the individual from the society.

Social contribution is argued as the individuals' ability of bestowing a quality on their society and the world in the bigger picture. The feeling of responsibility will contribute to the society (Keyes, 1998).

Social coherence is formed as the meaning given to the factors that constitute the social environment. According to Ryff (1989) healthy people acknowledge their life

as meaningful and coherent, so the social form of individual meaningfulness will lead to healthier society.

Social acceptance; Ryff (1989) suggested that accepting all the aspects of their lives is good for individual mental health and Keyes (1998) claimed that believing the quality of other people in the society and accepting their characteristics can promote self-acceptance.

Social actualisation; is described as the belief that society with both the individual and its constitutions have the ability of growth. The idea is taken from the growth in individual level (self-realisation from Maslow (1968)) and reflected back to the society.

In conclusion, technologies can be classified by their effects in wellbeing and ICT can support these effects. Riva and his colleagues illustrated a summary of the three levels in which technologies used for supporting the three components of wellbeing defined by positive psychology and related ICT topics for each level (see Figure 2.3).

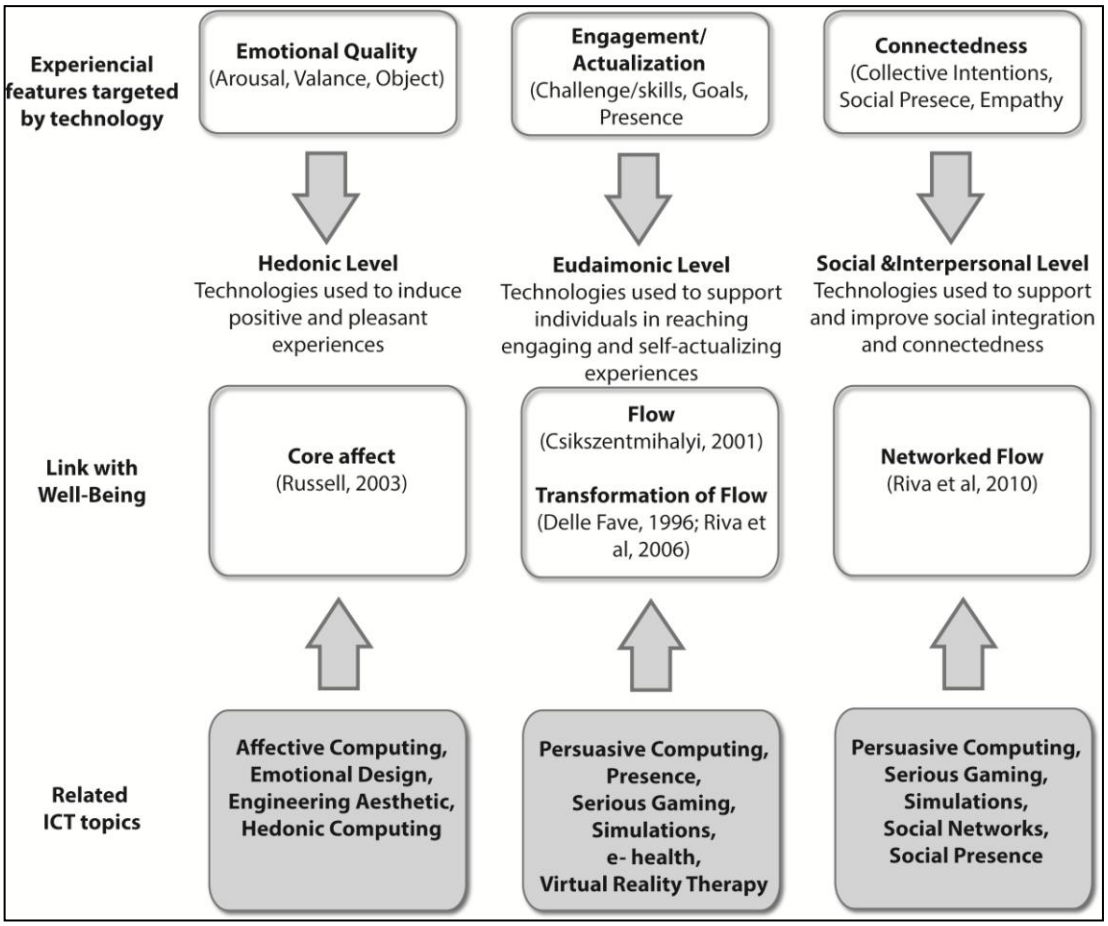


Figure 2.3 Positive Technology domain (Riva et al., 2011)

The three levels of Positive technologies (hedonic, eudaimonic and social and interpersonal level) can be united in the concept of "personal experience" (Riva et al., 2012). There are two definitions of experience according to Merriam Webster Dictionary (2014) "a direct observation of or participation in events as a basis of knowledge", and "the fact or state of having been affected by or gained knowledge through direct observation or participation." Therefore, it can be said that controlling the contents of personal experience will characterize the future intentions of people (Serino et al., 2013). In other words, people can both form and directed by personal experience.

As can be seen in Figure 2.3 in order to increase the quality of personal experiences different technologies can be used.

2.2.2 Information and Communication Technologies (ICT)

In this section, Information and comuniation technologies (ICT) will be defined and Mobile Health Systems (mHealth) are introduced and exemplified. Additionally, smart phones and applications, health and wellness applications and specifically diet control mobile applications in relation with obesity will be discussed.

ICT is defined as:

> a complex and varied set of goods, applications and services used for producing, distributing, processing, transforming information – [including] telecoms, TV and radio broadcasting, hardware and software, computer services and electronic media (Marcelle, 2000, p.5)

According to Perron, Taylor, Glass, and Margerum-Leys (2010), ICT represents the electronic tools which are used for transmitting, influencing and keeping information. With the advances in wireless technology and the internet all the smart devices are added to ICT tools now.

ICT changes our way of life by affecting social and work life (Milošević, Shrove, and Jovanov, 2011). The developments in ubiquitous computing and ambient intelligence (Intille, 2004) make ICT indispensable for many areas.

Nowadays, use of information and communication technologies for supporting health and wellness increases. It is because technologies that control "exercise, smoking, sexual behaviour, TV and internet use, stress management, maintaining social relationships" (Ijsselsteijn et al., 2006, p. 2) can slow or even avoid different illnesses and higher the quality of life. The developments in new sensor technologies and context awareness help these technologies in understanding the context and the activity of a person and allow the devices help the person at the right time. Moreover, with the increased availability of persuasive feedback access, the users benefit the ICT tools more (Ijsselsteijn et al., 2006).

Isaacs et al. (2013) points the interest in using technology for promoting physical health. Isaacs et al. give multiple examples of tools for monitoring food intake and motivating exercises for preventing obesity. It is indicated that technologies support behaviour change with the help of feedback about individuals' exercise, diet and sleep practices and by encouraging them for setting goals and promoting social

support. On the other hand, there are studies for promoting psychological health. In the study of Kanis et al. (2009) it is claimed that technology can help positive ideas to be elicited, expressed and communicated by means of interactive system design and development. Additionally, technologies help not only physical and psychological health but also healthy aging. Ijsselsteijn et al. (2006) claim that by considering the increased population of older people, studies about technologies for autonomy are conducted in order to increase the quality of later life because a good later life is possible to reach by altering lifestyles like changes in diet, exercise patterns or adopting healthy behaviours like maintaining engaging environment.

Guillén et al. (2009) explain the importance of ICT in encouraging healthy lifestyles and development of public health initiatives by praising the aspect of its capacity to reach a broad number of people while preserving even increasing personalization. Additional positive features are indicated as ability to adapt recommendations according to changing needs of individuals, capability of forming combinations for nutritional and activity support and possibility of unifying multicultural aspects in the bigger picture. According to Guillén et al. (2009) ICT used for improving health and wellness has to have three functions. They are; personalization, adaptation and mobility.

ICT systems have moved from being public with short and generic messages of health campaigns to being personal with more elaborate and individual messages which target more critical and specific problems of individuals within a group. Personalization of messages, leads change and decreases the level of negative consequences while convincing individuals for adopting those (Guillén et al., 2009). Additionally, personalization of systems make use of data mining, software systems for decision support and context awareness in order to support identifying illnesses, treating and caring according to personal genetic and life style (Pantelopoulos and Bourbakis, 2010; Jovanov, Milenkovic, Otto, and De Groen, 2005)

In order to achieve personalized messages which result in best possible outcome and lead action, these systems use analyzing, storing and matching data abilities of computers for blending public health knowledge with detailed individual information. Then, they can be offered to individuals in a way that motivate them

most (Guillén et al., 2009). In order to find the most motivating way, ICT tools become context aware. Context is defined as all the information that is used for illustrating the state of people, space or object by Milošević et al. (2011). Context awareness is explained as the ability of system for understanding the states of users through data collection, deduce, interfere according to the constructed model and evaluate the performance (Korel and Koo, 2007; Yang, 2006). The unreliable and time consuming method of information gathering through self-reporting can be exchanged by the methods enhanced by context awareness like GPS, sensors that detect light, noise level, position.

Lastly, increased ubiquity of ICT tools will increase the degree of application of personalized messages which are offered in the best way possible (WHO, 2002) because pervasiveness makes the information flow anywhere and anytime.

The use of ICT is given importance especially by the developed countries because of managing chronic diseases and improving life quality of the aging population (Milošević et al., 2011). Milosevic et al evidence that the population of the people over 65 is expected to be doubled by 2025. For that reason, in order to answer the needs of elderly people traditional health care methods has to be shifted. In the report of IEEE Medical Technology Policy Committee (2009) it is argued that the appropriation of technology can promote health care services, decrease health care cost and increase the quality of life of elderly people.

According to Jovanov et al. (2005) and Bonato (2010) mobile health systems are the best mediator of these technologies which are for supporting health care system because they are easy to manage and by easing the access of health records they can motivate people especially those who have chronic conditions taking active roles in their conditions.

2.2.2.1 Mobile Health Systems (mHealth)

Mobile Health Systems (mHealth) are emerged from the use of technology for mobile monitoring (Rašković, Martin, and Jovanov, 2004). It is also referred to as "mobile computing, medical sensor, and communications technologies for health-care" (Milošević et al., 2011). With the help of technological developments in low

cost, small, light and smart sensors, personal mobile devices which have the ability of sensing, processing and communicating signs are getting more into our lives (Shahriyar, Bari, Kundu, Ahamed, and Akbar, 2009). Mobile devices are usable, ubiquitous and accessible as well as they have high technological abilities (Holzinger, Dorner, Födinger, Valdez, and Ziefle, 2010) It is claimed that these devices can provide cheap and constant mobile help with updated medical records to patients and it is indicated that Mobile Health Systems are helpful for the situations necessitate continuous monitoring for diagnosis, facilitate best conditions for the patients with chronic conditions or provide rehabilitation with computer assistance (Milošević et al., 2011). Milosevic et al list some of the usage areas of mHealth systems as follows;

- Monitoring patients after medical operations,
- Monitoring patients that have chronic illnesses,
- Providing social networks for elderly people,
- Monitoring people for promoting health and wellness (eating and exercise habits),
- Monitoring the situations of soldiers and firemen,
- Emergency services and phenomenon results in mass casualty,
- Rehabilitation in assistance with computers,
- Initiation of emergency services which provide longer monitoring.

The aim of mHealth is to make sure that anyone can use health care services regardless of the place, time and character constraints (Shahriyar et al., 2009). Shahriyar et al. also emphasize the role of design in developing and evaluating technologies for involving people in their own health care.

Many illnesses are the consequences of the daily life choices of people like diabetes (Yaggi, Araujo, and McKinlay, 2006) obesity, stress (Norris, Carroll, and Cochrane, 1992), anxiety (Fox, 1999), high blood pressure and irregular heartbeat (Shahriyar et al., 2009). In these diseases, patients are advised to see their doctors at certain intervals but in many cases, people do not want to or are not able to go for a check-up (Shahriyar et al., 2009). Bodenheimer (2005) claimed that more than 70% of all health care belongs to chronic disease expenses. According to National Center for

Chronic Disease Prevention and Health Promotion (2005), in the US more than 80% of adults are overweight or obese because 70% of them do not get adequate nutrition from fruit, vegetables and vitamins. For that reason, if tools for monitoring and managing some sections of everyday life are presented to users, they can become more in control and responsible about their health (Lin et al., 2012). Shahriyar et al. (2009) point smart and personalized mHealth tools which provide users with medical feedback, save their time, increase their control over their own health and decrease long term expenses on health care. Shumaker, Ockene and Riekert (2009) indicate that design in consideration of users' needs and perceptions which results in usable and helpful devices is the most important element for the successful mHealth devices.

Heart disease is the most common way of death in the world and it is triggered by controllable risk factors which include, smoking, inadequate exercise, malnutrition, high blood pressure, and abnormal blood lipid levels (Stephens and Allen, 2013). Other than heart disease, obesity, diabetes, hypertension, myocardial infarction, stroke, renal insufficiency, osteoporosis and chronic back" are the other illnesses which are led by those factors (Holzinger et al., 2010).

These diseases threaten not only the health situation but also the economic situation of people. While the health expenses of people increase, country economics is also affected. For example, health expenses for obesity can reach 7% of all health care expenses in developed countries like USA with 70 billion dollars for direct expenses and 48 billion dollars for indirect expenses like ineffective working because of the illness (WHO, 2010). Therefore, governments and various institutions aim to prevent these illnesses because this type of health management will reduce the future health costs (Holzinger et al., 2000). With this aim, mHealth devices become an important way of leading individuals to healthy living. Nutrition scanners, exercise trackers, trackers for specific users groups (babies, people with chronic diseases) are some of the mHealth devices.

Some of the examples will now be presented under the categories of i) nutrition scanners; ii) activity trackers; iii) general health trackers; and, iv) trackers for specific users groups.

i) Nutrition Scanners

With the advancements in technology, the studies on the devices for nutrition scan have increased. Along with numerous concept devices, SITU Smart Scale and Vessyl are two of the commercially available product examples.

SITU Smart Scale (Michael Grothaus Limited, 2014)

SITU Smart Scale is a food scale that can communicate with mobile devices. 'SITU' not only weighs the raw food but can also calculate an entire meal in calories with its total nutrients. It is claimed that SITU can give the precise calorie and nutrient content, and export the personal data for sharing with doctors, coaches and nutritionists. Consequently, it helps users act on the information given.

Figure 2.4 SITU Smart Scale (situscale.com)

Vessyl (Mark One, 2014)

Vessyl is a bottle that recognizes its contents and tracks the nutrition information of liquids in real time. Over a perios of time, it learns the users' consumption habits and

patterns. Therefore, it can guess the users' hydration needs. The creators of Vwssyl explain its aim as helping users make healthier and more informed decisions about their diet in real time.

Figure 2.5 The Vessyl (myvessyl.com)

ii) Activity Trackers

Within the mHealth devices, activity trackers as wristbands are the most popular ones. Fitbit Flex is one of the top rated ones in user reviews. However, there are studies for making activity trackers truly wearable and OMsignal is an alternative for wristband type activity trackers.

Fitbit Flex (Fitbit Inc., 2013)

Fitbit Flex is a wristband that can track wearer's activity and sleep. During the day, it tracks steps, distance, calories burned and sleep quality. The users understand how well they are doing with their aim by checking out the lights on it. It also can communicate with mobile devices and users can follow their progress in real time from their mobile devices through a mobile application. According to its creators, Fitbit Flex motivates the users for being more active.

Figure 2.6 Fitbit Flex (fitbit.com/flex)

OMsignal (OMsignal Inc., 2014)

OMsignal is defined as a biometric smart wear that can track users' activity. It alerts users about their hearth rate when the users dropped under or risen above their aims and encourage them for pulling back or pushing on. It also warns users when they breathe irregular or unbalanced and gives advices to improve their breathing. Moreover, it gives reports about performance through its app right after working out.

Figure 2.7 OMsignal (omsignal.com)

iii) General Health Trackers

Technology allows users track their whole health other than their nutrition and exercise patterns. Cue is a general health tracker that presents users more than tracking weight and counting steps.

Cue (Cue Inc., 2014)

Cue is a health tracker that tracks users' health in a molecular level. Users collect a sample of saliva, blood or mucus from their noses and place it into the cartridge. Within minutes, Cue analyzes the sample and sends the reports to users' smart phones. Through a mobile app users can track their Vitamin D, inflammation, influenza, testosterone and fertility. The app directly connects the users with health carers when needed. Users can also learn from their activity levels, food and sleep patterns to shape their body.

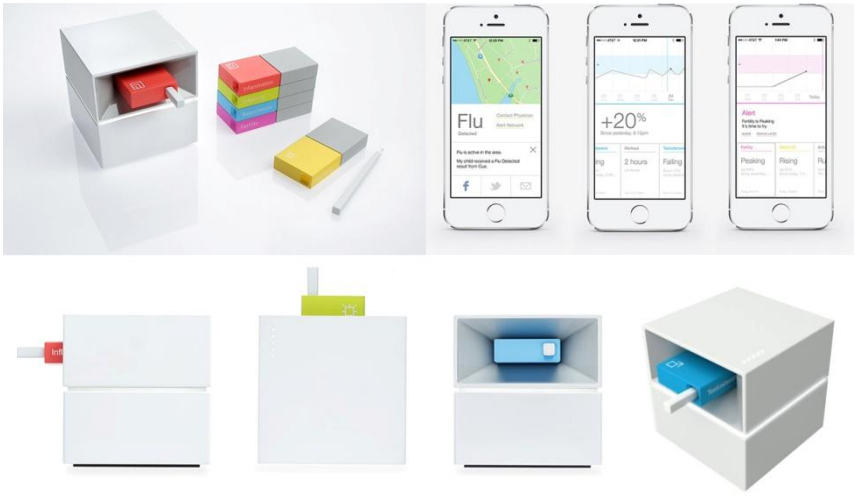


Figure 2.8 Cue (cue.me)

iv) Trackers for Specific User Groups

The use of mHealth devices becomes widespread in managing lives that require specific attention. People with chronic diseases for tracking their situation, addicts for quit smoking, and even parents for baby caring can make use of mHealth devices.

iHealth Align (iHealth Lab Inc., 2014)

iHealth Align is the smallest mobile glucometer used for managing diabetes. It is plugged into the smart phone's headphone jack. It analyzes blood which has dropped on the test stick and displays the blood glucose results on the screen of the phone. Through its mobile app the users can track their results and share them with caregivers if they want to.

Figure 2.9 iHealth Align (ihealthlabs.com/glucometer/ihealth-align/)

My Spiroo (My Spiroo. Inc., 2014)

My Spiroo is a mobile spirometer which helps to control asthma. It is said that it correlates with the degree of the obstruction in the airways and warn about possible health problems before the actual symptoms manifest themselves. It also warns users according to their location (e.g. increased pollen count in air). It is plugged into the smart phone's headphone jack, records the reports and allows users share them with

health carers through a mobile app. The aim is reducing the number of exacerbations and protecting from asthma attacks.

Figure 2.10 My Spiroo (myspiroo.com)

Quitbit (Quitbit Inc., 2014)

Quitbit is a lighter with a built in display. The users light their cigarettes using heating coil. It provides feedback through its display and a mobile app for leading users for smarter decisions. The users can also set goals and customize them. Moreover, it can synch with other tools like e-cigarettes or nicotine gum.

Figure 2.11 Quitbit (quitbitlighter.com)

Owlet (Owlet Baby Monitor Inc., 2014)

Owlet is a smart sock that is worn by babies during their sleep. It collects information about the babies' heart rate, oxygen level, body temperature and sleep data, and sends it to the parent's smart phones. It also can detect the dangerous positions during sleep and worn the parents. It is hypoallergenic and electronic components are based in a water proof silicone case. It is recharged by the help of a micro usb charger.

Figure 2.12 Owlet (owletcare.com)

These examples show that mHealth devices can be used various areas to help improving people's wellbeing. All of the above examples and most of the mHealth devices work in corporation with smart phones and mobile apps. The reason is mostly because the increased popularity of the smart phones. As Apple's CEO Tim Cook declared, the latest model of their smart phone is sold 9 million in its first week in Apple product launch event at Yerba Buena Center for the Arts on March 7, 2012 in San Francisco, California. The popularity of smart phones among mobile devices made them important in health and wellness enhancement.

2.2.2.2 Smart Phones and Apps

Sarasohn-Kahn (2010) define cell phones or mobile phones as voice communication and SMS providers with the use of wireless communication networks, the ones with additional features such as camera, mp3 player and games as full feature phones, the ones with web browsers and organizer functions as PDA phones and the ones which run on a specific operating system as smart phones which help people in accomplishing tasks anywhere and anytime (Bentley and Tollmar, 2013).

With the recent developments, smart phones are embedded with accelerometers, digital compasses, gyroscopes, GPS, microphone and camera (Lane et al., 2011).

Therefore, smart phone has become the single device that assembles various devices in its entity. For that reason, smart phones become inseparable parts of our lives. According to International Data Corporation (IDC) report, the number of smart phone users has exceeded 1 billion in the last quarter of 2013 and it is estimated that it will reach 1.7 billion by the end of 2017 (Gens, 2013).

Smart phones can allow people to monitor their wellbeing without a drastic change in their lives through their programmable platforms (Lane et al., 2010). Smart phones can understand the context and ease self-logging (Bentley and Tollmar, 2013). Smart phones can provide users with real time feedback for the choices of everyday life for helping people manage their health and direct their behaviours accordingly (Lane et al., 2011). The other advantages of smart phone usage for health intervention can be listed as reduced cost, availability, mobility, rapid delivery of information universally and without user request (Park and Kim, 2009; Patrick et al., 2009; Heron and Smyth, 2010).

While smart phones present the new workstations in small and wearable way, they revolutionize lots of new fields and applications (Milošević et al., 2011). In 2008 Apple, one of the biggest smart phone manufacturing companies introduced application stores and the applications that are used in desktop computers for performing a specific function for users began to be used in smart phones too. In parallel with the increase in smart phone usage, mobile applications run on smart phones, tablet computers and other mobile devices become widespread too. Applications run on smart devices, popularly are referred to as 'apps'. Across geographies the majority of smart phone users have more than 20 apps on their device at present; in many cases this is closer to 30 apps (Aitken, 2013).

Applications that are specifically designed for smart phones become a unique channel for distribution of health information and supporting self-management (Handel, 2011). According to National Institute of Health report these apps help patients in improvement of their health, provide them with personalized healthcare and enable them to monitor their advancement (Benner and Thoene, 2011).

The design of new smart phones with persuasive feedback leads the way of applications that can track various facets of physical and mental health (Lin et al.,

2012) too. With the advanced technology at hand, researchers develop applications to promote health and prevent diseases (Stephens and Allen, 2013). Recent applications not only benefit from the sensors and features of smart phones which can monitor different aspects of human behaviour leading physical, mental and social wellbeing (Lane et al., 2011) but also communicate with external health devices like blood pressure monitors, pedometers and glucometers (Holzinger et al., 2010). In other words, mobile phones encourage health behaviours and improve health (Woo et al., 2013) with the help of applications.

The most downloaded applications are mostly related with social media or games. 49.50% of apps are communication apps and 0.26% of apps are health apps of all downloaded apps (Böhmer, Hecht, Schöning, Krüger, and Bauer, 2011). However according to a study in 2012 among the applications available for iPhone, Android, and Blackberry 70-80% of apps are health apps and 60% of total health apps were for weight loss and exercise (Kasbo, McLaughlin, Falco, Idriss, and Moczarska, 2012). According to a survey conducted in America in 2010, 82% of adults use mobile phone, nearly 30% of them use their mobile phones for accessing medical information on them and 10% of the cell phone users launch health apps on their phones (Fox, 2013).

Health apps can be classified as "medical reference, hospital workflow management and health and wellness management" but majority of the health related applications are in the category of health and wellness management (Milošević et al., 2011, p.7).

2.2.2.3 Health and Wellness Applications

Diet, exercise, mood, medication, sleep, women's health, infant care, chronic disease management application can be given as examples within health and wellness apps available on online app stores.

In recent years, mobile apps have been developed for self-care aiming at patients with chronic diseases but the main aim is encouraging people for healthier lifestyles (Holzinger et al., 2010). mHealth apps, promote patient centered healthcare by increasing the involvement of patients and improving self-management capabilities of patients (Handel, 2011). Health applications make people competent in their own

health and promote the information flow between patients and health care providers by helping users keep and control their health information like test results and allergies (Holzinger et al., 2010). Therefore, health apps enable intervention in areas such as obesity and smoking as well as prevention of chronic diseases (Handel, 2011).

Health and wellness apps can assist their users to monitor and motivate themselves for healthier lifestyles in long term (Holzinger et al., 2010). The usage of these apps through smart phones makes use of the sensors integrated in these phones and actively monitors and leads the users. Consequently, they become able to promote health and wellness of individuals.

In June 2014, one of the biggest smart phone companies Apple Inc. introduced "HealthKit" which functions as a health center bringing practitioners, patients and people together in order to reach efficient, effective and accessible health (healthkit.com). Along with exercise and diet, it allows users track bodily functions such as blood pressure and cardiac rhythm. When a problem occurs with the users it contacts with the health carers. "Strength", the recent advertisement of Apple also draws attention. The full commercial is about the health applications which help users in various sports, counting steps and tracking weight.

According to Nilsen et al. (2012) apps have been proliferating in parallel with the increased interest in mHealth since 2009. According to IMS report in 2013 over 43000 health apps are available just for AppStore (Aitken, 2013) and studies for developing health apps are increasing (Kaipainen, 2014). With the advances in technology, wellbeing applications can be downloaded in a very short time, with universal access and without too much effort by easing the adoption of users (Lane et al., 2011). As a consequence, mobile device users who downloaded at least one mHealth application to their smart phones doubled between 2011 and 2012. (Jahns, 2012).

In recent years there is a wellbeing crisis throughout the world (Bentley and Tollmar, 2013) and obesity is one of the biggest reasons. By considering the increase in obesity and popularity of health applications, diet control apps come to the forefront.

2.2.2.4 Obesity and Diet Control Apps

Body Mass Index (BMI) is the excepted measure for defining overweight and obese. It is calculated as by dividing body mass into height. According to WHO, people with 25.0 to 29.9 kg/m2 BMI are overweight and people with 30 kg/m2 or higher BMI are obese (2011) and prevalence of obesity has doubled worldwide since 1980 (Woo et al., 2013). According to WHO (2006) while 400 million obese people expected to reach 700 million 1.6 billion of overweight people will reach 2.3 billion by 2015.

There is a growing number of obese population in the USA (Centers for Disease Control and Prevention [CDC], 2010) and Europe (British United Provident Association [BUPA], 2011). A lot of countries try to fight with obesity with different methods. For example, a while ago, in Dubai, local government officials announced a 30-day challenge (to coincide with Ramadan) with an award of a gram of gold for every kilogram of weight lost (Subramanian, 2013). The number of obese and overweight people increases also in Turkey. Ministry of Health in Turkey try to encourage healthy eating and active living by TV adds, competitions and educational programs for children. According to Ministry of Health of Turkey (2010), these efforts should be accessed by all parts of the society for preventing diseases.

Despite obesity is one of the most preventable causes of death (Chopra and Darntonhill, 2004) it is one of the leading actors in the illnesses which cause death like cardiovascular diseases, hypertension, diabetes, some cancer types, muscula-skeletal system diseases. Moreover, other than being a global health problem, it also affects country economics negatively (Ministry of Health of Turkey, 2010).

In consideration with the correlation of obesity with various illnesses and economy WHO stated firmly the urgency of weight loss interventions in anyone's reach (Morak et al., 2008). Thus, lots of organizations with WHO develop strategies and put various methods such as; changing dietary habits, adopting adequate and balanced diet and increasing activity levels of individuals into practice (Ministry of Health of Turkey, 2010). However, a healthy life can be reached not only with the access of health care offered to the public but also the individuals should also be

conscious about their health and be inclined to positive behaviour changes (Ministry of Health of Turkey, 2010).

Reducing daily calorie intake is the basic requirement and increasing energy consumption is the helpful element of weight loss. Shumaker et al. (2009) list decreasing the amount of food eaten with smaller portions or fewer servings and preferring low calorie food for reducing the calories taken in a day and physical activity for increasing energy consumption. In the handbook of Health Behaviour Change all the attempts for weight loss is named as "individual-level approaches to dietary change" and it contains several key elements to succeed weight loss and prevent regain (Mc-Cann and Bovbjerg, 1998, p.220). The elements include "nutrition education, goal setting, self-monitoring, ongoing program contact and social support".

Nutrition Education. It is very important for weight loss. Wardle, Parmenter, and Waller (2000) explained that having a command of nutrition information of food lead healthier diets.

Goal Setting. It refers to determining specific goals for weight control. Defining a goal is important for increasing the motivation of dietary adherence.

Self-Monitoring. Kanfer (1970) defined self-monitoring as the observing and recording aimed behaviours systematically. The aim of self-monitoring is increasing awareness of individuals about themselves (Baker and Kirschienbaum, 1993) and consequently affecting the targeted behaviours (Burke et al., 2008).

It has been proved that, self-monitoring is effective for various behaviour changes for weight loss, increased achievements in sports, reducing alcohol and tobacco consumption, success in academic studies and parenting skills (Kazdin, 1974; Kirschenbaum, 1987). More than 20 years ago, researchers agreed that self-monitoring is the most effective method used in behavioural treatments of obesity (Kirschenbaum, 1987; Perri, Nezu, and Viegener, 1992; Wadden and Foster, 1992; Wadden, 1993). Studies examining self-monitoring from eight weeks to two years

(Burke, Wang, and Sevick, 2011) support this statement by presenting the contribution of self-monitoring in weight loss in long term (Burke et al., 2011) and preventing regaining (Wing and Phelan, 2005). According to Rothman, Sheeran, and Wood (2009) dietary self-monitoring make people realize their negative behaviours and make comparison between their current behaviour and ideal behaviour.

The most effective way of self-monitoring for weight loss is recording all the foods eaten right after eating (Glanz, Murphy, Moylan, Evensen, and Curb, 2006). Recording food intake at certain intervals (e.g. at the end of the day) have a negative effect on weight loss because it takes the chance of individuals for correcting their previous actions throughout the day away (Burke et al., 2008). It is also stated that recording food intake within 15 minutes is positively associated with weight loss (Burke et al., 2008). In fact, recording food before eating can increase attention in dietary habits and change food choices (Zepeda and Deal, 2008). For that reason minimizing the time period between eating and recording become very important in dietary self-monitoring. With this aim, diet monitoring apps provide users with reminders. Studies show that reminding users with messages can encourage them for detailed food log (Tsai et al., 2007).

According to Burke et al. (2012) the most preferred method in self-monitoring for diet is using paper diaries which is time consuming and difficult for people. Moreover, as the diary could not be reached by the interventionist at once, it delays the feedback which motivates and supports people (Burke et al., 2012). For that reason, new approaches come to the forefront with the help of technology. Nowadays, keeping track of food through diet control applications eases the process by using the cameras of smart phones for taking a photo of food (Helander, Kaipainen, Korhonen, and Wansink, 2014). Boushley et al. (2009) emphasized that monitoring food through taking photos increase adherence and help accuracy of the people who are not willing enough to keep detailed records of food (Zepeda and Deal, 2008).

Stumbo (2013) and Zhu et al. (2010) indicated that smart phones and photography make diet monitoring easy and convenient. Current diet apps use three ways for

using photos for providing feedback. They are using them as reminders, make use of crowdsourcing and recognition of food from automated capture.

First of all Kaipainen (2014) explain using food photos as reminders as “reflective prompts” and claims that diet apps that let taking food photos through smart phones as “reflective prompts” become very helpful in engaging people with diet monitoring.

Calorie Count allows users take food photos by using the smart phone cameras in food log option. A snapshot can be seen in Figure 2.13.

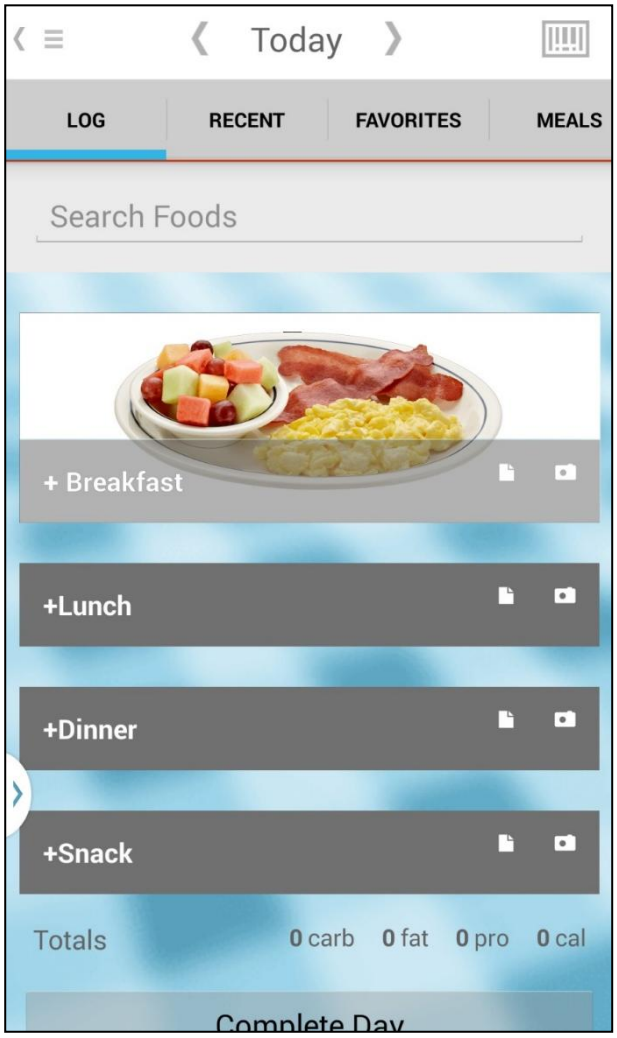


Figure 2.13 Food log by reflective prompts in Calorie Count

Crowdsourcing is offered as another way for providing feedback through photos and it is used by lots of the mobile applications in the market for giving information about food intake according to portion size. Mobile apps can provide feedback whether food is healthy or not through photos and motivate other users for giving feedback by crowdsourcing (Stumbo, 2013). Moreover, Noronha, Hysen, Zhang, and Gajos (2011) claim that despite the unclear items of photos, the feedback achieved through crowdsourcing is nearly as accurate as the feedback provided by professionals. Additionally, it is stated that this technology can be used for sharing healthy eating suggestions between participants (Parker et al., 2012). For example, My Diet Coach provides users with tips that enhance with users' suggestions. A snapshot that illustrates the tips can be seen in Figure 2.14.

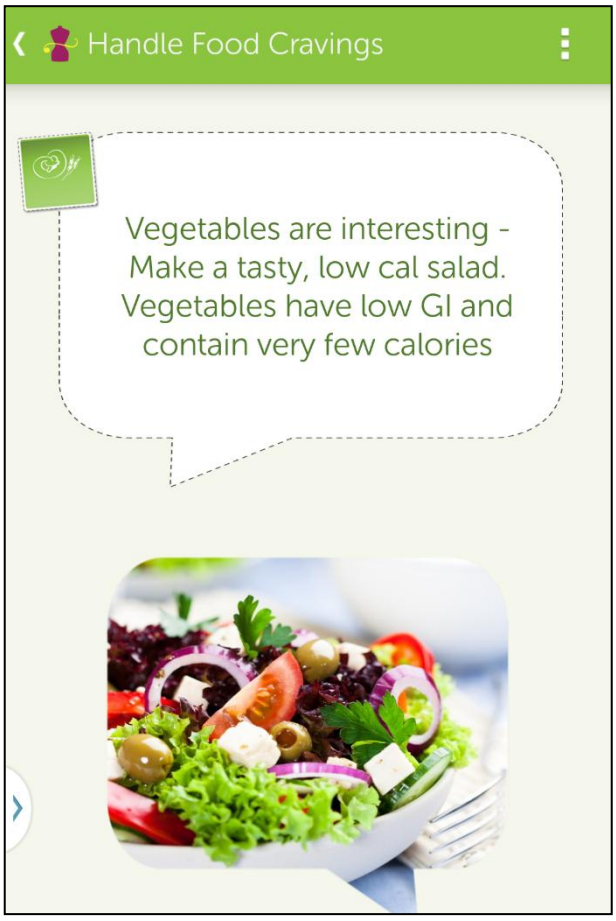


Figure 2.14 Healthy eating tips enhanced by crowdsourcing in My Diet Coach

Lastly, providing feedback through photo by automated capture is a newly emerging method. Despite the studies for automated capture of dietary intake, recognition of content and portion size from photographs is still challenging (Stumbo, 2013).
Lots of diet apps use barcode scanners for recording nutrition details of food by using smart phone cameras to capture barcodes from the food package and retrieving data assigned to that package.

In June 2014, Amazon CEO, Jeff Bezos introduced "Firefly". Firefly identifies nearly 100 million items both objects and content like music and TV shows when the built in cameras of devices are pointed at them (see Figure 2.15). This feature can be a step up from the barcode scanners. A diet app (MyFitnessPal) has already taken advantage of this feature to facilitate food logging process for end users. The app plans to allow food log from the image identified by Firefly and supply nutrition information of that food.

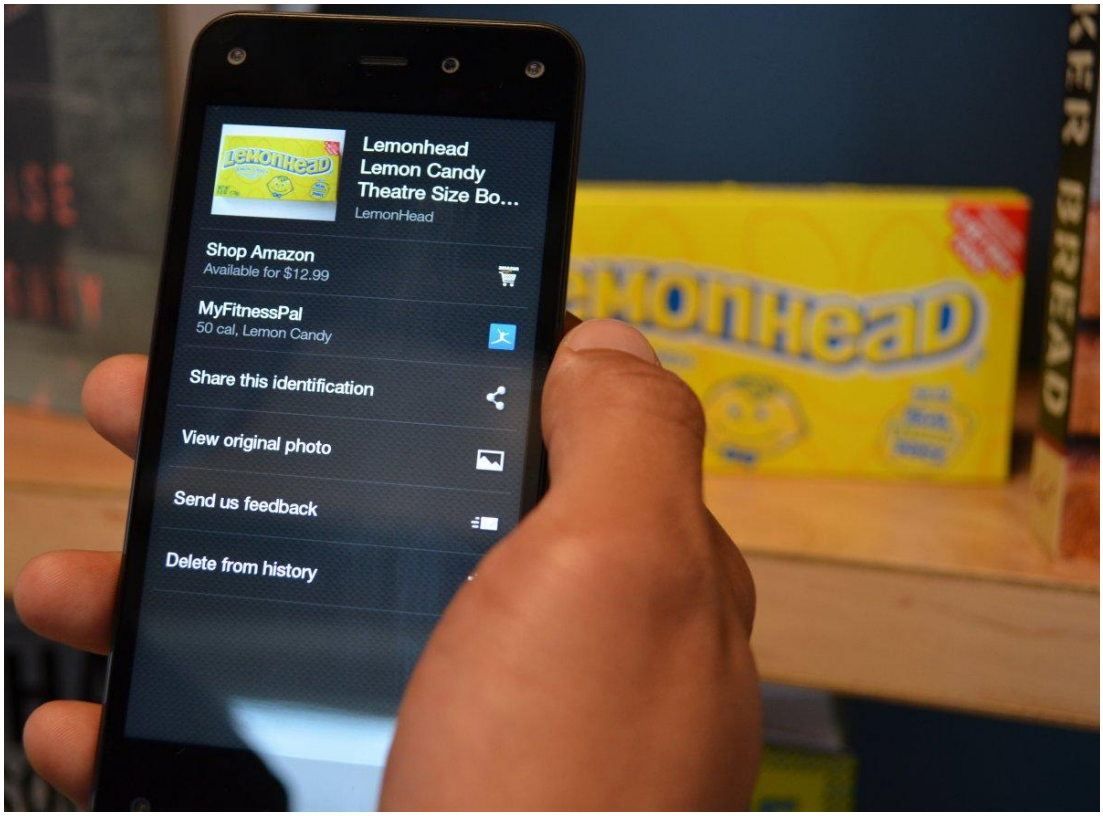


Figure 2.15 Recognition of food by Firefly

In diet monitoring, it has been proved that keeping track of what is eaten, how much is eaten, when is it eaten and how much fat is consumed is support weight change (Baker and Kirschenbaum, 1993). Many diet apps in the market have the features that ease keeping track of quality, quantity and nutrition details of foods according to time.

Ongoing Program Contact. It is a vital component of individuals' adherence in a weight loss program. Perri and Corsica (2002) emphasized that continuation of program contact helps maintaining the changes in diet.

Social Support. It is important for the individuals trying to make and maintain dietary changes because studies showed that insufficient social support is negatively related with dietary changes (Latner, Stunkard, Wilson, and Jackson, 2006). It is predicted that participating weight loss programs with a partner give advantage to participants in their dietary change (Wing and Jeffery, 1999).

However, despite all the efforts for encouraging weight loss, people continue eating excessive amount of unhealthy food (Kaipainen, 2014). Consequently, obesity treatment gained importance.

Arslan et al. (1999) gather five methods for obesity treatment: medical nutrition treatment, exercise treatment, behavioural change treatment, medicine treatment and surgical treatment. Diet, exercise and behaviour change forms a grand majority of the weight change leading noteworthy clinical benefits. For that reason, medical nutrition treatment, exercise treatment and behavioural change treatment are explained in detail.

Medical Nutrition Treatment. The aim is weight loss by redounding adequate and balanced diet to individuals. In this treatment individuals lose 0.5-1 kg per week. Studies show that, dietary interventions result in weight loss (Shumaker, Ockene and Riekert, 2009).

Exercise Treatment. It comprehends physical activity and exercise. It is important for not only supporting weight loss by balanced diet but also avoid regaining lost weight (Wareham, 2007).

Behaviour Change Treatment. The aim is to alter or reduce the negative behaviours causing unhealthy eating and inactivity and to encourage positive ones. According to Akgün (2008) the six factors of behaviour change treatment are listed as to self- observing, controlling the stimulants, adopting alternative behaviours, self-awarding, cognitive reconstruction and social support. With self-observing, individuals become aware of their actions which cause obesity, with controlling the stimulants, individuals become able to stop the first chain of the successive problematic behaviours, with adopting alternative behaviours individuals apply previously defined fun activities at the times of hunger, with self-awarding individuals are awarded for the behaviours preventing obesity, with cognitive reconstruction individuals become able to motivate themselves by positive thinking and with social support, individuals are provided with active positive support by their environment.

As application of only these treatments failed to stop pervasion of obesity, mobile technologies (Stephens and Allen, 2013; Riley et al., 2011) specifically diet control apps are offered to support them. According to Tufano and Karras (2005) the fast development and acceptation of wireless devices give advantages to these applications in helping individuals for weight loss treatment by feedback transmission. Studies show the help of personalized computer messages in reducing total fat and saturated fat intake (Campbell, 1994). It is also proved that nutrition information and personalized feedback provided by computers decrease fat intake and increase vegetable intake (Glanz, Basil, Maibach, Goldberg, and Snyder, 1998).

Together with feedback, using some behavioural strategies like self-monitoring of dietary intake (Burke et al., 2011) and weight (Steinberg et al., 2013) in healthy eating interventions is claimed to be effective (Michie, Abraham, Whittington, McAteer, and Gupta, 2009) as they support healthy eating and increasing activity levels for weight loss (Van Dorsten and Lindley, 2011).

Adherence (Artinian et al., 2010) and positive reinforcement (Powers and Osborn, 1976) can motivate people and provide them with real time feedback. Moreover, positive feedback for adherence is more effective than the analysis of nutritional

details in changing eating behaviour (Helsel, Jakicic and Otto, 2007; Klasnja and Pratt, 2012).

Studies show that the use of diet applications are well accepted by the users and the positive effects on weight loss, physical activity, BMI (Body Mass Index), waist circumference, fat and sugar intake and eating behaviours have been acknowledged (Stephens and Allen, 2013). However, there is limited study about how these apps can be improved with the aim of enhancing wellbeing.

As previously addressed, decreasing calorie intake and increasing energy expenditure are the two requirements of weight control and they are achieved through well balanced diet and increased activity level. These actions affect not only physical health but also wellbeing of people.

> *Balanced Diet.* It is agreed that balanced diet is very important in people's wellbeing. In the report of the National Institute for Mental Health in England (2005) well nutrition is stated in the framework for promoting mental health and wellbeing (Aked, Marks, Cordon, and Thompson, 2008).
>
> *Physical activity.* In parallel with numerous positive effects on physical health physical activity increase positive moods (Pasco et al., 2011) support mental health by contributing social relationships, time management skills and empowerment (Alexandratos , Barnett and Thomas, 2012) and improve quality of life (Nyboe and Lund , 2013).

The physical appearance is important for most of the people and it also can affect wellbeing. The changes in the appearance such as weight gain can become a problem for most of the people. This increases the importance of diet apps used to improve wellbeing of people.

To conclude, wellbeing is a very broad term. There are two basic approaches to wellbeing; hedonic and eudaimonic wellbeing. Self Determination Theory is another approach that tries to explain wellbeing by concerning both happiness (hedonism) and human actualisation (eudaimonism). In order to enhance wellbeing of people, technologies can be used and they are called Positive technologies. Positive technologies base on positive psychology and ICT. The aim of positive psychology is

to achieve, pleasant, engaged and meaningful life and technologies can help achieving this aim by promoting three levels; hedonic, eudaimonic and social and interpersonal level. For each level, different mHealth devices become prominent. By considering the rate of obese and overweight people and also the ones that worry about their weight, diet control mobile apps take the attention. In literature, some requirements like self-monitoring and feedback are examined and the effects are proved in successful weight loss. However, the studies about the requirements for wellbeing in diet apps are not that broad. Therefore, in this study together with the effects of the features for successful weight control, the effects of the diet apps for wellbeing are also discussed.

CHAPTER 3

DESIGN OF THE FIELDWORK EXPLORING THE EFFECTS OF MOBILE DIET CONTROL APPS ON USERS

This chapter introduces the fieldwork that explores how the mobile diet control apps and their certain features affect users' moods and their weight control preferences. Accordingly, it presents the phases of the fieldwork, selection of the participants and mobile diet apps, as well as data collection methods and tools.

3.1 Design of the Fieldwork

The aim of the fieldwork was to figure out how diet apps can be further developed in order to better support people's weight control experiences and to enhance their overall wellbeing. Therefore, a three-phase fieldwork was designed. Phase 1 (Pre-Interview), designed to gain insights about the participants' present mood and their preferences for weight control prior to the study. In Phase 2 (Usage), the participants were given a week to use a single diet control app. Phase 3 (Post-Interview), aimed at understanding the participants' feelings and their general assessment of the app that they used for a week. Details of each of the three phases will be presented after describing the participant recruitment and selection of the mobile diet control apps. Overview diagram showing the three phases of the fieldwork can be seen in Figure 3.1

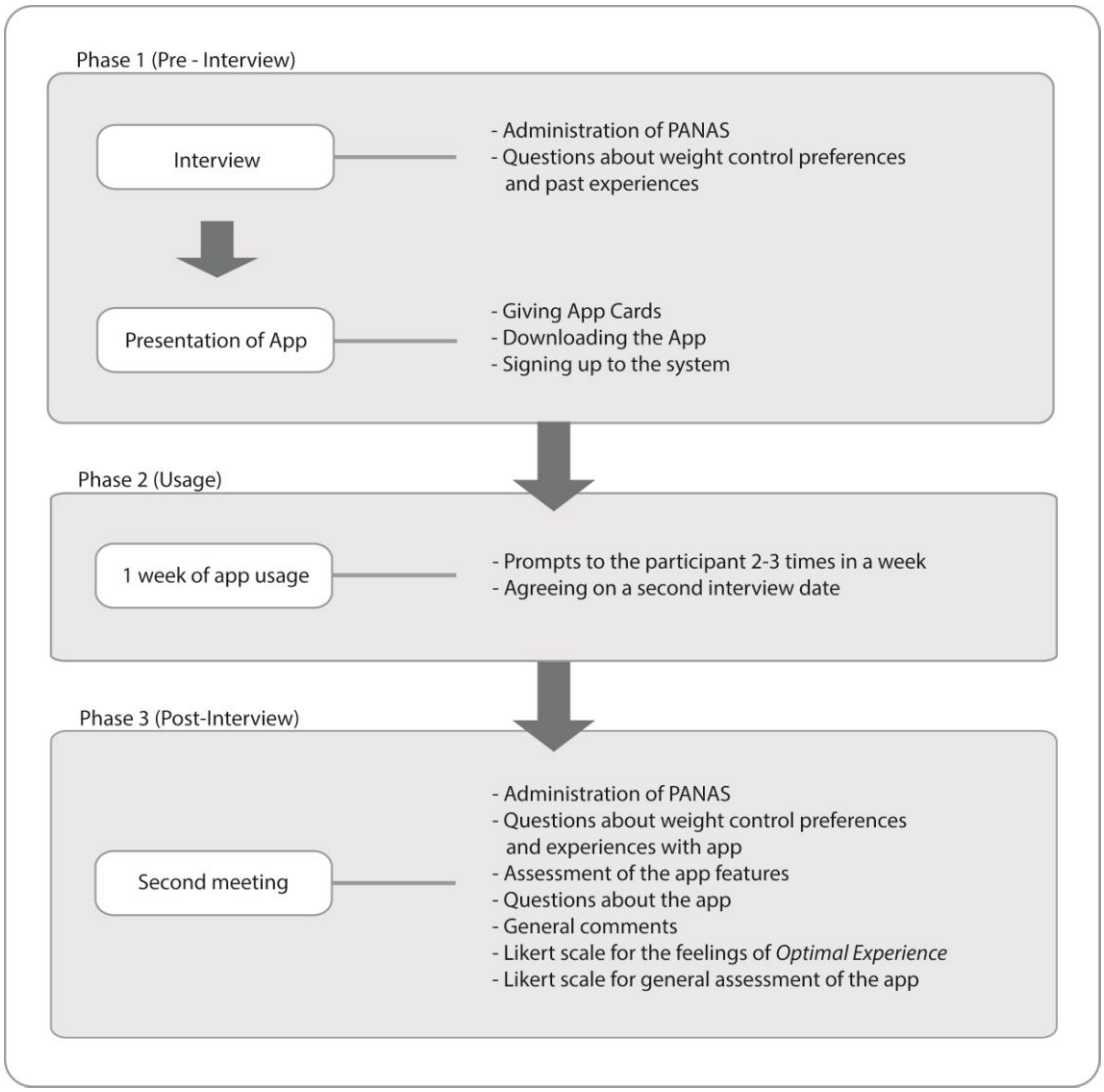


Figure 3.1 Overview diagram of the fieldwork phases

3.2 Data Collection Tools and Methods

The fieldwork had an ultimate aim to offer ways of improving mobile diet apps, and to help enhancing the overall wellbeing of people consequently. Accordingly, combination of qualitative and quantitative data collection tools and methods were used.

In this study, it was important to explore the possible effects of mobile diet apps on users through 'before' and 'after' inquiries, as commonly used in literature to assess possible effect(s) of a certain variable (e.g. Hjelm, 2004). Besides, to measure

wellbeing there should be a time restriction for evaluating the differences (McNaney et al., 2012). This was also a consideration in choosing the appropriate methods.

Measuring wellbeing is very challenging because of its multi-faceted nature, yet researchers have been developing numerous methods for measuring the felt experiences such as intimacy, happiness, and pleasure (Thieme et al., 2012). Current methods comprehend subjective rating scales, most of which enforce a restricted time period (McNaney et al., 2012).

Positive and Negative Affect Scale (PANAS). For the present research, a variety of these tools and methods were examined. Of these, PANAS was one of the tools found to be suitable. The PANAS is a brief measure of mood states, commonly used in research studies (Watson, Clark, and Tellegen, 1988). It blends mood and emotion related terms under the general term "affect" (McDowell, 2006). Watson (1999) defines 'affect' by categorizing it into "Positive Affect" (PA), which consists of *enthusiasm*, *alertness*, *activity* and *engagement*; and into "Negative Affect" (NA), which consists of *distress*, *anger*, *guilt*, *fear* and *nervousness*. The scale consists of 10 positive 10 negative words that describe different moods and emotions. A rating on each word is done by using a five point Likert scale. Participants are expected to respond to each of the words by considering their experiences for a particular time period. A common calculation method for the total score is the sum of the responses which can be range from 10 to 50. PANAS can also be used to compare before and after differences.

At the beginning of the first and second interview session, PANAS scale was administered to the participants. The participants were asked to read each item and then to indicate on the 5-item Likert scale (with 5 being 'extremely', and 1 being 'slightly' or 'not at all') to what extent they felt (e.g. 'interested') about each word.

Interviews. According to Light (2006), if it is important to learn about people's motivation, emotional responses and the important things in a given situation, the qualitative interviewing is the method that can be selected. Besides, in order to help clarifying quantitative data, qualitative research interview would be appropriate (King, 1994). In this study, it was important to gather the participants' assessments about the selected diet apps that they were going to use. Therefore, semi structured

interviews with open ended questions were planned for before and after the usage of the apps.

In Chapter 2 under weight control interventions and mobile applications section key elements to succeed weight loss and prevent regain (Mc-Cann & Bovbjerg, 1998) together with obesity treatment methods Arslan et al. (1999) are reviewed.

In the light of this information, the questions about methods, goal settings, self-monitoring, nutrition information and social support were gathered to be asked to the participants in the Phase 1 and Phase 3 of the fieldwork in order to observe the changes in their weight control preferences and understand the effects of apps.

List of app features. After these general questions the participants are provided with lists of features of the apps. The features are explored by the researcher as an expert user. For MyFitnessPal forty features, for Noom Coach thirty eight features and for Calorie Count thirty two features are examined and they are gathered under the common topics consisting of personal information, food, exercise, social network, charts and widget which consists of similar features in each app. In Myfitnespal and Noom Coach a feedback topic was included. In MyFitnessPal food log, in Noom Coach exercise log and in Calorie Count social networks topics have a dominance over other features.

The users were asked to indicate the frequency of each feature by marking one among the given adverbs. The sheets are filled in company with the researcher, in order to give the explanations and avoid misunderstandings.

Likert Scales for feelings. In constructing the scales, Pace's (2004) guidelines for *optimal experience* including exploiting curiosity; being conscious of time urgency; matching challenges to the skills of users; focusing attention with relevant, interesting content; avoiding distracting interface elements; and enhancing discovery with surprise, and Csíkszentmihályi's (1990) features of *optimal experience* consisting of challenges, skills, deep concentration, clear rules, unambiguous feedback, loss of self-consciousness, control of actions and environment, and positive effect and intrinsic motivation were used as a guide.

Likert scales are presented to the participants in order to learn to what extent selected apps can meet optimal experience. The users are asked how much these apps made them feel the given adjectives. They were provided with a table and expected to mark the frequency.

Likert Scales for general assessment of apps. In order to learn how much the apps can meet the features of optimal experience (Csíkszentmihályi, 1990) a small survey about frequency of contentment about interface elements, using the app easily, getting clear feedback, finding features easily, completing the tasks easily and contentment about awards and offerings of the apps is conducted.

3.3 Selection of the Mobile Apps

According to IMS report in 2013 over 43,000 health related apps were available just for AppStore and almost 50% of healthcare apps were available to consumers that could be downloaded for free (Aitken and Gauntlett, 2013). By considering 45% of market share of Android and 33% of market share of Apple iPhone, the apps that can be downloaded from Google Play and App Store were decided to be used. It was a challenging task to evaluate all the application available. Therefore, the top twenty applications offered free within the two online stores were listed after extracting the ones that did not support English language (see Table 3.1). The application ranking in the online app stores were based on user reviews, 5-star ratings, and the number of downloads. Although this information cannot reflect the exact variables, they were taken into consideration among the developers and used as basis for criteria in various studies (Azar et al., 2013; Breton, Fuemmeler, and Abroms, 2011; Abroms, Padmanabhan, Thaweethai, and Phillips, 2011). Thus, it was believed to be relevant for this study.

For weight control and improvement of dietary habits self-monitoring of food intake is recommended (Burke et al., 2008; Burke, Wang, and Sevick, 2011). For this reason, the apps promoting for example, adherence to a specific diet category were also not included.

Table 3.1 Top 20 free diet applications selected from Google Play and Apple Store combined (2014)

	Google Play	App Store
1	**Calorie Counter - MyFitnessPal**	**Calorie Counter & Diet Tracker by MyFitnessPal**
2	**Noom Weight Loss Coach**	**Fitbit**
3	**Calorie Counter by FatSecret**	**Lose It!**
4	Ideal Weight (BMI)	**Weight Watchers Mobile**
5	**Weight Watchers Mobile**	**Fooducate - Healthy Weight Loss,**
6	BMI Calculator - Weight Loss	LIVESTRONG.COM - Calorie Tracker LITE
7	Lose Weight Free	**My Diet Coach - Weight Loss for Women**
8	**Lose It!**	**Calorie Counter and Diet Tracker by Calorie Count**
9	Diet Point · Weight Loss	Weight Loss Hypnosis
10	**Fitbit**	**Calorie Counter and Food Diary by MyNetDiary**
11	**My Diet Coach II- Weight Loss**	**Calorie Counter by FatSecret**
12	Lifesum – Calorie Counter	**My Diet Diary**
13	**My Diet Diary Calorie Counter**	CalorieKing Food Search
14	Diet Assistant - Weight Loss	Calorie Counter, Food and Exercise Tracker
15	**Monitor Your Weight**	**Noom Weight**
16	Lose weight without dieting	Daily Carb
17	Diet Plan	Foodzy
18	**Calorie Count**	Weight Recorder
19	**Calorie Counter MyNetDiary**	**Monitor Your Weight**
20	**Fooducate Healthy Weight Loss**	BMI Calculator

[NB. Bold names indicate the common apps in both platforms.]

As the study was conducted in Turkey, an additional list that shows the top 10 diet apps in Turkey, was gathered. It was noticed that the language choice had a big role in this ranking, because although the apps in Turkish do not provide basic features like calorie counting, they are placed at the top of the list (See Table 3.2). Then, the apps common in both Table 3.1 and 3.2, and compatible with both Android and Mac OS platforms were examined in detail. A comprehensive list of app features (see Appendix A) was created. It was observed that the apps had lot of common features.

Amongst them, with regard to their most distinctive features three apps were found to offer different approaches. As Aked, Marks, Cordon, and Thompson (2008) suggest different approaches can accommodate different people. Thus, the decision was made on: MyFitnessPal (by MyFitnessPal Inc.), Noom Coach (by Noom Inc.), and Calorie Count (by About Inc.).

Table 3.2 Top 10 diet applications available in Google Play and App Store in Turkey

	Google Play	App Store
1	Miracle Diet Guide	Diyetkolik.com
2	**Noom Weight**	Fitness Point
3	Diyetkolik.com	**My Diet Diary**
4	**Calori Counter by FatSecret**	**Calori Counter by FatSecret**
5	Lose Weight Fitness & Workouts	Topoğlu Diet
6	Kalori Sayar	**My Fitness Pal**
7	Kalori Cetveli	My Diet Coach
8	**My Fitness Pal**	Diet App 6 weeks to weight loss
9	Diyet Rehberi	**FitBit**
10	BMI	Burn Calories and Lose Weight

(NB. Bold names indicate the common apps in Table 3.1 and Table 3.2.)

3.3.1 MyFitnessPal

MyFitnessPal is one of the most used weight loss and exercise trackers. It has a database of 3 million foods with nutrition information and allows entering custom recipes as well as remembering frequently used foods. One of the prominent characteristics of MyFitnessPal is the food database that comprehends meals from

Turkish cuisine with Turkish names. According to the personal information entered, the system calculates the personal daily calorie intake, then by keeping logs for the food eaten and exercise done in a given day, the app allows weight tracking. It also provides users with a social network to follow friends and to share experiences. Example screenshots for MyFitnessPal can be seen in Figure 3.2.

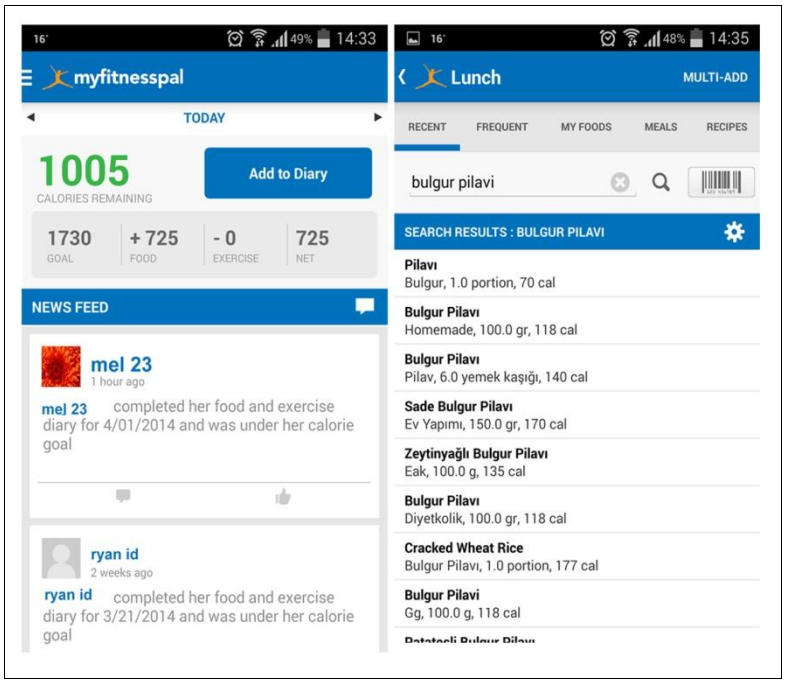


Figure 3.2 Example screenshots for MyFitnessPal.

3.3.2 Noom Coach

NoomCoach works like a personalized coach rather than a tracker. For the first couple of days it conducts some questionnaires about the user's health condition, food and exercise preferences and forms daily challenges accordingly. Every day, it creates personal tasks to guide the user on the path to weight loss, and rewards the user by taking him/her to the next level when the tasks are achieved. In meal log, it has a simple colour coding for healthy and unhealthy food. It also assists users with short articles about healthy eating. The prominent difference of Noom Coach is a GPS based workout tracking with an integrated map, a pedometer, and a

customisable music list that can accompany the user during physical exercises. Example screenshots for NoomCoach can be seen in Figure 3.3.

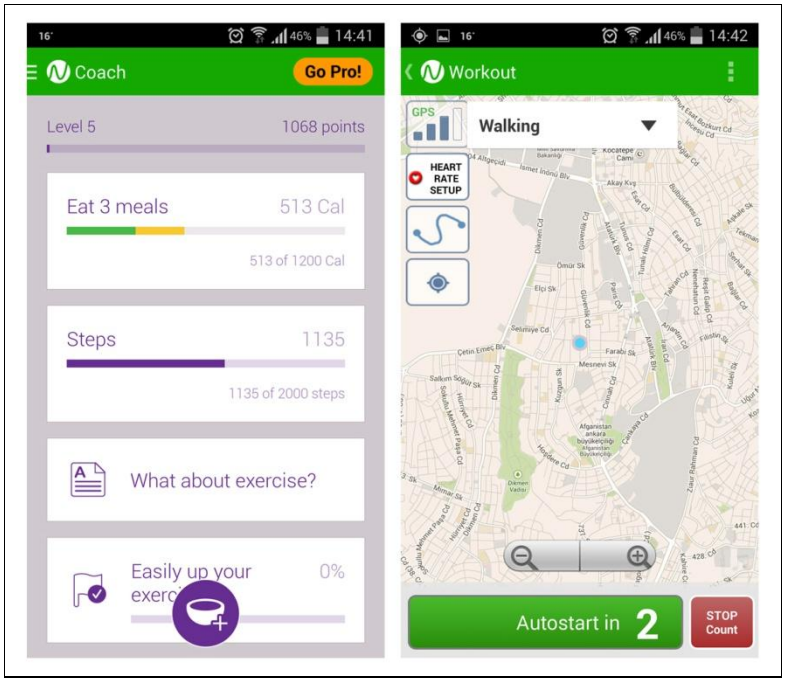


Figure 3.3 Example screenshots for NoomCoach.

3.3.3 Calorie Count

Calorie Count is more like a social platform that allows its users to share their experiences in weight control with a community as well as to receive feedback from Calorie Count users. It calculates daily calorie intake and gives four main assignments: food log, activity log, weight log, and water log. The first step is to log food and activities. Then, the users can mark the day complete and submit a comment with their reports. If the users consumed more than 1200 calories that day, their report will be made public. Moreover, the users can chose who they follow and the users' reports they want to receive. The users view, like and comment on the reports from their homepage dashboard. The links to discussion forums and its community and Facebook, Twitter connections constitute its prominent distinctive characteristics. Example screenshots for Calorie Count can be seen in Figure 3.4.

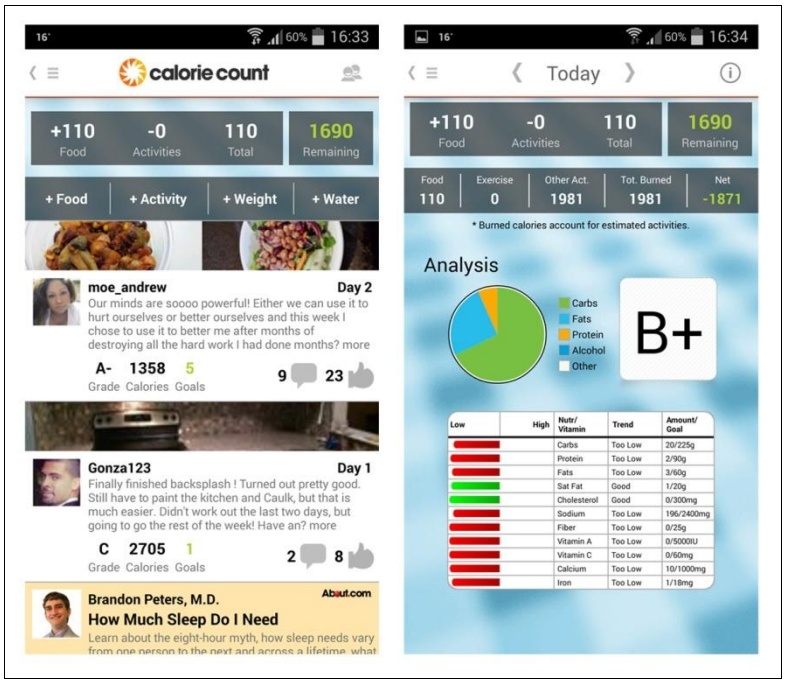


Figure 3.4 Example screenshots for Calorie Count.

3.4 Participant Recruitment

In order to participate in the study, the set criteria were: to have a smart mobile phone and being familiar to using mobile-based apps; to have a good comment on English; and to be willing to lose weight (or trying to lose weight at the time) or to have an interest in healthy eating.

Despite the fact that a balanced and healthy diet should be everybody's concern, as Kuru (2013) indicated, people's initial goals affect the success of body monitoring devices and lead willingness to keep using these. Moreover, design for wellbeing can be successful only if the user is actively involved and the success of interventions are affected by willingness of the participants for pursuing their own wellbeing and commitment of personal effort investment (Desmet and Pohlmeyer, 2013). Therefore, having an interest in healthy eating or trying to lose weight at the time of the study was an important consideration for the selection of the participants.

Consequently, with a notice to immediate surroundings of the researcher, 15 participants who met the criteria were secured to participate in the study. Of the

participants, nine were female and six were male graduate students between the ages of 23-30. After the selection of the participants, they were informed about the study procedure and agreed on a date to meet.

3.5 Venue and Equipment

Phase 1 and Phase 3 of the fieldwork, pre and post interviews, were carried out at the researcher's office. All interview sessions were voice recorded with voice recorder feature of Samsung S4 smartphone. Additionally, the researcher took notes.

3.5.1. Pilot Study

At the beginning of the study, to confirm the management of the fieldwork phases and to make necessary improvements, a pilot study with a single participant was carried out. As recommended by the participant, during Phase 2 (Usage), SMS reminders were decided to be sent to the rest of the participants. Also, some alternative questions were added to post-interview questions in Phase 3. However, the remaining arrangements were left untouched as described in Section 3.1. Thus, the data obtained from the pilot study was combined with the remainder of the fieldwork.

3.6 Detailed Description of the Phases and the Study Protocol

Detailed description of the fieldwork Phases and the protocol followed for each of the participants in each study sessions follow.

3.6.1 Phase 1: Pre-Interview

The aim of the Phase 1 was to understand the participants' present mood before using the selected diet app and to learn about their existing weight control preferences.

- The researcher arranged a face-to-face meeting with the participant after they agreed to participate in the study. The participant was reminded of the aim of the study and the consent form was administered to the participant (see Appendix B), explaining that data gathered from the participants were to be kept discrete and that they were free to leave the study at any point without feeling any pressure.

- To observe the difference between the mood changes of the participants before-and-after using the selected diet app, in Phase 1 the PANAS scale (see Appendix C) was asked to be filled in for an indicated time (i.e. last week).
- Then, open-ended questions about their weight control preferences were asked (see Appendix D).
- The participant was then assigned to one of the three diet apps chosen for the fieldwork. They were asked to use that app for a week. In order to briefly introduce the app, the participant was presented with an app card explaining the application with five screen shots and short description of key features. Informative app cards shown to the participants for MyFitnessPal, Noom Coach, and Calorie Count can be seen in Figures 3.5 to 3.7.

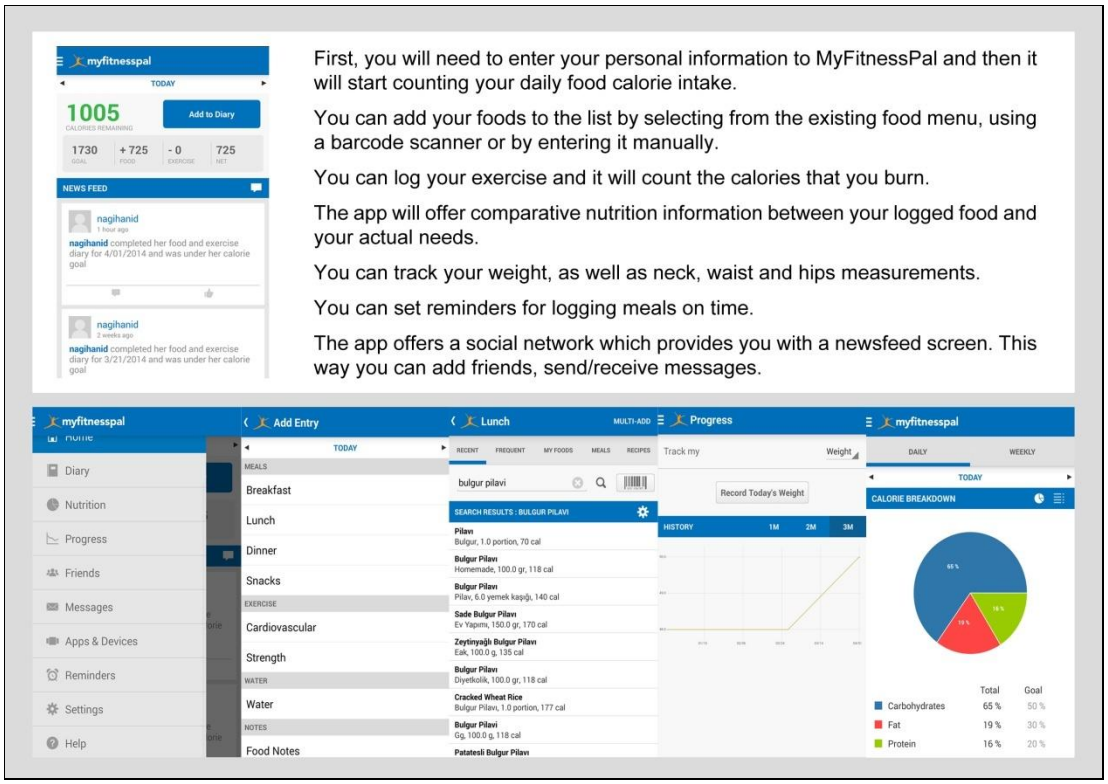


Figure 3.5 Informative app card for MyFitnessPal.

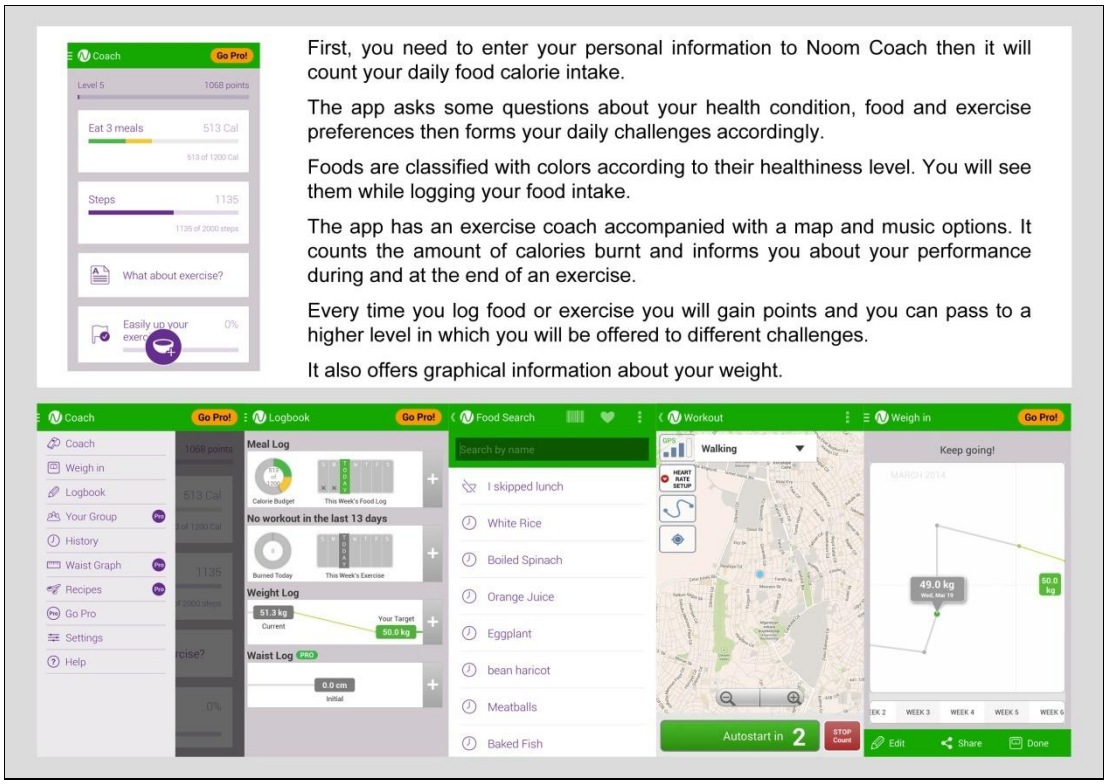


Figure 3.6 Informative app card for Noom Coach.

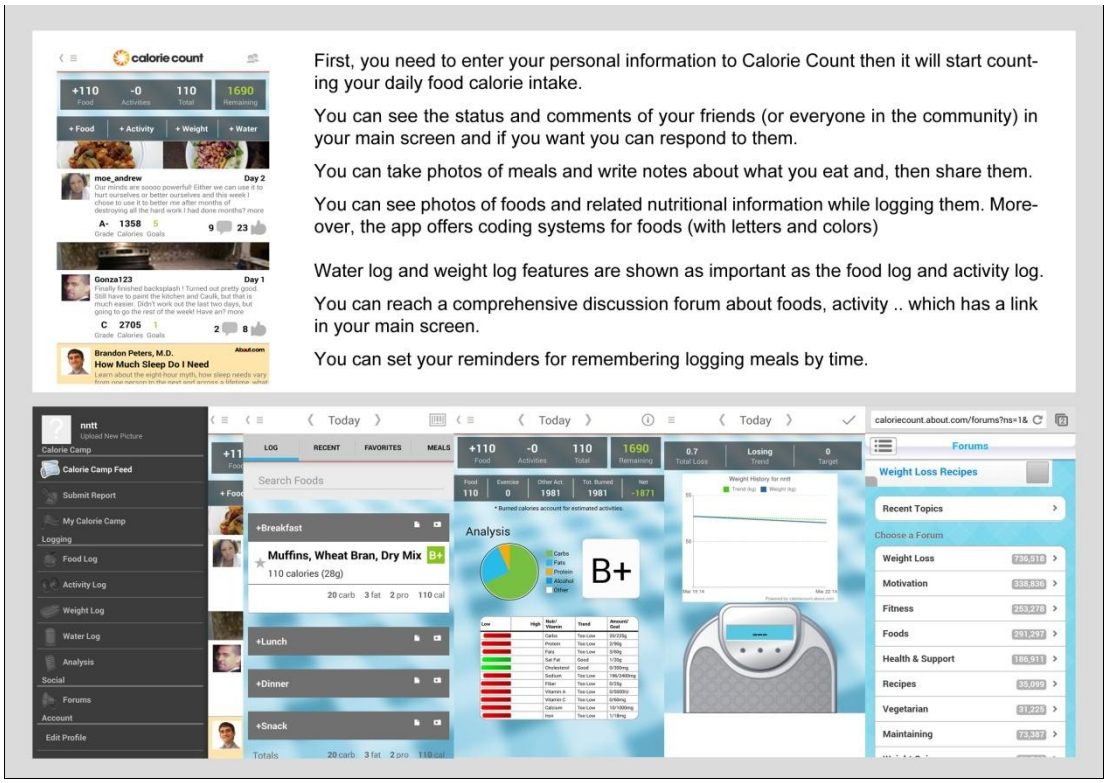


Figure 3.7 Informative app card for Calorie Count.

- Then, the participants were accompanied to downloading the app to their device and signing up for the system.
- Lastly, they were asked to use the application at least for one week time. The time duration was decided according to the study about self-monitoring for weight control by Baker and Kirschenbaum (1993), which claims monitoring behaviour can be predicted by looking at the first week. Moreover, consistent self-monitoring in initial weeks can foresee weight loss of over a six month period (Hartman, Wapner, and Saxton, 1990).

In Phase 1, each session with each participant lasted about 10 minutes.

3.6.2 Phase 2: Usage

- In Phase 2, five participants for each of the three apps (15 participants in total) were expected to use the apps for minimum of one week. During this period, the participants were prompted by SMS messages sent two or three times a week. This way, it was expected to get feedback if they were experiencing any usage problems with the apps.
- On the completion of a week, the date for second interview was decided.

3.6.3 Phase 3: Post-Interview

Phase 3 had two main aims: i) to compare possible changes in the participants' mood and weight control preferences after using the apps; ii) to understand the strength and weaknesses of the used diet control apps.

- Therefore, after minimum of a week usage, the participants were asked to fill in the PANAS scale for the second time, this time considering the week that they used the app.
- Then, questions about weight control preferences with application were asked (see Appendix E).
- The participants were presented the table of comprehensive list of features for the app that they used (see Appendices F, G, H). They were then asked to indicate which features they made use of or noticed/not-noticed.

- Finally, they were asked to grade the feelings about the app during its usage, and to make general assessments about the app making use of Likert scales. (see Appendix I, and J).

In Phase 3, each session with each participants lasted about 45 minutes. At the end of Phase 3, all participants were thanked for their involvement in the fieldwork.

3.7. Arrangement and Duration of Fieldwork Sessions

The fieldwork was carried out during June and July of 2014. In Phase 1, each session with each participant lasted about 15 minutes. During Phase 2 each of the 15 participants spent a week with the selected app. 15 participants (9 female, 6 male) were prorated to the selected three apps in consideration of balancing male and female multitude for each of the apps. A group composed of two male and three female users was assigned to each of the apps. In Phase 3, each session with each participant lasted about 45 minutes.

3.8. Ethical Considerations

The fieldwork required collection of personal data on the participants' diet control preferences as well as their usage information and assessment of mobile diet control apps. Therefore, as recommended by the METU Graduate School of Social Sciences, Ethics Committee approval was obtained (see Appendix K).

CHAPTER 4

RESULTS, ANALYSIS AND DISCUSSIONS OF THE EFFECTS OF THREE MOBILE DIET CONTROL APPS ON USERS

This chapter presents the overview of data analysis together with results and analysis of the fieldwork, followed by related discussions.

4.1 Overview of Data Analysis

As both Phase 1 and Phase 3 deal with qualitative and quantitative data, for the analysis, combination of qualitative and quantitative methods were used. Data analysis and results will be presented under Phase 1 and Phase 3.

4.2 Phase 1: Pre-Interview

Phase 1 analysis included evaluation of PANAS scale (pre usage), and the participants' answers to questions about their weight control preferences.

PANAS. PANAS scale is claimed to provide independent measures of positive affect (PA) and negative affect (NA) (Clark and Watson, 1991). In the scale presented to participants, positive and negative emotions were mixed. During the analysis, in order to compare the results positive and negative affects were separated and the answers were put in Microsoft Excel sheets. The full set of answers is given in Appendix L. However, as the PANAS scale was intended to make comparisons also between 'before' (i.e. Phase 1) and 'after' (i.e. Phase 3) effects of the app usage on the participants' moods, comparative results will be presented later in Section 4.4.

Interview. The participants were asked questions about their preferences for weight control. Same questions were asked to all 15 participants. As the questions were

open-ended, the participants' answers were collated in the form of participant statements, and formed the basis of the Tables 4.1 to 4.6.
In order to better understand the explanations of the participants, thematic analysis methods were used. The voice recordings were transcribed into written form and they were assessed by segmentation, categorisation and relinking to each other as Grbich (2007) suggested.

Despite the answers had no influence in distribution of the three apps to the participants for their use in Phase 2, in order to observe the affect changes based on the apps and to ease the comparison between Phase 1 and Phase 3, their responses were presented under each app. The results for each of the questions will now be presented.

Q.1: When you try to lose weight do you follow a special method?

All of the 15 participants indicated at least one method, some participants stated multiple preferences. 'Doing exercise/sports' was the most popular preference mentioned by 13 participants. Six of the participants said they followed a diet; four consulted a dietician before; another four participants said they were paying attention to their diet; and finally, one of them listed the food consumption.

Six out of 13 participants, who said that they did exercise/sports, either followed a diet or paid attention to their diet at the same time. One of the participants out of remaining seven, thought that it was easier to lose weight by doing exercise/sports; and the others thought that being healthy was more important than being skinny. Only one of the participants among the ones that had consulted a dietician before indicated to continue seeing a dietician.

Weight control preferences indicated by the 15 participants can be seen in Table 4.1. The statements were marked as 'x' to indicate which of the participants mentioned them.

Table 4.1 Weight control preferences indicated by the 15 participants

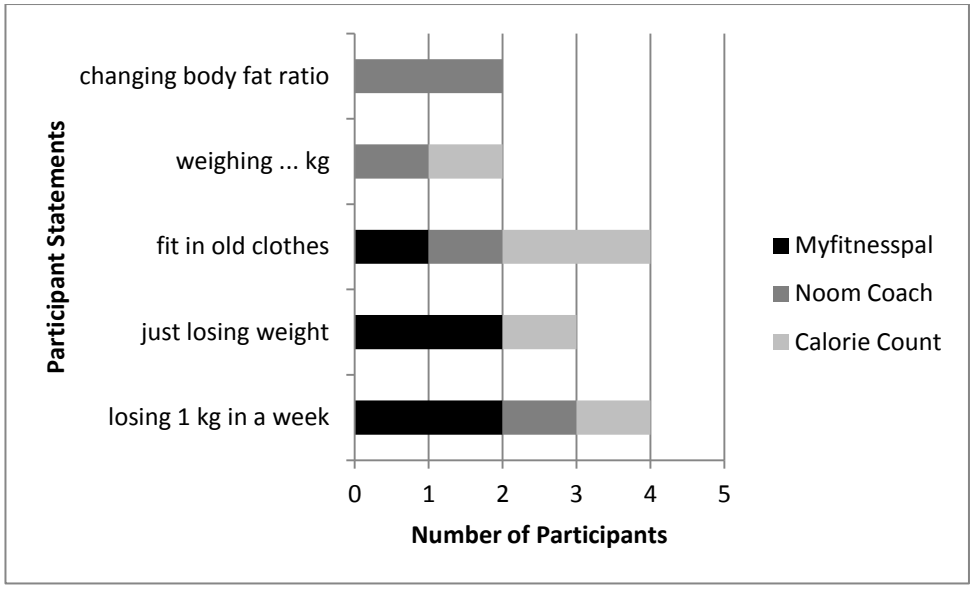
	MyFitnessPal users					**Noom Coach** users					**Calorie Count** users					
Participant statements:	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14	P15	∑ times mentioned:
doing exercise/sports	x	x	x	x	x	x		x	x	x	x	x	x	x		**13**
following a diet		x			x			x			x		x		x	**6**
consulting a dietician		x		x										x	x	**4**
paying attention to diet			x			x	x					x				**4**
listing food consumption							x									**1**

(P0X: participant number; 'x': a preference by a participant.)

Q.2: What about your goals about weight control?

Out of 15 participants there were five different statements mentioned. Four of the participants emphasized that they wanted to 'fit into the old clothes'. The other four participants thought that the healthy way of losing weight was 'to lose 1 kg in a week'; hence their aims were to achieve that. Three of the participants said that they just wanted 'to lose weight'; they did not have a specific goal. Two of them were very exact about their goal, and they aimed 'a specific weight'. Finally, two of the participants indicated that they wanted to be fit so they tried 'to change the body fat ratio'. Goals about weight control as indicated by 15 participants can be seen in Table 4.2.

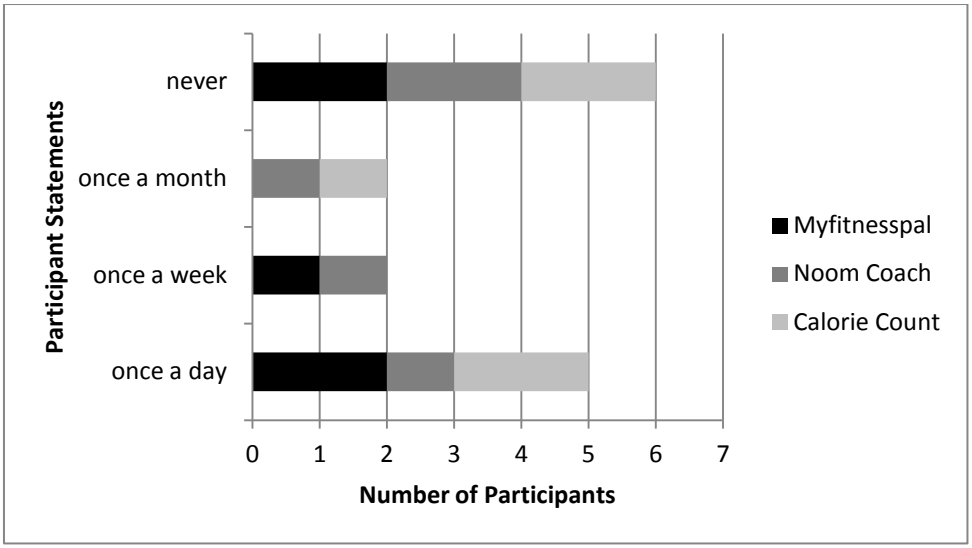
Table 4.2 Goals about weight control as indicated by 15 participants



Q.3: Do you measure your body size and weight? How often?

Out of fifteen participants, none measured their body size regularly; only two of them indicated that they measured their body size a long time ago. Six of the participants did not weigh themselves; five weighed once a day; and two weighed once a month. Reason for not weighing themselves as indicated by two participants was not having a working scale; and two of them said they could understand from their outfits so they did not need numeric values. Frequency of weighing as indicated by 15 participants can be seen in Table 4.3.

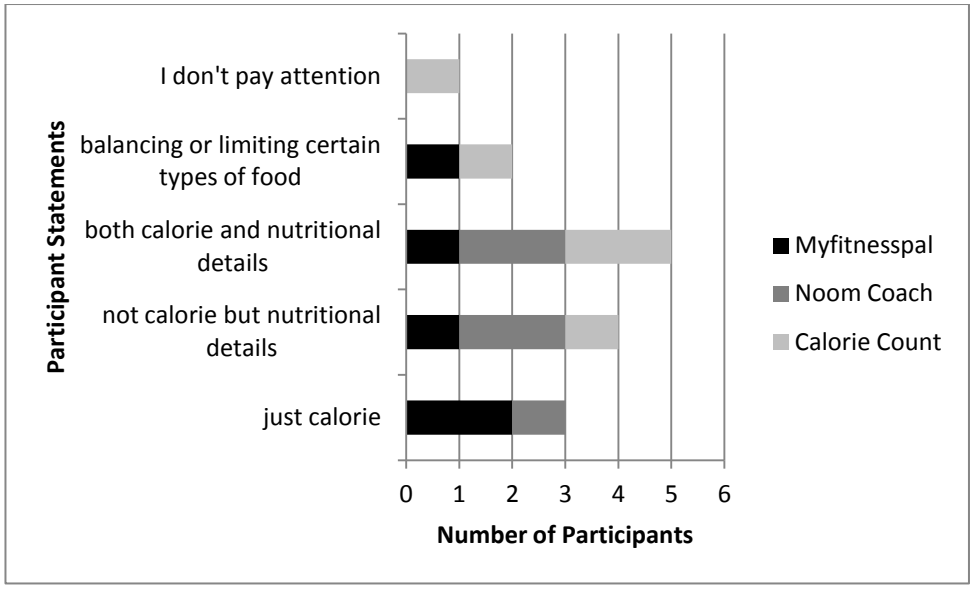
Table 4.3 Frequency of weighing as indicated by 15 participants



Q.4: Do you pay attention to the nutritional information of what you eat?

Five of the participants paid attention to both calorie and nutritional details; four of them were not interested in calories, but they paid attention to nutrition details of food; three of the participants paid attention to just food calories; two were interested in balancing their food according to their types or in limiting certain types of food; only one participant did not pay attention to this information at all. This participant indicated the interest in slow food; so what the participant was interested in how to eat rather than what to eat. The 15 participants' interest in nutrition information can be seen in Table 4.4.

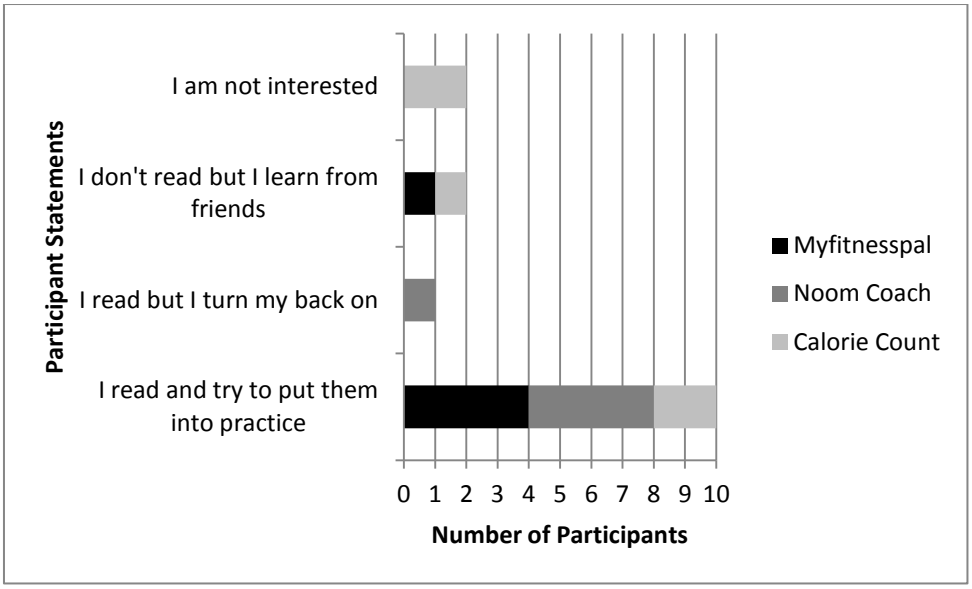
Table 4.4 Interest in nutrition information as indicated by 15 participants



Q.5: Are you interested in any methods, suggestions, and facts for weight control?

Ten of the participants said that they liked reading about methods, suggestions and facts for weight control as well as trying to put them into practice. Two of the participants clarified that they did not actively search and read, but they learned from friends. Two of them said they got bored with these kinds of information so they were not interested in; and one of the participants read, but could not put the readings into practice. Three of the participants, who indicated to like reading and put them into practice, specified that they read not particularly about weight control but healthy life in general. Answers to this question can be seen in Table 4.5.

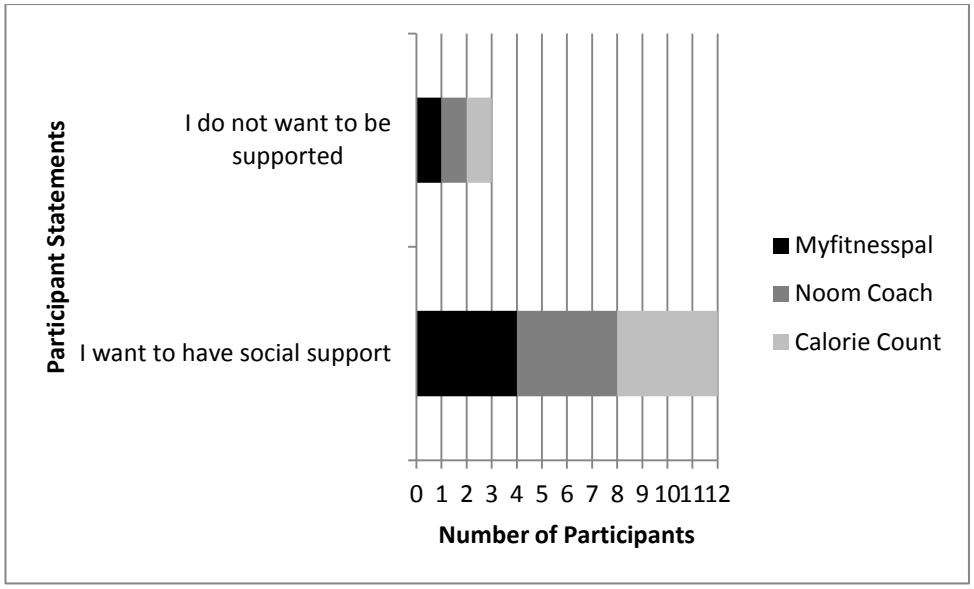
Table 4.5 Interest of 15 participants in methods, suggestions, facts



Q.6: Do you prefer having social support when trying to lose weight?

Twelve of the participants answered this question positively and remaining three answered negatively. Eight of the participants thought that being accompanied in their diet or exercise motivated them. Three of the participants said that they liked to have social support from their parents and friends. Three indicated that they did not like to be supported because it was and it should be a personal act. One of the participants used a metaphor of 'acting in a concert' to imply having a social support during weight losing. And said that weight losing process differed from person to person hence it could not be done together. However, the participant liked sharing the experiences. Answers to this question can be seen in Table 4.6.

Table 4.6 Social support preferences of 15 participants



Q.7: Have you ever used any software app(s) for diet tracking before?

Only five of the participants indicated that they tried using an app before, and two of them continued using. Two already had tried MyFitnessPal, one of them used Noom Coach; and the other two participants did not remember the names of the apps. Three of the app users quitted using the app after few days; one of them stopped using after a week; and the last one used the app intermittently for two months.

They all emphasized the difficulty of logging meals one by one; and one of them said it was not reassuring because there were too many options for a single food and was not easy to choose among them. The Noom Coach user liked the pedometer feature, but the others did not indicate a specific feature that they liked.

One of the participants, who did not use an app, explained the reason for not using any as seeing the dishes in quantified form was not pleasant; and another participant mentioned about having short-term plans for diet and being able to follow them, hence there was no need for software.

4.3 Phase 2: Usage

In Phase 2, each of the selected three apps (i.e. MyFitnessPal, Noom Coach, Calorie Count) was used by five participants. In total, 15 participants used the apps for 7 to 10 days. Data related to Phase 2 was collected at Phase 3: Post Interview, and will be presented in the following sections.

4.4 Phase 3: Post-Interview

Phase 3 analyses included comparative analysis of PANAS (Phase 1 & Phase 3), the participants' answers to questions about their weight control preferences and the selected apps; evaluation of the app features, and evaluation of participants' assessments about the apps.

4.4.1 Comparative Analysis of PANAS (Phase 1 & Phase 3)

Similar to Phase 1, the participants' answers were collected; positive affect (PA) and negative affect (NA) related terms (i.e. emotions) were transferred to Microsoft Excel sheets. The full set of answers for this phase can be seen in Appendix L.

In this study, the aim was to find out the effect of the usage of diet control apps on people. The mean values of the scores given by all participants to each emotion were calculated for PA and NA.

Tables 4.7 and 4.8 present the mean values of the scores given by all participants to each word of PA and NA.

Table 4.7 The mean values of the scores given by all participants to each PA related terms

Positive Affect: PA	Mean value of 15 participants' answers **'before'_ using the apps**	Mean value of 15 participants' answers **'after'_ using the apps**
interested	3,53	3,27
excited	2,87	3,27
strong	3,07	3,33
enthusiastic	3,46	3,40
proud	2,66	2,93
alert	2,40	2,33
inspired	3,00	2,93
determined	3,20	3,53
attentive	2,60	2,87
active	2,73	3,13

Table 4.8 The mean values of the scores given by all participants to each NA related terms

Negative Affect: NA	Mean value of 15 participants' answers '**before'_ using the apps**	Mean value of 15 participants' answers **'after'_ using the apps**
distressed	3,00	2,40
upset	1,87	1,80
guilty	1,47	1,67
scared	1,73	1,53
hostile	1,40	1,13
irritable	1,80	1,73
ashamed	1,80	1,33
nervous	2,93	2,20
jittery	2,47	1,73
afraid	1,60	1,33

In order to see whether the changes in the values of PA and NA for Phase 1 and for Phase 3 were significant, Student's T-Test was performed using 't test calculator' option of the online software Graph Pad (GraphPad Software, Inc., 2014).

The T-Test is a standard statistical calculation around the arithmetic means of a dual data set, for which the data may be either paired (e.g. before/after data) or originating from two separate and unrelated samples (Kennedy & Neville, 1986). In practice, the key use of the T-Test is in determining a statistically significant difference (rather than a difference by chance) between the arithmetic means of the dual data set.

By using T-Test, before and after mean values of PA and NA were compared. Mean (M), ST (*standard deviation*), SEM (*standard error of mean*) were calculated, and to determine the significance of the difference that the apps expected to create on PA and NA, p values were calculated (see Table 4.9).

According to the results p value of PA equals 0.37 and p value of NA equals 0.16. By conventional criteria this difference was not statistically significant. The mean of before minus after equals -0.1466 and 95% confidence interval (CI) of this difference is from -0.4848 to -0.1914. It can be said that after positive affect is higher than the before positive affect but it is not high enough to see the effects of the apps. The mean of before minus after equals 0.3200 and 95% confidence interval of this difference is from -0.1461 to -0.7861. It can be said that after positive affect is lower than the before positive affect but it is not low enough to see the effects of the apps.

Table 4.9 Summary of T-test calculations

	Mean	Confidence Interval (CI)	Standard Deviation (SD)	Standard Error of a Mean (SEM)	P Value	**Result**
Before **PA**	2,9533	-0.4848 to -0.1914	0,3719	0,1176	0.3742	No statistically significant effect found
After **PA**	3,0990		0,3474	0,1098		
Before **NA**	2,0066	-0.1461 to -0.7861	0,5832	0,1844	0.1616	No statistically significant effect found
After **NA**	1,6866		0,3900	0,1233		

Despite no statistically significant effects found between before and after PANAS, the increase in the after values of PA and the decrease in the after values of NA showed that the apps might have positive effects on participants' PA and NA. A

study conducted with more participants can more clearly show the statistical differences between users' before and after PA and NA.

4.4.2 Analysis of Interview Questions

The participants were asked questions about their preferences for weight control similar to that of before the usage of apps (Phase 1). The interview followed specific questions related to their diet app usage (Phase 2). The results and analysis will be presented as: i) evaluation of weight control preferences, ii) general evaluation of the apps, and iii) evaluation of the users' feelings and moods and general assessments.

4.4.2.1 Evaluation of weight control preferences

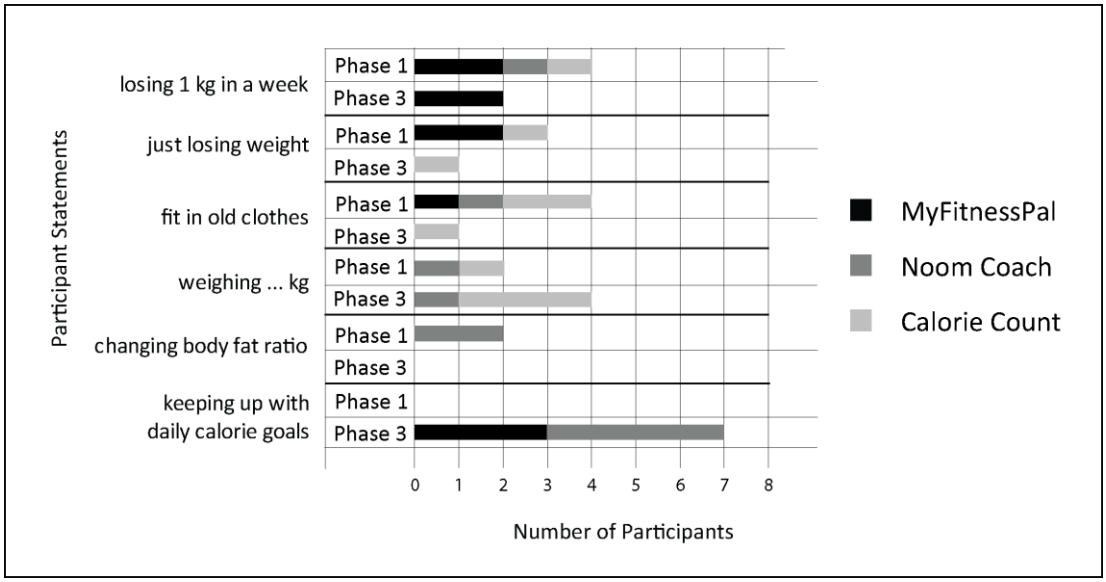
Although the participants were not provided with a list of answers that they gave in Phase 1, their answers to questions from Q1 to Q5 showed similarities. Full list of questions are presented in Appendix D. As the questions were open-ended, the participants' answers were collated in the form of participant statements, and formed the basis of the Tables 4.10 to 4.13. In the tables, answers given to these questions in Phase 1 and Phase 3 by the participants indicated separately for all three apps used.

Q.1: Have you set yourself a goal?

As can be seen in Table 4.10, all the answers in Phase 1 except changing body fat ratio were repeated in Phase 3 and the answer of '*keeping up with daily calorie goals'* was added to the list and mentioned by the majority of the participants in Phase 3.

In Phase 3, the daily calorie calculation changed most of the MyFitnessPal users' and nearly all of the Noom Coach users' aims but did not affect Calorie Count users' aims. Most of the Calorie Count users aimed at reaching a specific aim in Phase 3. The aim of *fitting in old clothes* was mentioned by only one user and *changing body fat ratio* was never mentioned.

Table 4.10 Weight control aims of 15 users before and after usage of the apps



Three users out of five MyFitnessPal users aimed at accomplishing daily calorie goals that the app set for them, two users aimed at losing 1kg in one week, the other two users stated their aims as just losing weight and the user aimed at fitting his clothes in Phase1 followed the calorie goal the app set for them.

Four users out of five Noom Coach users aimed at keeping up with daily calorie goals and one of them set a desired weight and wanted to reach it. The users stating their goals as fitting into their old clothes and changing body fat ratio in Phase 1 turned to daily goals with this app.

Three of the five Calorie Count users aimed at a specific weight, one of them aimed at fitting in old clothes and one wanted not gaining weight. There were some changes in the aims of the users in comparison to the first interview, but they explained that it was not because of the app. One of them stated that the participant had to eat unhealthy food late at night because of the long working hours so she could not adhere to the aims and one of them indicated that the participant was very busy and stressed during the week and in their week of malnutrition not gaining weight would be an accomplishment and one of them emphasized that she could not adhere to the aims for a specific weight because the participant was very busy and tired during the

week and there was no time for exercise. Two of the participants among aiming at a specific weight emphasized that one of them lost 1 kg and the other one lost 2 kg.

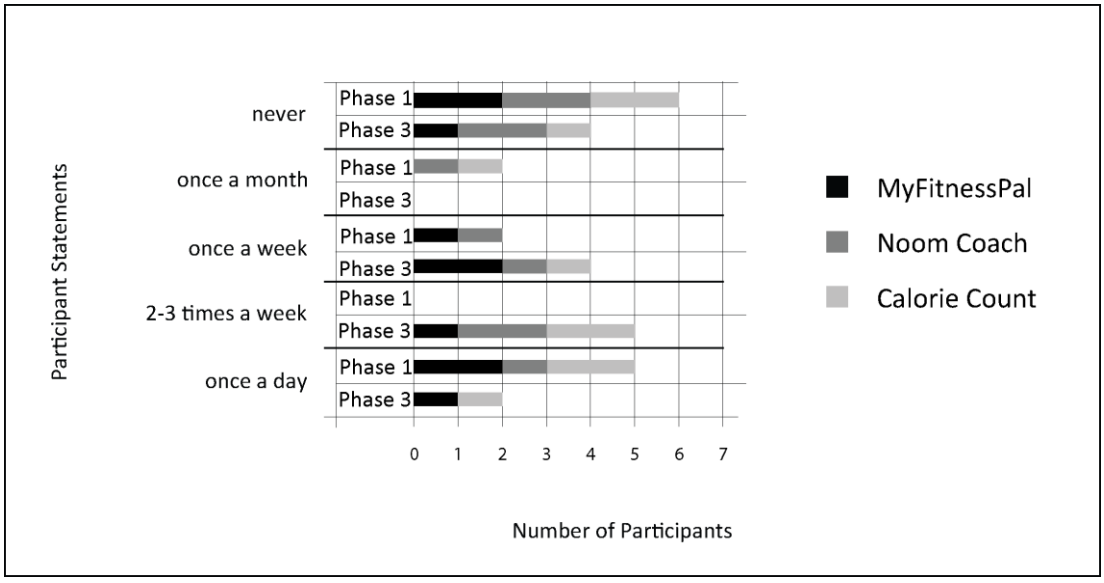
Q.2: Have you measured your body size and weight? How often?

During the week that the users were using the apps none of the users measured their body. One of the users said that the participant did not measure body size because of not having a tape and indicated that it can be tricky because the tape could be held too tight or loose. Another user wished that measurement could have been done with the help of the sensors integrated to her phone.

As can be seen in Table 4.11, all the answers in Phase 1 except *once a month* were repeated in Phase 3 and the answer of weighing *two or three times a week* was added to the list.

The apps made most of the participants weigh themselves at least once during the week of usage. In Phase 3, the number of the participants that never weigh themselves and that weigh once a day were decreased and weighing two or three times a week was the most mentioned answer in Phase 3.

Table 4.11 Frequency of weighing before and after usage of the apps



Two among five MyFitnessPal users weighed once, one of them never weighed because of a broken scale, one of them weighed twice or three times in a week and one stated that the participant weighed every day. The user who has not tracked her body in the last year in the first interview stated weighing two or three times during the week of usage.

Two of the users from five Noom Coach users said they never weighed because of a broken scale, two of them weighed once, one weighed twice or three times in a week and the other weighed every day. In comparison to answers of the first interview, the app raised the frequency of weighing. The one who never weighed and the one weighed once a month became curious and weighed themselves during the week of usage.

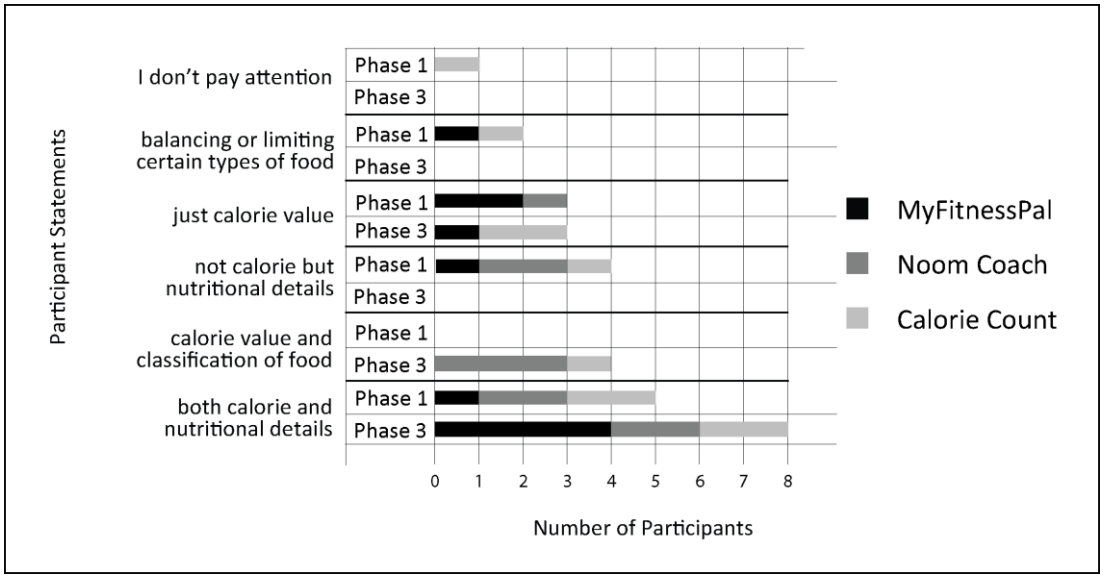
Lastly, two of the Calorie Count users weighed twice or three times a week, one of them never weighed because of being afraid of the results. One of the two Calorie Count users that never weighed before usage weighed everyday during usage and the other one weighed once. One of the users that used to weigh once a month weighed twice or three times in a week. Therefore, it can be said that the frequency of weighing is slightly higher than before usage.

Q.3: Have you paid attention to the nutritional information of what you have eaten?

As can be seen in Table 4.12, the answers of *just calorie value both calorie and nutritional details* were repeated in Phase 3 and *calorie value and classification of food* was added to the list and mentioned by the majority of the participants in Phase 3.

In Phase 3 all the participants were interested in calorie value offered by the apps. Additionally, classification of food attracted most of the Noom Coach users' and one Calorie Count user's attention but did not affect MyfitnessPal users.

Table 4.12 Interest in nutrition information of 15 participants during usage



All the apps provided users with calorie value and nutritional details of food, however none of the users used this information before eating but used for checking their food intake.

During the usage of the app four MyFitnessPal users paid attention to calorie and nutrition information of food and the other user was interested in only calorie value of food. One of users who paid attention to both calorie and nutrition information of food and wanted to decide their meals according to their needs. In the first interview only one of MyFitnessPal participant stated that she was interested in both calorie and nutritional details of food but the app made the others more interested in calorie value and nutrition information of foods.

Three of Noom Coach users paid attention to calorie value and classification of food as presented green, yellow and red food. Two of them were interested in calorie and nutrition information of food. The users stated their interest as only calorie, only nutritional details or balancing their diet in the first interview, turned to classification of food presented by the app.

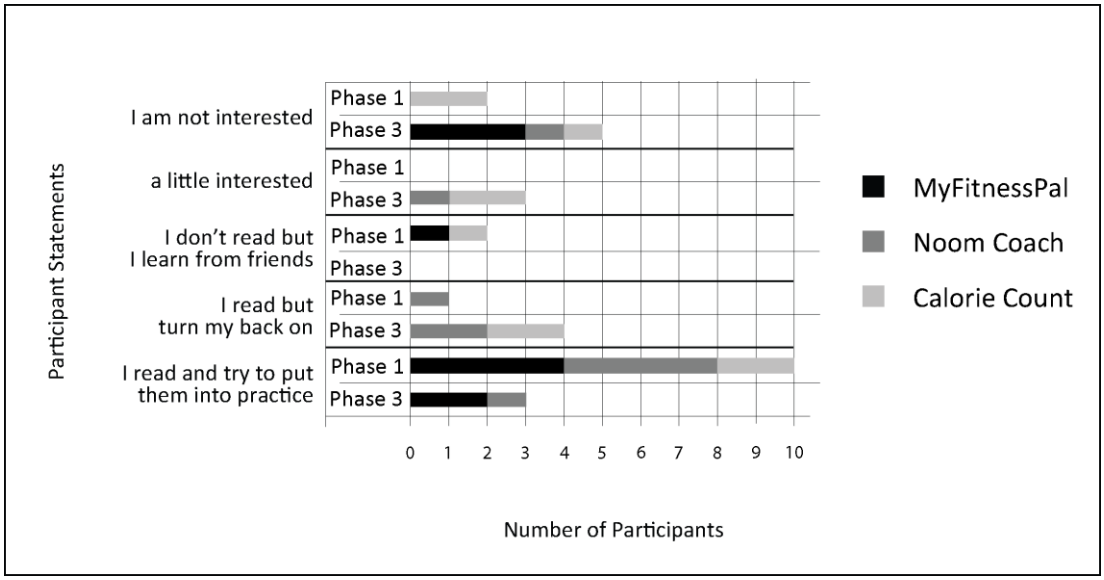
Two of the Calorie Count users paid attention to both calorie and nutrition information of food, two of them were interested in only calorie value and the other paid attention to calorie value and classification of food presented as A,B,C class food. One of the users indicated that it was a testing period; the other said it was a learning process so they paid attention to calorie value as well as nutrition information of food. However, one of the users stated that more explanation was needed because the users could not know what to eat for meeting their deficient minerals or vitamins and one indicated that the user was paying attention of nutrition details of food before but the app increased the responsibility.

Q.4: Have you sought for any information about any methods, suggestions, facts for weight lost?

As can be seen in Table 4.13, all the answers except *I don't read but I learn from friends* were repeated in Phase 3 and the answer of *a little interested* was added to the list. The number of the participants that read methods, suggestions and facts and tried to put them into practice in Phase 1 was decreased and the ones that were not interested in them were increased in Phase 3.

Despite the fact that all the apps that were used by users provided some tips, articles or suggestions about weight control, a small number of the participants paid attention to them. However, some of the Noom Coach users read the articles and some of the Calorie Count users read the suggestions from Calorie Count users but they did not put them into practice.

Table 4.13 Interest of 15 participants in methods, suggestions, facts during usage



During the usage of the app three of MyFitnessPal users were not interested in methods, suggestions, facts for weight control, the other two stated that they read the tips and paid attention to warnings of the app. The ones stated that they were interested in methods, suggestions or facts in the first interview did not take the tips of the app into account.

One of the Noom Coach users did not pay attention to the articles that the app presented, one of them read but did not take them into account, one of them said he was a little interested and the other one said she read the articles and tried to implement the things that she learnt. The articles presented by the app were not read and taken into account by none of the users which indicated their interest in methods, suggestions and facts in the first interview.

Two of the Calorie Count users were a little interested and if they had more time they could have taken notice of them more. Two of them read the recommendations and paid attention to their newsfeed but not implement learnt things in their life and one of them was not interested in the recommendations of the app. These kinds of apps were used by knowing users and basic suggestions cannot get the attention of those users. Calorie Count made its users who said they did not read and were not

interested in methods, suggestions and facts in the first interview read the newsfeed but not implement the things they learnt in their life.

Q.5: Do you think that this app has encouraged you to be (more) socially connected?

None of the users think that the apps have encouraged them to be more socially connected. According to eleven of the users it did not have an effect on their socialization. None of them used social network of the apps because three of them thought that it was too personal and they did not want their friends to see what they ate or how much exercise they did and two of them emphasized that they could have shared their information only in a close circle not in a platform like Facebook. They said if they had their friends who were following a diet in the platform, they could have a motivation to use it. Only three of them indicated that the apps were mentioned in a conversation and it was the only social effect of the app.

In the first phase most of the users indicated that they wanted to be accompanied or have social support but, none of the users had tried using social connections of the apps.

4.4.2.2 General evaluation of the apps

The questions related to general evaluation of the applications aimed at understanding the frequency of app usage, contribution of apps, intention in continue using and the assessment of app features by the participants.

The questions in this section from Q.6 to Q.9 were aimed at collecting participants evaluation of the apps in general. Q.6 to Q.8 were open-ended questions, the participants' answers were collated in the form of participant statements, and formed the basis of the Tables from 4.14 to 4.16. For Q.9 three scales for indicating the frequency of app features were presented to the participants and after they filled the scales questions about the features as sub questions of Q.9 were asked.

The usage frequencies of app features are presented in Tables from 4.17 to 4.19, and the answers of the app feature related questions were formed the basis of the Tables from 4.20 to 4.26.

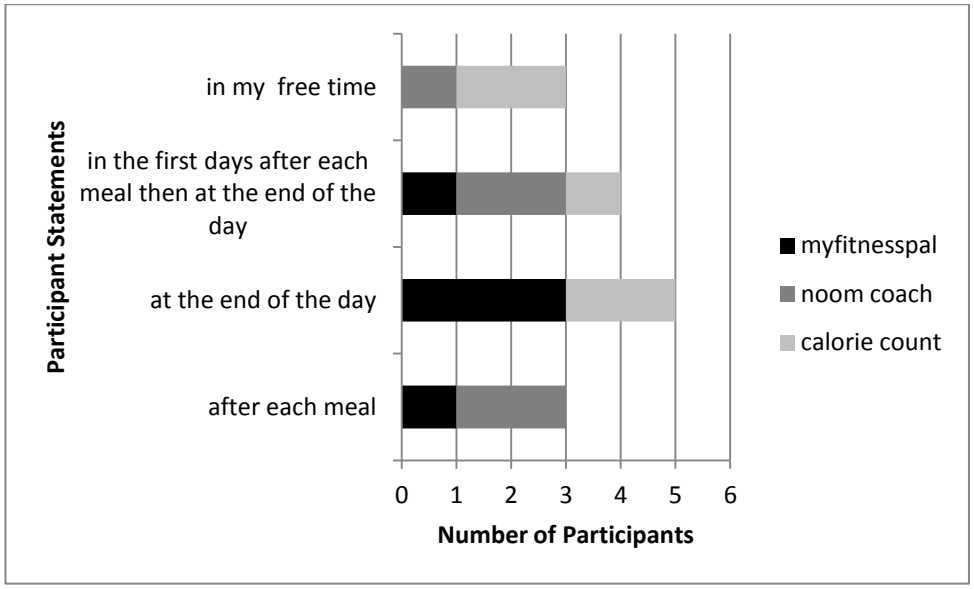
Q.6: How frequently have you used the app?

Three of MyFitnessPal users used it at the end of the day. One of them said that she used the apps after every meal by checking her food every time, and one of them was very excited about the app so during the first days the app was used after each meal then the user lost excitement and began using it at the end of the day.

Two of Noom Coach users used the app after each meal because of the notifications, two of them used it after each meal during the first days then lost their attention and began using it at the end of the day and one of them used the app in his free time because of being busy after the meals.

Two of the Calorie Count users used the app at the end of the day, two of them used it in their free time because logging food took too much time and one of them used after each meal at first then began using at the end of the day because the participant was following a special diet and eating similar food everyday and after some time the calories of eaten foods were learnt.

Table 4.14 Frequency of app usage by 15 participants



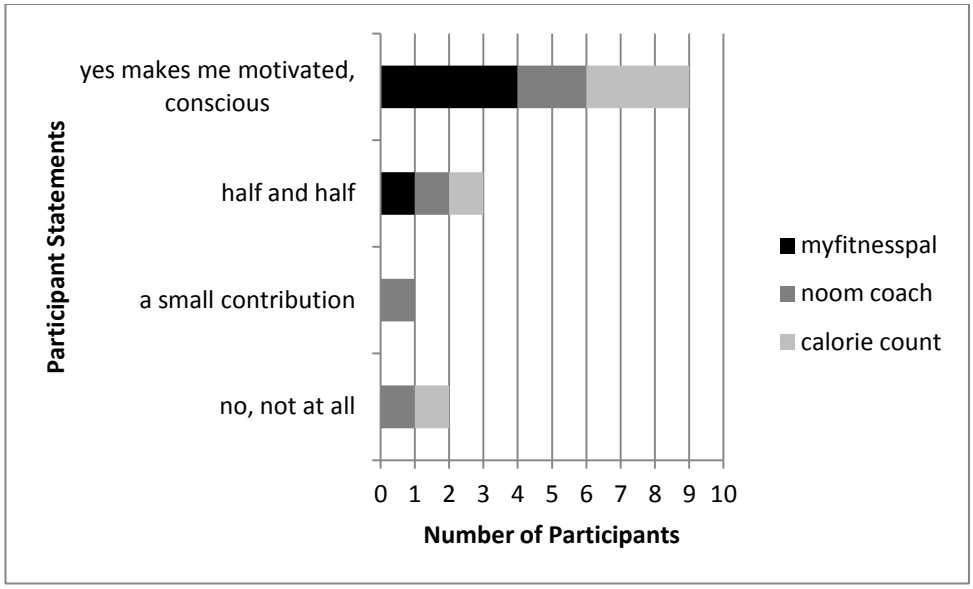
Q.7: Do you think that this app has helped you achieving (or getting close to) your goal?

According to four of MyFitnessPal users the app has helped them in their aims. One of them indicated losing 1.5 kg, one of them stated that the app made the user more alert, one of them liked being warned by a program but not by a person and the other one indicated that quantified approach to eaten meal has helped. However, one of the MyFitnesPal users emphasized that the app has made the user more conscious about healthy living but the same thing could not be said about the aim which was for losing weight.

Two of the Noom Coach users said the app made them more conscious. One of them said the app did not helped in the aim because the app was found inadequate, one of them thought that the app had a small contribution in the aim because of the classification of food, one of them said it has an effect half and half because tracking was good but logging food was difficult.

Three of the Calorie Count users thought that the app made them more motivated and conscious and one of those indicated that he was not aware of the calorie value of his food, he learnt with this app and it made tracking easier. One of them thought that it did not help in the aim because the user did not like this app specifically and one of them indicated the effect as half and half because the user thought the app gave an inspiration.

Table 4.15 Contribution of apps to 15 participants



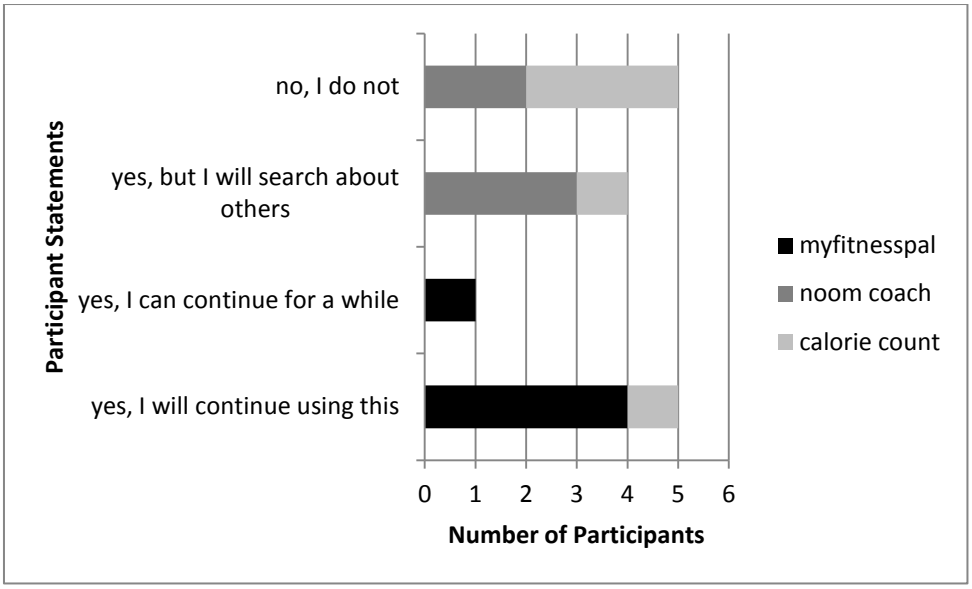
Q.8: Do you think that you would use an app for diet tracking/weight losing in future?

Four of the MyFitnessPal users specify that they will continue using the app that they have been using for the last week and the other one stated that the user will continue using it for a while.

Three of the Noom Coach users indicated that they were thinking about using a diet app but they would search about the other apps and then decide which app it would be and the other two users did not want to use an app because they did not find the app qualified enough.

Three of the Calorie Count users did not want to use a diet app in the future because one of them got bored, the other did not think that he could gain profit from that app in the long term and the last one thought that the user could not be accurate enough while logging foods and exercises. Thus in order to continue using, the app should have provided the users with more accurate way of logging. One of the users wanted to continue using the app and one of them indicated that the user would look for other apps.

Table 4.16 Intention of 15 participants on using a weight control app



Q 9: Please fill in the scales according to your usage frequency?

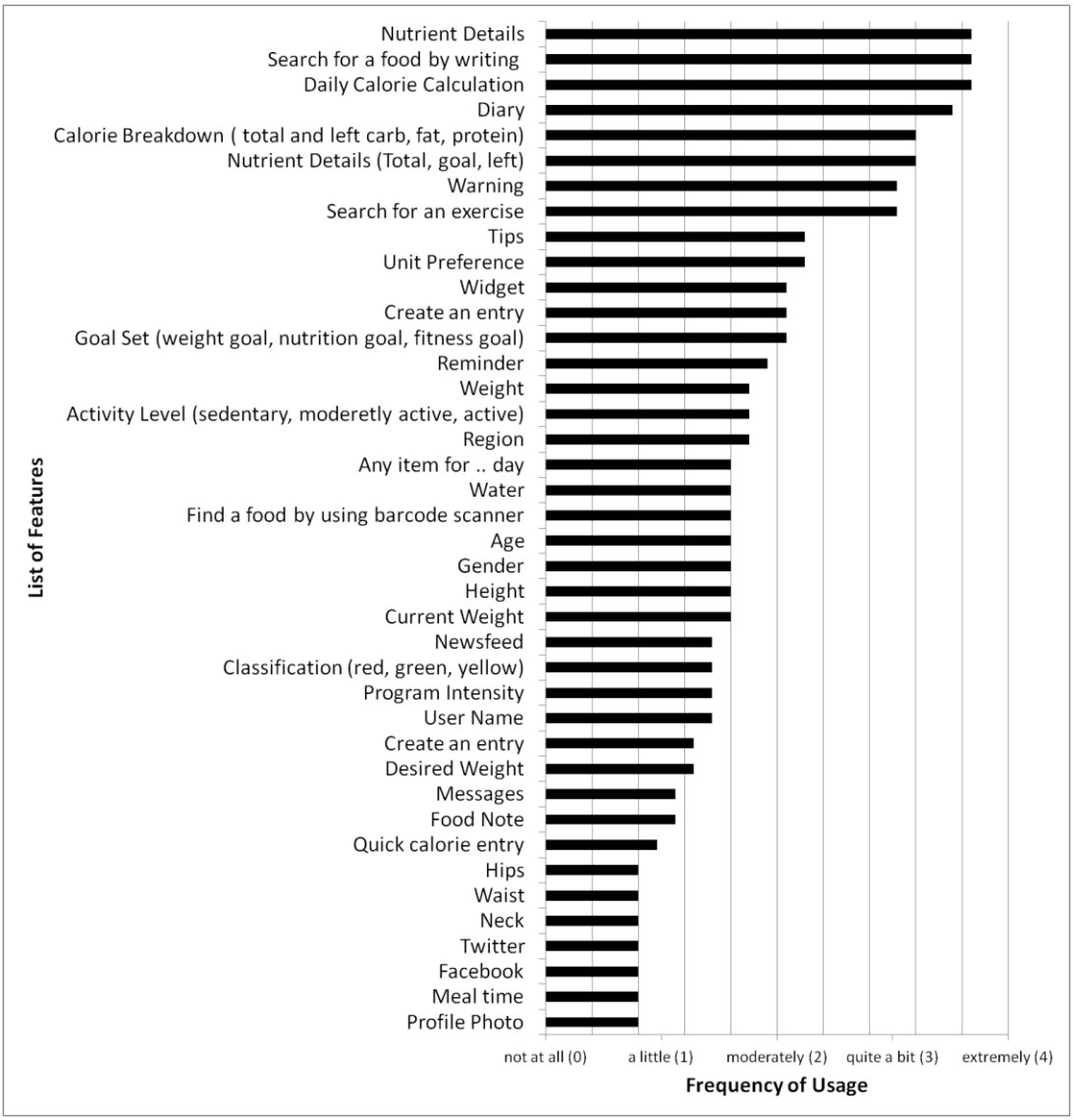
In this part a list of app features were presented to the participants and interrelated questions indicated as 9a, 9b and 9c were asked.

The participants indicated over a five point Likert Scale about their usage frequency of all app features. After each participant marked their usage frequency of each feature, the collected results were put in Microsoft Excel sheets created according to the applications. The mean values of five users' usage frequency of every feature were calculated according to the numbers assigned to adverbs which are shown in brackets in the tables. The usage frequency of features by each participant is presented in Appendices M, N, O. Tables from 4.17. to 4.19 show the usage frequency of features by mean values of marked adverbs.

In MyFitnessPal; by considering their higher mean values it can be said that, daily calorie calculation, search for a food by writing and nutrient details were the most used features because the users indicated that they took food log as the main task for this app and they wanted to track what was consumed most and what was remained lack. Two of the users used widget because they liked checking their situation without running the app. One of the users used create an entry feature extremely in

order to log their foods as accurate as possible. A user took warning and tips into account extremely because they were found to be very to the point. None of the users used profile photo and social networks because they did not want to share their diet; one of the users indicated that if it was in closer circle the user could have used it. However, three of them followed their newsfeed. None of the users used neck, waist and hips charts because they did not measure their body. They did not used search for an exercise feature because they did not have time for exercise. Quick calorie entry feature was not used much because they did not realize its absence. Meal time was one of the least used features because four of them did not realize and one did not use meal time because of not having a regular diet. Three of the users did not realize widget of the app, two of them did not realize water log option, one of the users did not realize that she was able to create an entry and classification of food, one was not aware of reminder for an item and one did not realize food note feature.

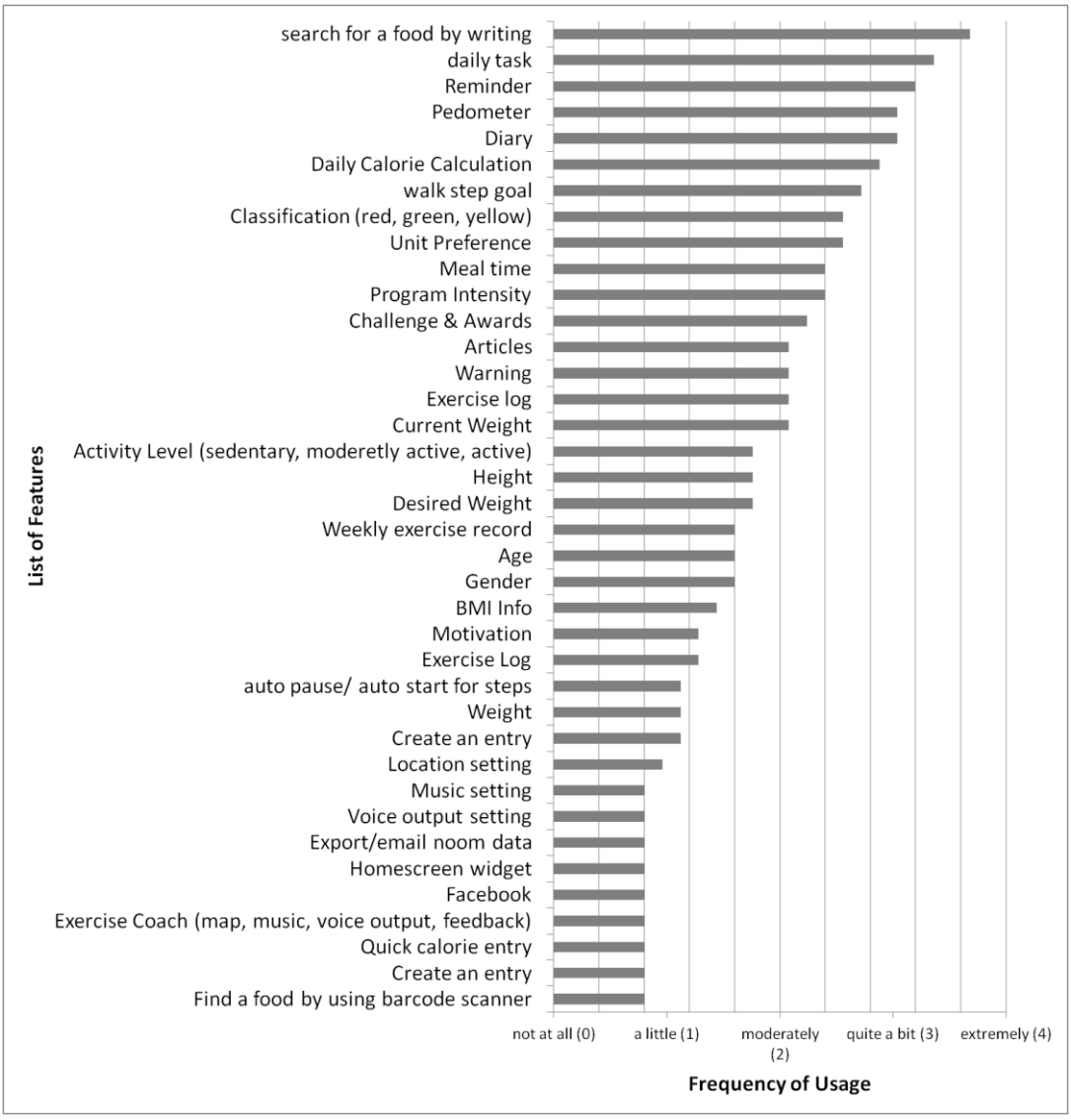
Table 4.17 Usage of MyFitnessPal features by mean value



In Noom Coach daily calorie calculation, search for a food by writing, classification of food, reminders, pedometer, daily task cards were the most used features. One user used these features most because the program made the user to do that. The other one used these ones more than others because they were more in the limelight and four of them took the calorie tasks and food log seriously because they took them as the main feature of the app. However, one of the users thought that the calorie value calculated for the user and the classifications of food were not what they were supposed to be so the user could not take notice of those. None of the users used

barcode scanner, exercise coach, create an exercise and quick calorie entry for exercise, social network and export data. They did not use social network because they were not motivated by this feature. None of them used export data because two of them did not realize and the other did not need to. None of them used exercise coach and related features because they either did not have time for exercise or they did not realize it. One of the users find the exercise coach inadequate and did not use. Four of the users did not use weight chart because two of them did not realize and the others did not used because two of them said their weight did not change so they did not need to log, the other one said the app did not remind the user. One of them did not need for creating an exercise because was able to find what was looked for. One of them did not read articles because they were boring. Four of the users did not realize barcode scanner and three of them were not aware that the app has a widget. One of the users emphasized that the app could encourage its users to use the features that were noticed or used frequently, e.g. by reminder notifications. This way, users would not forget to log certain type of information.

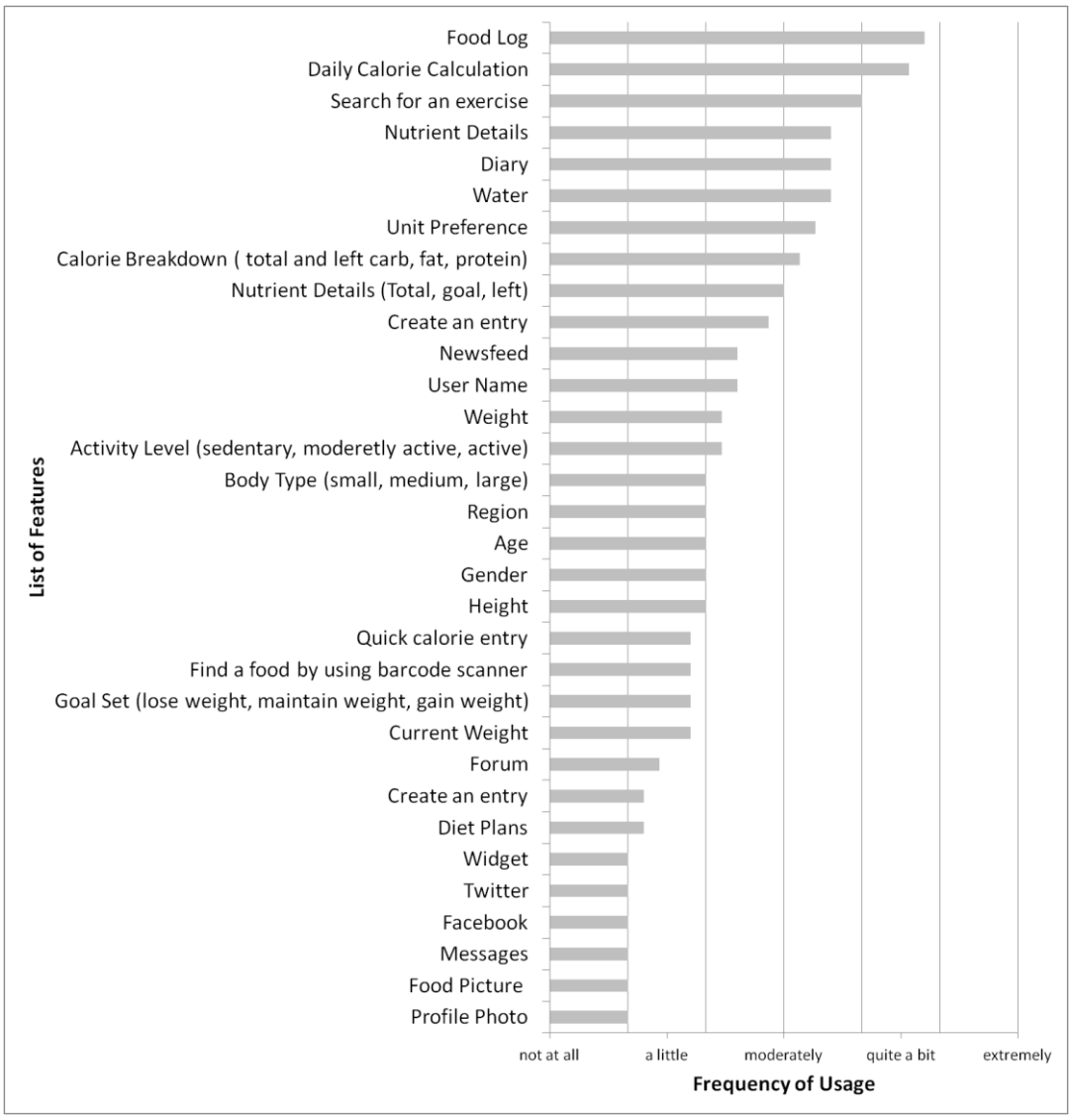
Table 4.18 Usage of Noom Coach features by mean value of 5 users



In Calorie Count, food log, daily calorie calculation and search for an exercise were the most used features because all of them indicated that it was important to track the food and drink and see how much calorie they got and how much they consumed. Profile photo, food picture, social network were the least used features. They did not use profile photo and social network because they did not want to share what they ate or how much they got thin with strangers. None of the users had noticed widget and only one user used barcode scanner because three of them did not notice and one of them was too lazy to use it. Three of the users did not realize that they could take

pictures of their meals through app. The two of the users that were aware of food picture feature indicated that they did not understand what it was for. Two of the users did not realize diet plans and two of them never used because one of them were not used to stuck on a diet list and the other had her diet list already. One of them did not see forum tab on the main menu. Create an entry did not used by two of the users because they stated that they could not know the nutrition information. Four of the users did not used create an entry for exercise log because they found what they were looking for from the provided list. Three of the users did not use weight chart because they did not weigh themselves.

Table 4.19 Usage of Calorie Count features by mean value of 5 users



Q 9.a: Which features did you specifically like? Why?

Users were asked to indicate the most liked features of apps. The users were not expected to select features from a presented list. Answers to this question can be seen in from Tables 4.20 to 4.22. The statements were marked as ‘x’ to indicate which of the participants mentioned that item.

The most liked features of MyFitnessPal were; diary because they liked having records of their actions, nutrient information because they think it was important to

observe that, calorie feedback because the user thought calorie track was important for losing weight, quick selection from previous logs because the user thought it made food log easier as the similar food was eaten every day, interface because the user was able to find what was needed and broad food database because for an app like that it has an unexpected Turkish meal database.

Table 4.20 The most liked features of MyFitnessPal indicated by 5 participants

	MyFitnessPal users				
Participant statements:	P01	P02	P03	P04	P05
diary	x				
nutrient information	x	x			
calorie feedback		x			
quick selection from previous logs			x		
interface, widget				x	x
broad food database					x

P0X: Participant number; x: indicated preference by a participant.

The most liked features in Noom Coach were diary because of being able to track their food and exercise easily, classification of food and nutrient information because they wanted to what they were eating, calorie count because it was the main thing to be aware of, pedometer because of motivational feedbacks and reminder because the user needed to be reminded and the app satisfied the user's needs.

Table 4.21 The most liked features of Noom Coach indicated by 5 participants

	Noom Coach users				
Participant statements:	P06	P07	P08	P09	P10
diary	x				
classification of food	x		x	x	
nutrient information					x
calorie count	x				
pedometer		x	x		
reminder		x			
interface		x			
challenge and awards		x			

P0X: Participant number; x: indicated preference by a participant.

The most liked features in Calorie Count were diary because the app was used as an information provider, nutrient information because it was important to learn what was eaten and how much was eaten, calorie feedback because the caloric value of the food wanted to be controlled and quick selection from previous logs because of eating similar meals.

Table 4.22 The most liked features of Calorie Count indicated by 5 participants

	Calorie Count users				
Participant statements:	P11	P12	P13	P14	P15
diary				x	
nutrient information			x	x	
calorie feedback		x			x
quick selection from previous logs	x				

P0X: Participant number; x: indicated preference by a participant.

Q 9.b: Which features did you specifically dislike? Why?

Users were also asked about the least liked features of apps. Similarly, the users were not expected to select features from a presented list. The statements were marked as 'x' to indicate which of the participants mentioned that item. The features that were not liked by the users were not specific to one app so the least liked features of all the apps are given in the Table 23.

Nine of the users did not like not being able to find the food that they searched for. Six of the users were not content with the different nutrition information for same food. Three of them did not like manual food log because they thought logging food by writing cannot be accurate enough. One of them did not like using the app through internet connection because the app wanted to be used without the internet connection.

Table 4.23 The least liked features of apps indicated by 15 participants

	MyFitnessPal users					**Noom Coach** users					**Calorie Count** users					
Participant statements:	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12	P13	P14	P15	∑ times mentioned:
not being able to find the food		x		x		x	x	x				x	x	x	x	**9**
different nutrient info for		x	x		x		x				x			x		**6**
manual food log										x	x				x	**3**
internet connection	x															**1**

P0X: Participant number; x: indicated preference by a participant.

Q 9.c: What kind of feature would you prefer to add to the application? What kind of technology would you prefer it to have?

The users were asked for recommendations for improving the apps according to their needs. The recommendations from users are listed for each app in Tables from 4.24.

to 4. 26. The users did not select from a list. The statements were marked as ‘x’ to indicate which of the participants mentioned that item.

The users used MyFitnessPal recommended that the app should allow logging food by taking photos of that food for making more accurate food log, have more refined interface because it comprehends too many features, a tutorial presenting the features of app for introducing the app, exercise coach that provide users with music and GPS supported maps for outdoor exercises, a button for sharing food picture, a button for comparing nutrient information of different food for selecting a healthier meal from menu and categorize logged food by time and list food from the most logged to least logged when searching food by writing for easing the selection.

Table 4.24 The recommendations of MyFitnessPal Users

	MyFitnessPal users				
Participant statements:	P01	P02	P03	P04	P05
refine interface	x				
tutorial		x			
exercise coach (gps, music)		x			
share button for food picture				x	
comparison button for food					x
logging food through photos			x	x	
categorizing food by time					x
listing food by the most preferred ones					x

P0X: Participant number; x: indicated preference by a participant.

The users of Noom Coach recommended that the app should allow users logging food by taking photos of that food in order to decrease the time consumed for food log and logging accurately, give comprehensive information about healthy eating in order to inform user for a long time, warn the user about the food eaten late at night because the food eaten day time and night time benefit human body differently, have a tutorial for introducing the app and its features, have visual expressions of unit preferences in order to log the food amount correctly and the app can offer a target weight by considering the BMI information of user.

Table 4.25 The recommendations of Noom Coach Users

	Noom Coach Users				
Participant statements:	P06	P07	P08	P09	P10
featuring comprehensive info about healthy eating					x
feedback by time	x				
tutorial		x			
logging food through photos		x	x	x	
visualisation of unit preference		x			
targeting weight by BMI info		x			

P0X: Participant number; x: indicated preference by a participant.

Calorie Count users also wanted logging food through photos for similar reasons with the users of other apps. They also wanted recommendation for next meal. The app can offer meals according to the users' needs by considering the previous logs and give warning for the food eaten late at night. Moreover, it was recommended that users could list the choices for searched food by popularity for easing the selection and the app could be synchronized with sport apps for logging exercises accurately.

Table 4.26 The recommendations of Calorie Count Users

	Calorie Count Users				
Calorie Count	P11	P12	P13	P14	P15
feedback according to time				X	
logging food through photos	x	x			x
listing food by the most preferred ones				X	
recommendation for next meal		x	x		
synchronization with sport apps				X	

P0X: Participant number; x: indicated preference by a participant.

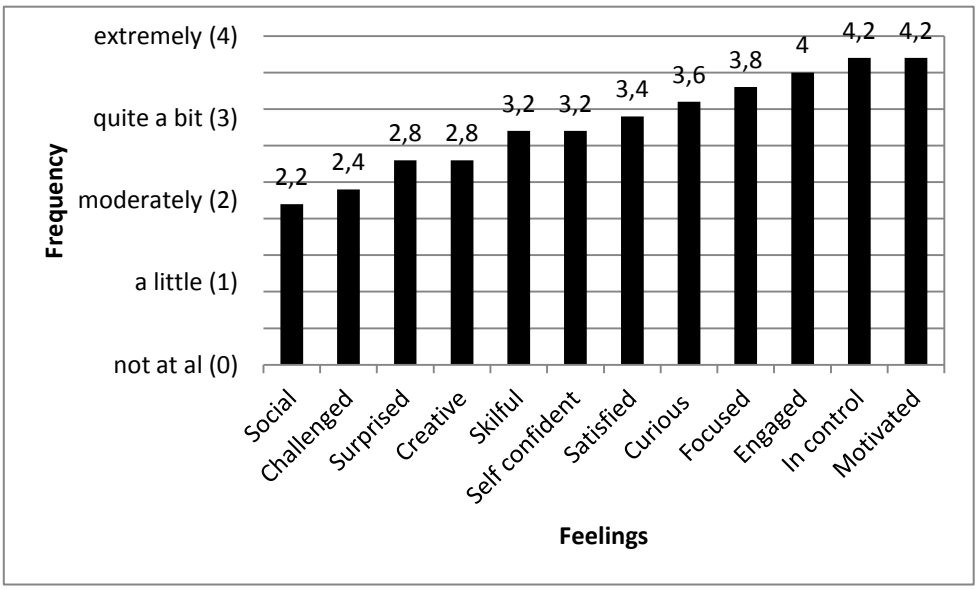
4.4.2.3 Evaluation of the users' feelings and moods and general assessments of apps

In this section participants were provided with two five point Likert Scales. One of them is for indicating the frequency of the feelings and moods during usage and the other one is for general assessments about apps.

Likert scales for frequency of feelings and moods. After each participant marked the frequency of each feelings and moods from the given lists the collected results were put in Microsoft Excel sheets. The answers of all the participants can be seen in Appendix P. The mean values of five users' answers were calculated according to the numbers assigned to adverbs which are shown in brackets in Tables from 4.27 to 4.29.

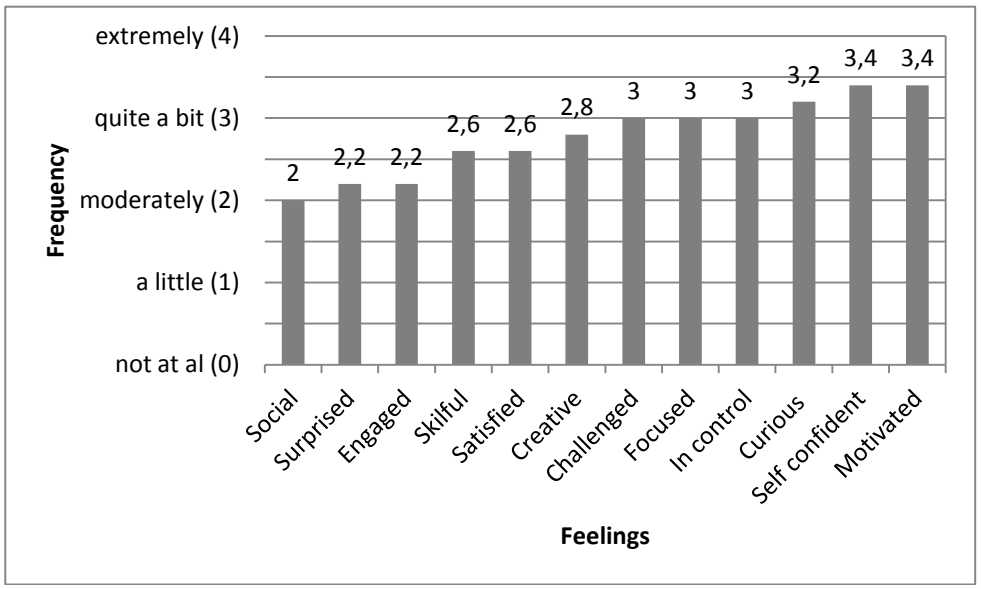
The users of MyFitnessPal felt social in lowest frequency and the users felt motivated and in control in highest frequency. The app could not make the users social, challenged, surprised or creative enough.

Table 4.27 Feeling frequencies of 5 MyFitnessPal users during app usage



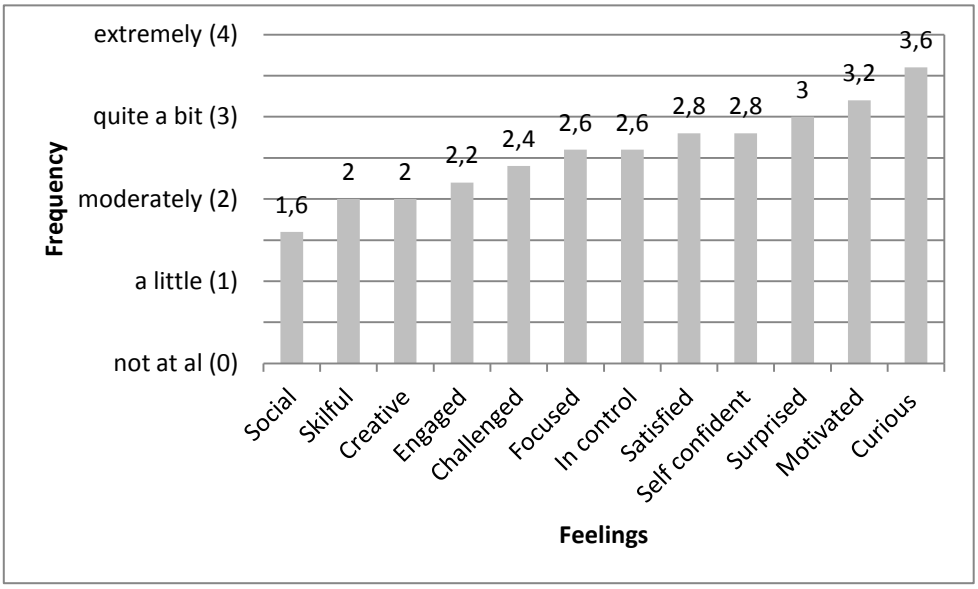
The users of Noom Coach felt social in lowest frequency and the users felt motivated and self confident in highest frequency. The app barely made users feel social, surprised, engaged, skilful, satisfied or creative.

Table 4.28 Feeling frequencies of 5 Noom Coach users during app usage



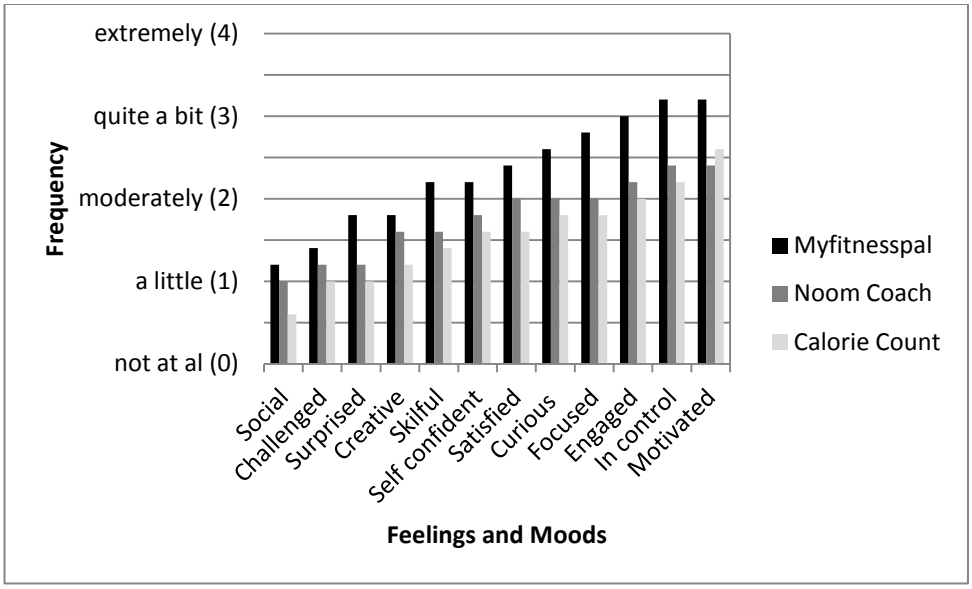
The users of Calorie Count felt social in lowest frequency and the users felt motivated and self confident in highest frequency. The app only made users feel surprised, motivated and curious moderately.

Table 4.29 Feeling frequencies of 5 Calorie Count users during app usage



All the apps fall short in affecting the social, challenged, surprised and creative feelings of participants but they made them motivated and in control more frequently. Nevertheless, it is possible to differentiate MyFitnessPal with higher frequency levels for each feeling. The comparison between apps is illustrated in Table 4.30.

Table 4.30 Feeling and mood frequencies of 15 participants' by app



Likert scales for general assessment of the apps. After the users marked the related frequency of the answers for different questions about general assessment of apps from the given lists the results were put in Microsoft Excel sheets. The answers of all the participants can be seen in Appendix Q. The mean values of each question's frequency were calculated according to the numbers assigned to adverbs which are shown in brackets in Table 4.31.

Most of the MyFitnessPal users (3 out of 5) said that they were often content with the interface elements; most of the Noom Coach users (3 out of 5) said that they were sometimes content with the interface elements and some of the Calorie Count users (2 out of 5) indicated that they were sometimes content with the interface elements and some of them were rarely content with the interface elements.

Most of the MyFitnessPal users (3 out of 5) thought that the app was often easy to use almost all of the Noom Coach users (4 out of 5) thought that it was sometimes easy to use, some of the Calorie Count users (2 out of 5) the app often easy to use and some of them said the app was sometimes easy to use.

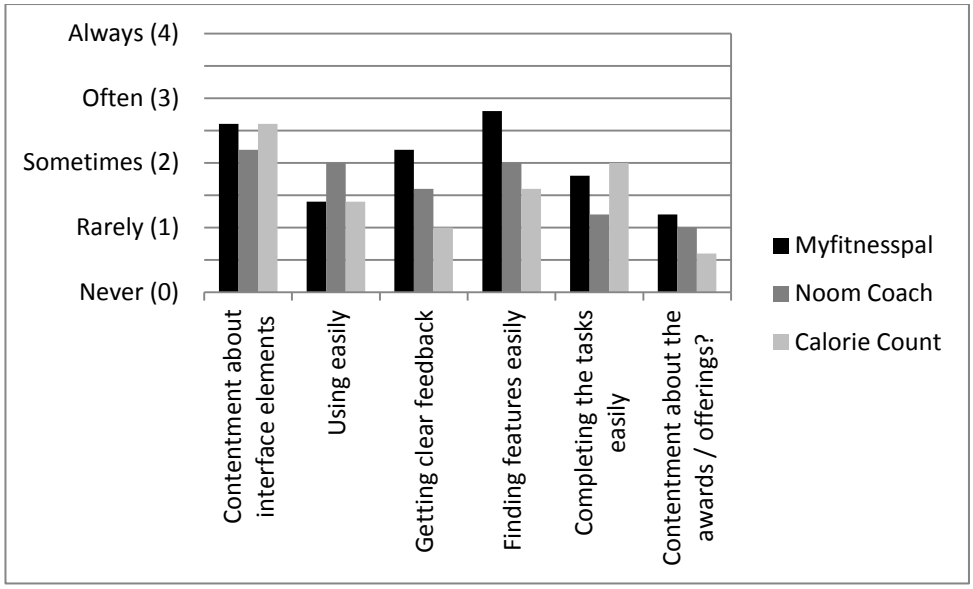
Some of the MyFitnessPal users (2 out of 5) thought that the app often provided them with clear feedback and the others rarely, sometimes and always got clear feedback. Most of the Noom Coach users (3 out of 5) said the app sometimes gave them clear feedback, and almost all of the Calorie Count users (4 out of 5) thought that the app sometimes provided them with feedback.

Most of the MyFitnessPal users and Calorie Count users (3 out of 5) were often able to find the features they want to use. Most of the Noom Coach users (3 out of 5) were rarely able to find the features that they were looking for.

Most of the MyFitnessPal users (3 out of 5) often completed the tasks like not exceeding daily calorie limit easily. Some of the Noom Coach users (2 out of 5) often and some of them sometimes completed the tasks like striking daily task cards out easily. Some of the Calorie Count users (2 out of 5) were rarely able to complete the tasks easily and the others sometimes, often and always completed the tasks like logging food, activity, weight and water easily.

Some of the MyFitnessPal users (2 out of 5) rarely content with the awards and offerings like easing food log with more recording. The others said they were content about them always often and sometimes. Some of the Noom Coach users (2 out of 5) were rarely and some of them were never satisfied with the awards like passing to the next level with points from tasks. Most of the Calorie Count users never satisfied with the offerings and awards like being able to publish the messages in Calorie Count community after collecting a certain amount of likes to the messages about weight control process.

Table 4.31 Assessment of apps according to mean value



4.5 Discussions

4.5.1 Discussions on Phase 1

For weight management life style modification is required (Wadden, Butryn, and Wilson, 2007). For that reason, all the questions in Phase 1 are about learning what users do for changing their life styles in order to manage their weight. According to the first question it was understood that all the users had at least a method for weight control. The majority of the users preferred doing sports and going on a diet. However, as previously explained in Chapter 2, increasing energy consumption by doing sports is one of the complementary elements of weight loss. Moreover, a study showed that diet programs are not effective in losing weight but they only slow down weight gain (Mann et. al., 2007).

On the other hand, body monitoring which is defined as an essential part of weight control (Baker and Kirschenbaum, 1993), was barely indicated by the participants. Additionally, they did not indicate any apps that they made used of for weight control but only a minority of the users tried an app for weight control. However, health coaching programs with which diet apps provide are proved to be effective in

leading people toward healthier life styles and preventing chronic conditions like obesity (Gatti, Brivio, and Galimberti, 2013).

While applying these methods a significant amount of participants generally set themselves long reaching or nonspecific aims like ‘losing weight in general’. Previously in Chapter 2 the importance of goal setting in weight loss and wellbeing was covered. For that reason, the users should be motivated for specific aims for their wellbeing.

Despite the fact that frequent weight tracking as a part of body monitoring positively affects weight loss (Hwang, Ning , Trickey, and Sciamanna, 2013) because of the reasons like lack of equipment (‘I did not have a working scale’), lack of interest or lack of motivation (‘ I did not need numeric values’) most of them do not weigh themselves. Hence, either the excuses should be eliminated or the users should be directed for more frequent weighing for successful weight control.

A majority of the users pay attention to nutrient information and read about the methods, suggestions and facts about weight control or healthy eating. As mentioned in dietary change (see Chapter 2), nutrition education and knowledge about weight control are important parts of starting and maintaining dietary interventions. Thus, that keeping the participants’ interest on methods, suggestions and facts about weight control and healthy eating alive is essential for weight control.

Within the process they prefer to be accompanied. Social support is one of the most important elements of dietary changes and wellbeing. Facilitating social support for participants will help people control their weight.

In conclusion, according to the results of the first phase of the study the participants need motivation for setting themselves specific goals and monitor their weight, food intake and exercises. In consideration to dietary intervention programs (McCann and Bovbjerg, 1998), they should be educated about nutrition, set themselves goals, monitor themselves and take social supports during usage of the apps.

4.5.2 Discussions on Phase 3

PANAS. In this study it was important to measure the effects of diet control apps on people's overall wellbeing. Nevertheless, besides having a healthy diet and being physically active, other factors like work, personal studies or individual relationships have a huge effect on people's wellbeing. For that reason, it became very challenging to measure only the diet apps PA and NA of on people. Yet, through this study it can still be claimed that the apps had higher for positive affect and lower for negative affect slightly. As this small change is not regarded as statistically significant, PANAS did not present an understanding about the effect of three diet apps on people's wellbeing. In addition to PANAS, the scale for emotions prepared based on the features of *'Optimal Experience'* which is presented as a way to wellbeing, was used for better understanding the apps' effects on participants.

Weight Control Preferences. According to the comparative questions about weight control preferences, there were some changes in users' aims, body monitoring preferences, interest in nutrition information, interest in methods, suggestions and facts and interest in social support.

- ***Changes in users' aims***

It is understood that the participants' aims have evolved from ambiguous ones into more specific and short dated ones. For example, daily calorie intake calculated for each user seems to be a determinant factor. All of MyFitnessPal users aimed at daily or weekly goals and for most of the Noom Coach users proceeded with daily goals. On the other hand, Calorie Count was not motivating enough for persuading the participants for focusing on a strict aim. Although, all the apps calculate a personal calorie intake for each user, daily calorie calculation of Calorie Count could not be as effective as the other apps. By considering that they have very similar interfaces for calorie display, the reason might be lack of motivation. As mentioned before (Chapter 2) positive feedback is very important for the people who try to change their dietary habits. In MyFitnessPal the users were motivated with quotes like "well done" for healthy and low-calorie food and in Noom Coach users get points as they log their meals and colored feedback for healthy and low-calorie food. However, Calorie Count did not provide participants such feedbacks. Some users indicated

their lifestyles as their excuses for not sticking to their aims but the app could have motivated them for not pushing healthy eating and exercise into the background by providing them with positive feedback to help them reaching their aim. In other words, the diet apps should support their users with positive feedback in order to motivate them in their aims even in their busy times.

- ***Changes in body monitoring preferences***

In comparison to before usage the frequency of monitoring weight was slightly higher but the frequency of measuring body have not changed as they found it unnecessary or difficult. Here, the apps should have explained the importance of weight and body size monitoring for their aims and wellbeing. Despite the fact that all the apps used illustrating charts for tracking their weight easily, most of the users did not make use of them. It might be because of necessitating another tool for measuring. Logging will be an extra effort for the users. The apps could have a presentation for showing the ease of logging weight to the users and motivate them to log. Additionally, the apps can be synchronized with the measurement tools or the devices can be equipped with sensors so that the apps can make measuring and logging at the same time possible.

- ***Changes in the interest in nutrition information***

Nutrition information is very important for weight control, as explained in Chapter 2 reducing daily calorie intake is the primary requirement of weight loss. In order to control the daily calorie intake the users should know about the nutrition information of food and act accordingly. All the three apps provided users with nutritional details of food. Although most of the users stated their interest in nutrition information of foods in the first phase, some of them did not pay attention neither to calorie value nor to nutrition information of food when provided by the apps. In MyFitnessPal the number of users that paid attention to calorie value and nutrition information was higher compared to the other apps' users. The reason might be the broad database of it because it made logging what they ate more accurate so they found the values more trustworthy. Besides, some participants thought that this information was presented in a complicated way so one of Csíkszentmihályi's (1990) features of *optimal experience*, unambiguous feedback, cannot be met by these apps. Moreover, all the

apps presented some classifications for food. In Noom Coach, users were able to see that as a colour coded bar chart and even if they did not paid attention to quantified values they became aware of the types of food they ate. It was a basic representation of their all day. On the other hand, in MyFitnessPal, classification was in the back stage and most of the participants did not realize and in Calorie Count, users stated that sometimes the app classified the same food differently so they could not rely on them. Besides, after the '*testing or learning period'*, in users' terms, is over, users should continue paying attention to the nutrition information of food. Therefore, in order to keep users' attention, as some of the users suggested, the apps can provide the users with more accurate, basic and explanatory information or the apps can broad their food database for assuring users the trustworthiness of information and make them use the apps.

- ***Changes in the interest is methods, suggestions and facts***

Although the majority of the users indicated that they were interested in methods, suggestions and facts in Phase 1, the information given by the apps did not taken into consideration by most of the users because some of the users complained about the time limitation and lack of quality. However, if the apps met the Pace's criteria for optimal experience especially exploiting curiosity and being conscious of time urgency and enhancing discovery with surprise, the participants would have been interested more and would have not complained about time management. Therefore, these apps should be well equipped enough to teach their users and presented in a more interesting way.

- ***Changes in the interest in social support***

Social connection is one of the most important methods for weight losing. Moreover, social level is one of three levels which technology should support for wellbeing. However, the apps could not support the participants socially mostly because the users said they did not want to share their information with their Facebook friends or strangers. Even Calorie Count which has social networks as its prominent feature could not persuade its users because of its complicated interface and lack of feedback. Despite all the apps let users set their privacy options for sharing data, none of them succeeded explaining. The privacy settings are hidden under the

general settings for the apps and users generally do not aware of them. An example of privacy settings from MyFitnessPal can be seen in Figure 4.1. The apps can reassure the users in privacy and make them more socially connected for supporting their weight loss and wellbeing. This can be achieved by introductory videos for the social connection features of the apps.

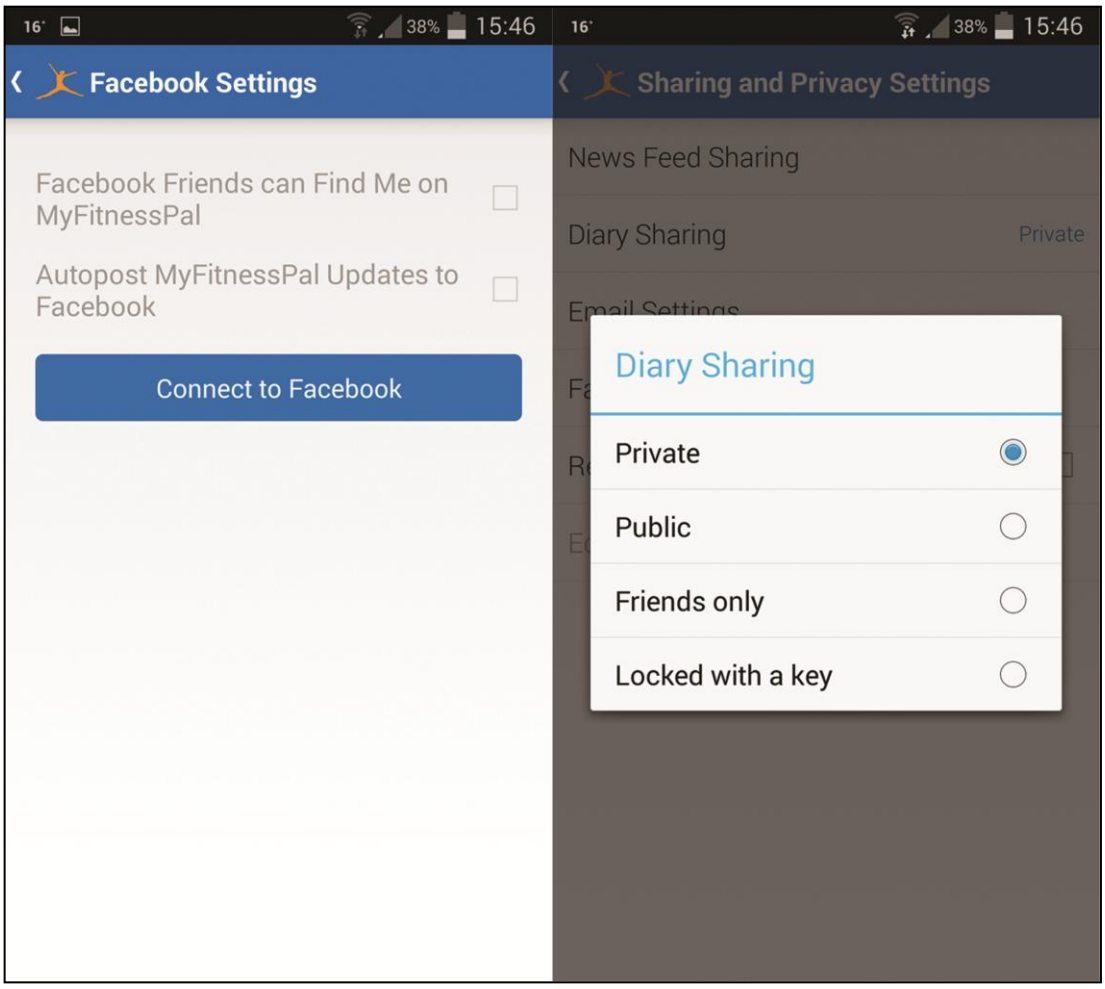


Figure 4.1 Privacy settings in MyFitnessPal

General Evaluation of Apps. According to the users' general evaluation of the apps the discussions on frequency of app usage, thoughts on goal achieving, intention in continue using, assessment of features and recommendations are presented.

- ***Frequency of app usage***

As mentioned in Self-Monitoring (in Section 2.2.2.4), the most effective way for weight loss is proved to be recording all the food eaten in 15 minutes and recording before eating can change food choices. However, none of the users used the apps before eating. The reason might be the fact that, the apps did not offer comparative nutrition information between foods. Therefore, the users might have thought that even if they have used the apps, it would not have changed their choices. Additionally, most of the users did not use the apps after the meals but, if they had logged their food after each meal, the app might have been more effective in controlling their diet. According to the users, logging food takes too much time because they could not find the food they ate easily and it was the main reason for not logging food after each meal. Moreover, they got bored after some time. Recording food is performed in similar ways in each app. The barcode scanners were rarely preferred because they thought it would not ease the process and most of them did not realize by most of them. In Calorie Count the feature for sharing the food photos was never used. The apps should ease the process for making the users more engaged. As expected, most of the recommendations for features from participants were related to making food logging easier, more interesting and less time consuming.

- ***Thoughts on goal achieving***

In spite of the fact that all the other users thought the apps had an effect on them, they all had some difficulties during usage which decreases their benefit. Their difficulties were mostly about food log which was seen as primary feature. That is why the rate of contribution in MyFitnessPal which has the broadest food database was higher than the other apps. When they could not get full profit from food log experience they diverged to secondary features about food log like classification of food. However, it was not enough to satisfy them. Therefore, food database and information about foods should be developed.

- ***Intention in continue using***

MyFitnessPal have persuaded users for using a diet tracking app in the future because they believed in the advantage of the app. However, the users of Noom Coach and Calorie Count did not think the same way because they thought the app was not adequate enough for their needs. The reason of Noom Coach and Calorie Count users' lack of contentment might be not using the prominent features of them. Noom Coach users indicated that they either did not have time for exercise or did not realize the features and they had trouble in food log and Calorie Count users did not used social network at all. The apps could not motivate the participants enough for making use of their strong features. Besides, food log was seen as a primary task by users. In consideration with the importance of adherence in dietary change programs it can be said that food database and emphasizing different features is important for engaging users.

- ***Assessment of features***

The most used features were common in three of the apps and they were about food log. Most of the users thought of food log as a main task and tried to used related features. However, as explained briefly in Chapter 2, successful weight control requires to fulfil many elements. Food monitoring is one of the most important ones but there are nutrition education, goal setting, ongoing program contact and social support. For this reason the supportive features of the apps should be used by the users. Tips by MyFitnessPal, articles by Noom Coach and users' suggestions about weight control by Calorie Count should have used more for nutrition education. Furthermore, reminders of the apps for goal setting, different tasks and challenges for ongoing program contact and social network connections of the apps for social support should have been used by the users. As some of the participants indicated the apps could have made the users use those features.

As expected the most liked features were the most used features generally. They were the ones that were about food log or that made food log easier like quick selection and widget. Therefore, in order to be more engaged with the apps, the users made use of other features. The least liked features were the ones that made food log

difficult and time consuming. For that reason the participants, recommend innovations for making their least liked features easier.

- ***Recommendations***

The participants were mostly aware that they should have paid attention to their diet and exercise in order to lose weight or to be healthier. Hence, all the recommendations were about refining these. The participants took food log as a main task in these apps and wanted to log their food intake as accurate and easy as possible. For that reason, they recommended additional features for making the food log more precise and less time consuming. Therefore, most of the participants recommended logging food through taking photos or they wanted the existing features be developed with improved unit preference for making food log more accurate. The other recommendation was about specialized feedbacks for warnings about late snacks or suggestions for next meal according to deficiencies. It is also very important because, personalized feedback may be more effective than analysis of nutritional information for changing eating behaviour (Rothman, Sheeran, and Wood, 2009; Helsel, Jakicic, and Otto, 2007; Klasnja and Pratt, 2007). Most of the recommendations are already in practice or can be put into practice with the existing technology. For logging food through photos, studies continue and MyFitnessPal will offer its users new ways of food log (Chapter 2).

Feelings and Moods within Optimal Experience. While the participants were using the apps optimal experiences were expected to occur. Therefore, the contribution of apps to their wellbeing would be observed better. Each feeling was expected to be felt at least moderately but the participants almost never felt social, challenged, surprised and creative. None of the users used social network of the apps so the frequency of feeling social were close in each app and very low. The tasks were repetitive in each app and some of the users emphasized they got bored so the reason of low frequency of felling challenged, surprised and creative might be that. MyFitnessPal users felt the given feeling more then the other apps' users. It might be because of the highly mentioned broad database of MyFitnessPal. All the participants mentioned about some problems with the apps during usage and as the users took food log as the main task the difficulties faced during food log might lower the

positive feelings and moods of the users. Nearly all the frequencies of given feelings and moods in Calorie Count were less than others. In consideration with the general assessments of the apps, the reason might be unclear interface, difficulties in using and difficulties in finding the app features. Therefore, as Calorie Count users indicated they did not like the app or found the app inadequate. Nearly all the users felt engaged, in control and motivated moderately.

General Assessment of the Apps. Almost all the participants occasionally were content with the interface elements of the apps. This might made the users in control. Again, nearly all the participants rarely were content about the awards or offerings. In other words, they were not satisfied with the MyFitnessPal's motivational quotes showed up when a healthy food logged or exercise completed, Noom Coach's points when tasks are completed and Calorie Count's likes from friends to the posts about progress in weight goals. In consideration of the app assessment, it can be said that all the users have difficulties about the general characteristics of the apps every time they interact with the app. However, as the apps offer most of the features for helping the users losing weight and enhancing their wellbeing, the presentation of the features should be reconsidered.

The technologies provide the developers with endless opportunities. Therefore, the design of the interaction of the apps gains importance here. The features of the apps should be presented to the users more simple and clear so that the enhancement of wellbeing through these apps can be secured.

CHAPTER 5

CONCLUSIONS

This study aimed at presenting suggestions to improve diet apps designed for enhancing wellbeing by understanding the effects of apps features and characteristics on users' thoughts, moods and emotions.

With this aim in mind, first, literature reviews on wellbeing and positive technologies were presented to better understand the concept of wellbeing and the ways for enhancing it (see Chapter 2). This helped identifying the elements that flourish personal experience for ensuring hedonic and eudaimonic wellbeing. Moreover, the health problems that reached an alarming rate in the world were emphasized and the technologies for supporting people in their health care were presented. The importance of diet in health was explained and the ways for controlling weight were examined. These helped to identify the necessities for diet apps which help users control their weight.

Secondly, a three-phase fieldwork (Chapter 3) was designed to see the strengths and weaknesses of the diet apps which combine the elements that enhance personal experience and help in controlling weight. The fieldwork laid out the strong and weak features of diet control apps and their effects on people's thoughts and feelings. Consequently, by combining the literature review and fieldwork, suggestions for developing diet apps were presented (Chapter 4).

This chapter covers the answers of the questions asked in Chapter 1 along with limitations of the study, it ends with the suggestions and opportunities for further research.

5.1 Revisiting the Research Questions

The answer to the main research question – *How can diet apps be enhanced in order to positively influence wellbeing?* – was sought through supportive questions, which are as follows.

Q 1: What is wellbeing and how can it be enhanced?

The answer to this question was reached through the combination of literature review on wellbeing and positive technologies. In this study, in the long term it is expected that wellbeing of people will be enhanced because people will become conscious about their eating preferences, learn about their mistakes, correct them and act accordingly in the future with the help of technologies. In other words, behaviour change is expected in the long run. However, the time period of this study is not enough for observing behaviour change. Therefore, the principles of positive technologies are used because despite they are mentioned separately in the literature their aims are similar.

Wellbeing is a wide concept that can be best explained by hedonic and eudaimonic approaches. Self Determination Theory embraces these two approaches by explaining wellbeing with both pleasure attainment and fully functioning. Besides, these aspects can be enhanced by the new technologies. The technologies can enhance wellbeing with *core affect, transformation of flow and networked flow*.

As explained in Chapter 2 quality of an experience can be enhanced through the changes in core affect which initiate positive moods with the help of objects or according to the stimuli that affect the states of people. In this study, diet apps were used for assisting initiation of positive moods. For enhancing flow or optimal experience, "balance between challenges and skills, deep concentration, clear rules and unambiguous feedback from the task at hand, loss of reflective self-consciousness, control of one's actions and environment, alteration of temporal experience, and intrinsic motivation" (Riva et al., 2011 p.4) should be ensured.

Therefore, to ensure these, the apps are expected to offer challenges according to users' skills (e.g. daily calorie calculation according to users' ability of frequent

exercise), get the attention of the users and make them control their diet despite difficulties (e.g. busy schedule) through motivating feedback and clear interfaces

Q 2: What are the effects of diet control apps on people's moods and emotions?

Experiences are hard to measure but crucial for the evaluation of design interventions (Thieme, Balaam, Wallace, Coyle and Lindley, 2012). Current methods available for measuring wellbeing mostly use subjective rating scales (McNaney et al., 2012). Therefore, in order to answer this question, various wellbeing measuring methods were reviewed and Positive and Negative Affect Scale (PANAS) (Watson, Clark, and Tellegen, 1988) was decided to be used in this study. Mainly because, the scale has been frequently used in other researches and it aims to identify the changes in the moods and emotions over a short period of time (e.g. as short as a week).

As explained in Chapter 3, PANAS is a brief measure of mood states which uses ten positive and ten negative words gathered under the general term affect and they are called positive affect (PA) and negative affect (NA). The affects were rated by 15 participants with the help of five point Likert scale by considering their experiences for the previous week before and after the usage of the selected diet control apps. In order to see the common differences in the ratings of the PA and NA the mean values are calculated for each word and the results of before and after PA and NA were analyzed using Student's T-Test.

According to the results and analysis, as presented in Chapter 4, following conclusions were reached.

- The app usage slightly raised the mean values that were calculated according to the scores given by the participants for positive affects which consist of *interested, excited, strong, enthusiastic, proud, alert, inspired, determined, attentive and active.*
- The app usage slightly raised the mean values that were calculated according to the scores given by the participants for negative affects which consist of distressed, upset, guilty, scared, hostile, irritable, ashamed, nervous, jittery and afraid.

- Despite the differences in the mean values, according to the results of the T-Test, affects were not statistically significant but a study conducted with more participants can more clearly show the statistical differences between users' before and after PA and NA.
- This study gave indications that the apps may affect the users' overall wellbeing positively. For that reason, these apps may be successful for initiating core affect (see Chapter 2) and if they are developed in a way that eliminates the problems defined in the fieldwork, such as terminating or at least minimising food log problems and designed with the aim of enhancing wellbeing, such as promoting features that make people in control and motivated (see Chapter 4) i.e. by providing more clear feedback, the positive effects of the apps can be observed more clearly.

Q 3: How do diet control apps change the weight control preferences of people?

To find answers to this question, initially the ways that people control their weight were compiled from literature. During the fieldwork, the findings then were complemented with the participants' answers to the interview questions (Phase 1 and Phase 3), which were prepared according to the key elements gathered from literature to succeed in weight loss and to prevent regain. Weight gain prevention strategies included *nutrition education, goal setting, self-monitoring, ongoing program contact and social support*.

As presented in Appendices C and D, setting goals, measuring body size and weight, following nutritional information, adherence and social support related questions were asked to the participants, and the apps were expected to change the participants' preferences in a positive way. According to the comparative analysis presented in Chapter 4, findings can be summarized as follows and the summary comparison of the changes in the participants weight control preferences 'before' and 'after' apps usage can be seen in Figure 5.1.

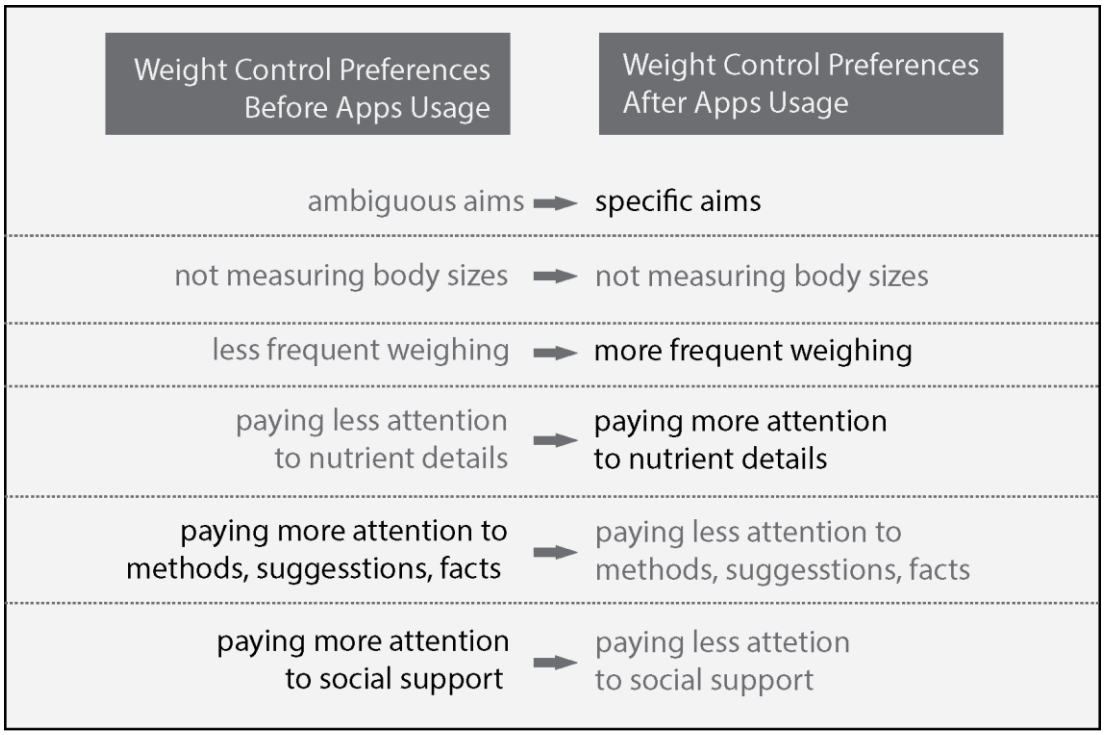


Figure 5.1 Changes in the participants' weight control preferences 'before' and 'after' apps usage

- In general, the apps made the participants set more specific aims for weight control. However, some of the apps affected the aims more than the others. For example some of the apps asked *desired weight* in the long term, set daily goals for the users and give positive feedbacks for the choices that support that aim. Thus, if the apps present opportunities to users for setting an aim and motivate them in adherence to that aim they can be more helpful for weight control.
- The apps did not change the frequency of measuring body sizes of participants since the participants were not reminded (by the apps) to track their body sizes or they found it difficult to make measurements and then log these measurements. In other words, the provided charts to ease the tracking of body sizes were not affective enough to change the choices for measuring body sizes of the participants.
- During the usage period of the apps, some of the participants weighed themselves more frequently whereas some weighed themselves less

frequently compared to their 'before usage' preferences. As a general observation, it can be said that the app usage increased the participants' weight measurement frequency. It should be noted that none of the participants were using smart scales and did not synchronize the apps with those. Therefore, with the expansion in usage of assistive devices to the diet apps like smart scales, the diet apps can be more helpful in motivating users for tracking their body sizes.

- Tracking nutrition information was found to be one of the most important elements of successful weight loss, and the apps made most of the users pay attention to this aspect by providing them with informative illustrations about nutrient details and calorie count on the app's main screen. As monitoring food intake is one of the most basic requirements of weight loss, it is advisable that diet control apps present nutritional details of foods to its users. However, in order to keep users' attention, information presented should be easy to understand.
- The apps made the participants less interested in the methods, suggestions and facts about weight control as provided by the apps, since most of them found the provided information not qualified enough or asserted that they did not have the time to look at them. However, it should be taken into consideration that this study was conducted with the three apps selected among thousands. Therefore, the results of the studies that use other apps (i.e. My Diet Coach which have suggestions as its prominent features) could have affected users' interests in the methods, suggestions and facts about weight control in a positive way. Moreover, existing apps can provide more appealing methods, suggestions and facts.
- The least effective side of the diet apps was found to be their social aspects. None of the participants used the social network connections provided by the apps. Therefore, the users could not benefit from the positive effects of social support explained in Chapter 2. It should be noted that the participants only used the apps for a week. In much longer studies, where the participants got more used to other features of the apps, this could have been a more popular option. Also, 'social connection' is expected to be used more by the

participants, where they would like to share their success stories (e.g. achieve the weight level that they targeted, etc.) with their friends and family.

Q 4: What are the strengths and weaknesses of current diet apps and how can they be further developed for enhancing users' wellbeing?

The answers to this question were compiled from the participants of the fieldwork, Phase 3. In order to understand their strengths and weaknesses, and make suggestions for further improving the diet apps to enhance people's wellbeing, following were gathered: frequency of the app usage, and their intention to continue using them, usage frequency of the apps' features, the most and least liked features of the apps, and recommendations of users. According to the answers and analysis presented in Chapter 4, findings can be summarized as follows.

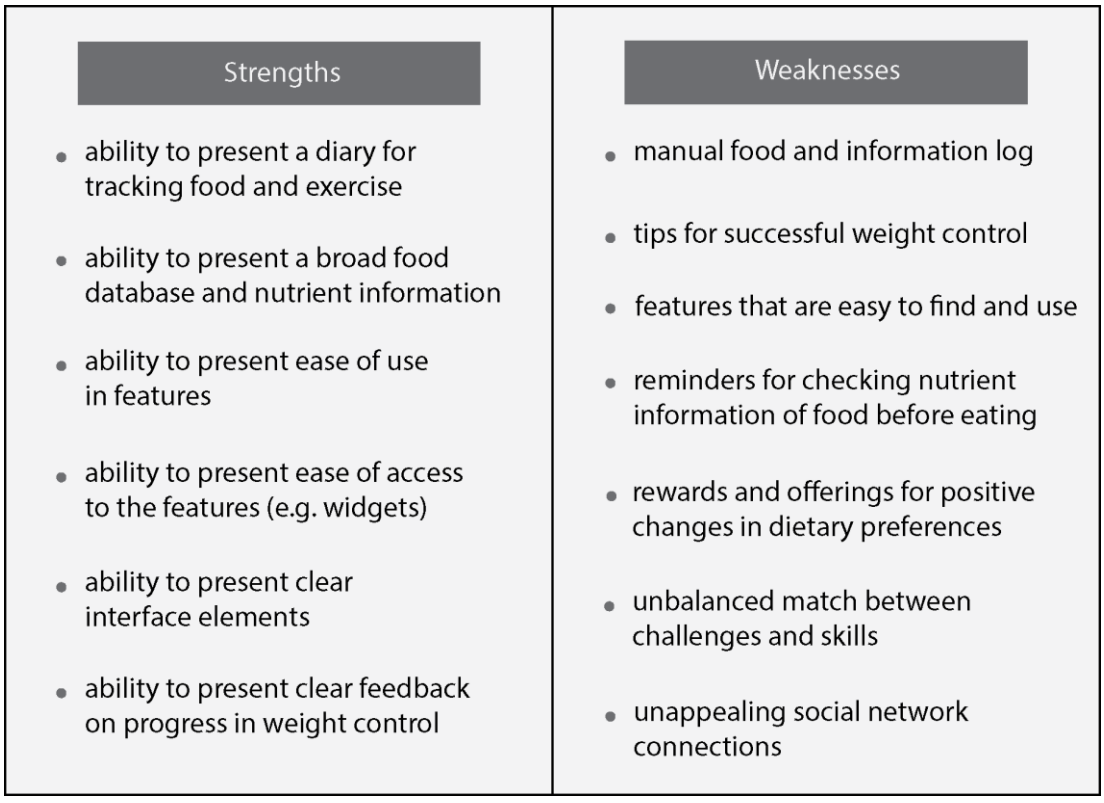


Figure 5.2 Strengths and weaknesses of diet control apps

- All of the participants used the apps everyday during one week. As mentioned in Chapter 2, recording food right after meal is important for successful weight loss and checking food information before eating has also positive effects on weight control. However, none of the participants used the apps before eating food. For this reason, the apps could not use the potential they have for making users check the nutrition information before eating. The inefficient reminders that some of the apps already have and the ineligible tips for explaining the importance of food log or rewards for that task can be considered as some of the weak features of the apps.
- As explained in Chapter 2, adherence in diet control programs is another important aspect in controlling weight. By considering that, the users of one of the app were more willing to continue using it as the app had some priorities over the others. The prominent and distinctive feature of that app was its very broad food database, where the participants could easily find the food they wanted to log rather than trying to find the closest food content. Therefore, offering a broad food database can be listed as a strong aspect for the apps.
- Being able to track the foods eaten can be listed as the strongest feature of the apps by looking at the high usage frequencies and the most liked features. Besides, in each app, easy-to-use features were also the ones that were the most liked and the most frequently used. For example, pedometer in Noom Coach gives feedback from the main screen of the phone throughout the day, so it was used frequently by the participants and became one of the most liked features. Therefore, it can be said that the ability to encourage users for using or discovering the app's features or to provide clear feedback and ease of use can be counted within the strongest features of the apps.
- Despite the high usage rates of 'food log', it is one of the weakest features of the apps because of the problems experienced during logging like not being able to find the food that is searched for from the provided list or to choose the right food from the ones that have the same name but different nutritional values. The apps offer users to create their meal for avoiding these problems but users may not be informed enough to log the nutritional details of their food. Therefore, the apps give tasks that are beyond users' capabilities and it

causes imbalance between the challenges and skills which lower people's wellbeing. As the least liked features were mostly about food log, recommendations of participants were generally for easing food log or making it more accurate. It indicates that, enhancements in food log may lead to increases in usage of diet control apps as they will be liked more. Social network connection can be listed as another weak feature of the apps because of the lowest usage rates in different apps. Because of varying reasons like security considerations and unappealing characteristics of the social network connections, the users did not use them at all. Social networks could have been a good tool for sharing experiences, motivating them and gaining knowledge about weight control if they had been used by the participants.

- According to the answers given by the participants, the most frequently used features and the most liked features vary from the app to the app, however in all it was common that the most liked features were the most used ones, i.e. the ones about food log. Tracking food is important, but it is not the only requirement for a successful weight loss. Thus, the other features that support weight control better (e.g. weight charts for tracking weight or social connections for social support) should also be used. For that reason, the importance of these features should be explained better by the app, be accessed easily and be used easily.
- Most of the suggestions made by the participants on app features were about improvement of food log. As the apps use crowdsourcing method for broadening the food database, some problems occur such as too many options for one food or different nutritional details for the same food. These problems lower the trustworthiness of the apps and consequently tracking what is eaten by the participants. Therefore, as explained in Chapter 2, the apps can make use of the recent developments in technology and make food log easier and more accurate by enabling food log, for example, by integrating food photos.

Q 5: What is the effect of the diet apps on the aspects of optimal experience?

In order to answer this question, feelings and moods within optimal experience and general characteristics of an optimal experience were excerpted from the literature,

as presented in Chapter 2, and the participants' assessments from the fieldwork from Chapter 3, were gathered.

- Among the feelings and moods that were listed, the frequency of social feelings was very low. However, as explained in Chapter 2 social relationships and networks not only improve but also preserve people's wellbeing. Besides, together with low frequency of social feelings, the participants that could not feel or be in the mood of challenged, surprised, creative enough could not reach the optimal experience. The reason of unused features and low intention to continue using the apps might be these feelings and moods that were not experienced enough. In order to make diet apps to better support wellbeing, they need to encourage users to be more social, challenged, surprised and creative. Encouraging users for using social network connections of apps or providing them with supportive social environment may higher the frequency of these feelings, because a group task can challenge the users, surprise them and encourage them to be more creative.
- According to the higher frequencies of engagement, in control and motivated moods and feelings, the apps made the users involved in the apps, take control over their weight and motivate them. The reason might be the feedback about food and exercise log that were used frequently by the participants.
- According to the general assessment of the apps by participants, it can be said that one of the optimal experience aspects, *autotelic experience*, could not formed by those experiences, because most of the participants were not content with the awards and offerings. Moreover, the importance of the rewards for positive actions of the people that try to control their weight was explained in Chapter 2. However, the low frequency of contentment about rewards (e.g. moving on to the next level) and offerings (e.g. giving chance to the users for sharing their success stories in the web site of the app) lower the possibility to reach optimal experience and consequently affect overall wellbeing of people negatively. For this reason, in order to secure long term

success, the apps should motivate people with more appealing awards. It could be reached through increasing the social network engagement.

- The participants had some difficulties about understanding interface elements, usage, feedback, finding features and completing the tasks. It is probably because related features of the apps are included in the system just because to be involved. For that reason, the apps have so many features for ensuring successful weight loss but the users cannot find them to use. Therefore, they become useless. In consideration with the aim of design for wellbeing, these characteristics of the apps can be designed for pursuing users' wellbeing. For example, the apps can provide clear interfaces that make the features easy to find and use for making users feel more in control.

However, for supporting wellbeing the apps should be designed for inducing excellence rather than eliminating deficiencies as explained in Chapter 1. The higher frequencies about contentment by the users about interface elements, usage, feedback, finding features easily and completing tasks easily may result in reaching optimal experience and enhance users' wellbeing.

To conclude, smart phones have become inseparable parts of daily life with the developing technology. They pave the way for the apps that are developed as a part of Positive technologies which become popular because of their usage in controlling increased chronic diseases by easing self monitoring. Diet control apps have become prominent among these apps that aim enhancing wellbeing because of the alarming rates of obesity, increased attention for adopting healthier lifestyles or taking good care of oneself.

As explained in Chapter 2 Positive technologies can enhance wellbeing in hedonic, eudaimonic and social and interpersonal levels. As the diet control app usage creates changes in users' moods and emotions in a positive way (core affect) and possesses the features that can lead to engaging and self-actualizing experiences (flow), they are perfect Positive Technology examples that can enhance wellbeing in three levels at the same time. Although current diet control apps have some deficiencies, they have the potential to be developed for human wellbeing. Therefore, with the

implementation of the suggestions that are given above, diet control apps will not only decrease the risk of obesity but also make people healthier and happier.

5.2 Limitations and Suggestions for Future Studies

During the study there were some limitations that should be taken into consideration in further researches.

When working with student participants their study timetable should be taken into account. Due to time limitations of the study, Phase 2 of the fieldwork coincided with the participants' relatively busy period. If it was possible to arrange their time to use the apps in a more relaxed time period, the study would have presented less time restrictions. However, the results were still fruitful in terms of getting their feedback because the apps were expected to assure adherence of the users despite restrictions. Thus, a study that considers the users' schedules can provide feedback about the app usage in case of optimum circumstances.

This study presents the results of Positive and Negative Affect Scale with a small group of participants. For that reason, it provides an insight about the changes in the moods and emotions of the users with the diet apps. A study conducted with greater number of participants may provide more significant results for reflecting the changes in moods and emotions of the users for 'before' and 'after' usage periods.

This study made use of different diet apps and was conducted with the participants who had different smart phones functioning in different operation platforms (e.g. IOS, Android). During the study, some of the apps were updated in some platforms and were not updated in the others. Thus, it was challenging to distribute the participants to the apps in consideration with the platform that their smart phone uses. For that reason, the match-ups between participants and apps were re-arranged after the study had started and ensured the balance in the number of the participants for each app. As the software updates could not be predicted before, it would be easier to work with participants who have smart phones running on the same platform or run the study simultaneously with the same start and end dates with all of them.

In this study the effects of the features of diet apps were explored according to the participants' usage and comments. The users were expected to explore the features by themselves. Thus, this study presents which features are not noticed because of the interfaces of the apps along with the effects of the features. However, some of the features were not used by the participants' at all – such as, social networks connections, because of their security considerations. For that reason, studies which present the features up front and pave the way for usage can be conducted to see the effects of particular features on wellbeing during weight control.

Moreover, this study was conducted by the participants that were willing to lose weight or interested in weight control, but in the literature the different consequences were observed with the people with different aims in different time periods. Therefore, studies with participants with specific characteristics (e.g. participants that have same motivations e.g. losing same amount of weight in the same time period) could be helpful for enlightening the way of future diet apps.

Lastly, in this study some suggestions for developing diet apps were listed. A follow up study which implements the suggestions to apps could be conducted for better understanding the consequences.

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APPENDIX A

COMPREHENSIVE LIST OF APPS FEATURES

Table A.1 Comprehensive list of apps features

		Features	MyFitnessPal	Noom Coach	Calorie Count	My Diet Diary	Livestrong	My Diet Coach	FitBit	Fat Secret	Diet Point	Diyetkolik.com
Personal Info		User Name	+	-	+	-	+	-	-	+	+	-
		Profile Photo	+	-	+	-	+	-	-	-	-	-
		Unit Preference	+	+	+	+	+	-	+	+	+	-
		Current Weight	+	+	+	+	+	-	+	+	+	+
		Desired Weight	+	+	-	+	+	-	+	+	+	+
		Height	+	+	+	+	+	-	+	+	+	+
		Gender	+	+	+	+	+	+	+	+	+	+
		Age	+	+	+	+	+	-	+	+	+	+
		Region	+	-	+	-	-	-	-	+	-	-
		Body Type (small, medium, large)	-	-	+	-	-	-	-	-	-	-
		Activity Level (sedentary, moderetly active, active)	+	+	+	+	-	-	-	+	+	+
		Goal Set (lose weight, maintain weight, gain weight)	+	+	+	+	-	+	-	+	+	+
		Program Intensity	+	+	-	-	-	-	+	-	-	-
		BMI Info	-	+	-	-	+	pro	+	-	+	-
		Daily Calorie Calculation	+	+	+	+	+	pro	+	+	+	+
Food	Food Log	Search for a food by writing	+	+	+	+	+	-	+	+	-	+
		Find a food by using barcode scanner	+	+	+	-		-		-	-	-
		Search according to restourant, brand	-	-	-	-	-	-	-	+	-	-
		Meal time	+	-	-	+	-	-	+	-	-	+
		Create an entry	+	+	+	-	+	-	+	+	-	-
		Quick calorie entry	+	-	-	-	+	-	+	+	-	-
		Water	+	-	+	+	+	-	+	-	-	pro
		Add Recipe	-	pro	-	-	-	-	-	+	-	-
		Get Recipe	-	pro	-	-	-	-	-	+	-	-
		Shopping List	-	-	-	-	-	-	-	-	pro	-
		Diet Plans	-	-	+	-	-	-	-	-	+	-
		Food Picture	-	-	+	-	+	-	-	+	-	-
		Food Note	+	-	-	+	-	-	-	-	-	-
		Diary	+	+	+	+	+	-	+	+	-	+
		Classification (red, green, yellow / A, B,C)	+	+	+	-	-	-	-	-	-	-
		Nutrient Details	+	-	+	+	+	-	-	+	-	pro
		Nutrient Details (Total, goal, left)	+	-	+	-	-	-	-	-	-	-
		Calorie Breakdown (total and left carb, fat, protein)	+	-	+	-	-	-	-	+	-	pro
Exercise	Exercise Log	Search for an exercise	+	+	+	+	+	-	+	+	-	+
		Create an entry	+	+	+	-	+	-	+	-	-	-
		Quick calorie entry	-	+	+	-	+	-	+	-	-	-
		Pedometer	-	+	-	-	-	-	-	-	-	-
		Exercise Coach (map, music, voice output, feedback)	-	+	-	-	-	-	-	-	-	-
Social Network		Newsfeed	+	pro	+	+	+	-	+	-	-	-
		Messages	+	pro	+	+	+	-	+	-	+	-
		Forum	-	-	+	+	-	-	-	-	+	+
		Facebook	+	+	+	-	-	+	-	-	+	+
		Twitter	+	-	+	-	-	+	-	-	+	+
Charts		Weight	+	+	+	+	+	pro	-	+	+	+
		Neck	+	-	-	-	-	-	-	-	-	-
		Waist	+	pro	-	-	-	-	-	-	-	-
		Hips	+	-	-	-	-	-	-	-	-	-
Feedback	Reminder	Food log	+	+	-	+	-	+	-	-	-	+
		Exercise log	-	+	-	+	-	+	-	-	-	-
		Water log	-	-	-	+	-	+	-	-	-	+
		Weight control	-	-	-	+	-	+	-	-	-	-
		Widget	+	+	+	-	-	-	-	-	-	-
		Warning	+	+	-	-	-	-	-	-	-	-
		Tips	+	-	-	-	-	+	-	-	+	-
		Motivation	-	+	-	-	-	-	-	-	+	-
		Articles	+	+	-	-	-	-	-	-	+	-
		auto pause / auto start for steps	-	+	-	-	-	-	-	-	+	-
		Export Noom Data	-	+	-	-	-	-	-	-	+	-
		Voice autput setting	-	+	-	-	-	-	-	-	+	-
		Music Setting	-	+	-	-	-	-	-	-	+	-
		Location Setting	-	+	-	-	-	-	-	-	+	-
		Weekly exercise record	-	+	-	-	-	-	-	-	-	-
		Theme (color pick)	-	-	-	-	-	-	-	+	-	-
		Challenge & Awards	-	+	-	-	-	+	-	-	-	-

APPENDIX B

CONSENT FORM

Bu çalışma, Orta Doğu Teknik Üniversitesi Endüstri Ürünleri Tasarımı bölümü öğretim üyesi Doç. Dr. Bahar Şener-Pedgley danışmanlığında yüksek lisans öğrencisi Nur Nagihan Tuna tarafından yürütülmektedir. Çalışmanın amacı, belirlenen akıllı cihaz uygulamalarının 1 hafta süreyle kullanan kullanıcıların iyi oluşuna destek olup olmadığını ölçmek ve bu amaçla nasıl geliştirilebileceğini saptamaktır. Bu sebeple sizden istediğimiz kullanım öncesi ve sonrası yapılacak olan ve yaklaşık 1-2 dakika sürecek anketi doldurmanız ve kullanım öncesi yapılacak yaklaşık 15 dakika sürecek olan ve kullanım sonrası yapılacak ve yaklaşık 45 dakika sürecek olan mülakatlara katılımınızdır. Cevaplarınız kesinlikle gizli tutulacak ve sadece araştırmacılar tarafından değerlendirilecektir. Elde edilen bilgiler bilimsel yayınlarda kullanılacaktır.

Çalışma sırasında sorulan sorular, kişisel rahatsızlık verecek herhangi bir ayrıntı içermemektedir. Soruların doğru ya da yanlış bir cevabı yoktur; önemli olan sizin ne düşündüğünüz ve ne hissettiğinizdir. Çalışmanın sonuçlarının güvenilirliği açısından sorulara içtenlikle cevap vermeniz bizim için çok önemlidir.

Çalışma sırasında sorulardan ya da herhangi başka bir nedenden ötürü kendinizi rahatsız hissederseniz istediğiniz zaman çalışmadan ayrılabilirsiniz. Bu çalışmaya katıldığınız için şimdiden teşekkür ederiz.

Çalışmanın sonuçlarını öğrenmek ya da bu araştırma hakkında daha fazla bilgi almak için Endüstri Ürünleri Tasarımı Bölümü Arş. Görv. Nagihan Tuna (Tel: 05558714758 E-posta: nagihantuna@gmail.com) ile iletişim kurabilirsiniz.

Çalışmaya katılmayı kabul ediyorsanız lütfen aşağıdaki cümleyi okuyup imzalayınız.
Bu çalışmaya tamamen gönüllü olarak katılıyorum ve istediğim zaman yarıda kesip çıkabileceğimi biliyorum. Verdiğim bilgilerin bilimsel amaçlı yayımlarda kullanılmasını kabul ediyorum.

İsim Soyad Tarih İmza

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APPENDIX C

POSITIVE AND NEGATIVE AFFECT SCALE (PANAS)

Positive and Negative Affect Scale (Watson, Clark, and Tellegen, 1988).

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what extent you feel this way right now, that is, at the present moment *OR* indicate the extent you have felt this way over the past week.**

1	2	3	4	5
Very Slightly or Not at All	A little	Moderately	Quite a Bit	Extremely

1. Interested	_____	**11. Irritable**	_____
2. Distressed	_____	**12. Alert**	_____
3. Excited	_____	**13. Ashamed**	_____
4. Upset	_____	**14. Inspired**	_____
5. Strong	_____	**15. Nervous**	_____
6. Guilty	_____	**16. Determined**	_____
7. Scared	_____	**17. Attentive**	_____
8. Hostile	_____	**18. Jittery**	_____
9. Enthusiastic	_____	**19. Active**	_____
10. Proud	_____	**20. Afraid**	_____

Positive and Negative Affect Scale Presented to the Participants

Katılımınız için teşekkürler!. Bu anket 1-2 dakikalık kısa bir anket olup seçilen uygulamaların kullanımından önce ve sonra olmak üzere 2 kere yapılacaktır. Lütfen küçük değişikliklerin önemli olduğunu göz önünde bulundurarak içtenlikle doldurunuz.

Bu ölçek farklı his ve duyguları içeren bir takım kelimeler içermektedir. Her maddeyi okuyun ve aşağıdaki ölçekteki numaralarıher kelimenin yanına listeleyin. Şu anda ne kadar bu şekilde hissettiğinizi belirtin. / Geçtiğimiz hafta boyunca ne kadar bu şekilde hissettiğinizi belirtin.

1	2	3	4	5
Çok Az ya da Hiç	**Az**	**Kısmen**	**Epeyce**	**Aşırı derecede**

1. **İlgili** (Interested) _____
2. **Sıkıntılı** (Distressed) _____
3. **Heyecanlı** (Excited) _____
4. **Üzgün** (Upset) _____
5. **Güçlü** (Strong) _____
6. **Suçlu** (Guilty) _____
7. **Korkmuş** (Scared) _____
8. **Düşmanca** (Hostile) _____
9. **Hevesli** (Enthusiastic) _____
10. **Gurur Duyan** (Proud) _____
11. **Sinir Bozucu** (Irritable) _____
12. **Tetikte** (Alert) _____
13. **Utanmış** (Ashamed) _____
14. **Esinlenmiş** (Inspired) _____
15. **Gergin** (Nervous) _____
16. **Kararlı** (Determined) _____
17. **İnce** (Attentive) _____
18. **Tedirgin** (Jittery) _____
19. **Aktif** (Active) _____
20. **Ürkmüş** (Afraid) _____

APPENDIX D

PHASE 1 INTERVIEW QUESTIONS

1. When you try to lose weight do you follow a special method?
2. (e.g. consulting with a dietician, going on a diet, doing sports/exercises, etc.)
3. Do you set yourself a goal? (e.g. I'd like to lose 1 kg in a month / or more general just to lose weight)
4. Do you measure your body size and weight? How often?
5. Do you pay attention to the nutritional information of what you eat? (e.g. calorie, fat content, etc.)
6. Do you prefer having social support when trying to lose weight? (e.g. sharing it with friends, family, etc.)
7. Have you ever used any software application(s) for diet tracking before? (e.g. web-based, smart device based, etc.)

→ If YES

- Name of the application(s)?
- How long did you use it?
- How did you decide to use it?
- (As much as you remember) What did you like/dislike about the app?
- Are you interested in any methods, suggestions, facts for weight losing?

APPENDIX E

PHASE 3 INTERVIEW QUESTIONS

1. Have you set yourself a goal?
2. Have you measured your body size and weight? How often?
3. Have you paid attention to the nutritional information of what you have eaten? (e.g. calorie, fat content, etc.)
4. Have you sought any information about any methods, suggestions, facts for weight lost?
5. How frequently have you used the app? (e.g. right after every meal, at the end of every day, every couple of hours, etc.) Any specific reason?
6. Do you think that this application has helped you achieving (or getting close to) your goal? How?
7. Do you think that this application has encouraged you to be (more) socially connected? How/in what way?
8. Do you think that you would use an application for diet tracking/weight losing in future?

→ Table

9. In this Table you will find the list of features provided by the app.
    - Please indicate the ones you have used,
    - Are there any features that you have not noticed?

- (If there is any) I see that you have not used ... function? Any specific reason?
- (If there is any) I see that you have used ... function a lot? Any specific reason?

9.a Which features did you specifically like? Why?

9.b Which features did you specifically dislike? Why?

9.c What kind of feature would you prefer to add to the application? What kind of technology would you prefer it to have?

APPENDIX F

FEATURES OF MYFITNESSPAL

Table F.1 List of MyFitnessPal features presented to theparticipants in Phase 3

MyFitnessPal features			not at all (0)	a little (1)	moderately (2)	quite a bit (3)	extremely (4)
Personal Info	User Name						
	Profile Photo						
	Unit Preference						
	Current Weight						
	Desired Weight						
	Height						
	Gender						
	Age						
	Region						
	Activity Level (sedentary, moderetly active, active)						
	Goal Set (weight goal, nutrition goal, fitness goal)						
	Program Intensity						
	Daily Calorie Calculation						
Food	Food Log	Search for a food by writing					
		Find a food by using barcode scanner					
		Meal time					
		Create an entry					
		Quick calorie entry					
	Water						
	Food Note						
	Diary						
	Classification (red, green, yellow)						
	Nutrient Details						
	Nutrient Details (Total, goal, left)						
	Calorie Breakdown (total and left carb, fat, protein)						
Exercise	Exercise Log	Search for an exercise					
		Create an entry					
Social Network	Newsfeed						
	Messages						
	Facebook						
	Twitter						
Charts	Weight						
	Neck						
	Waist						
	Hips						
Feedback	Reminder	Food log					
		Any item for .. day					
	Warning						
	Tips						

APPENDIX G

FEATURES OF NOOM COACH

Table G.1 List of Noom Coach features presented to the particiapants in Phase 3

Noom Coach features			not at all (0)	a little (1)	moderately (2)	quite a bit (3)	extremely (4)
Personal	Unit Preference						
	Current Weight						
	Desired Weight						
	Height						
	Gender						
	Age						
	Activity Level (sedentary, moderetly active, active)						
	walk step goal						
	Program Intensity						
	BMI Info						
	Daily Calorie Calculation						
Food	Food Log	Search for a food by writing					
		Find a food by using barcode scanner					
		Meal time					
		Create an entry					
	Diary						
	Classification (red, green, yellow)						
Exercise	Exercise Log	Search for an exercise					
		Create an entry					
		Quick calorie entry					
	Pedometer						
	Exercise Coach (map, music, voice output, feedback)						
Social Network	Facebook						
Charts	Weight						
Feedback	Reminder	Food log					
		Exercise log					
		daily task					
	Homescreen widget						
	Warning						
	Motivation						
	Articles						
	auto pause/ auto start for steps						
	Export/email noom data						
	Voice output setting						
	Music setting						
	Location setting						
	Weekly exercise record						
Challenge & Awards							

APPENDIX H

FEATURES OF CALORIE COUNT

Table H.1 List of Calorie Count features presented to the particiapants in Phase 3

Calorie Count features			not at all (0)	a little (1)	moderately (2)	quite a bit (3)	extremely (4)
Personal Info	User Name						
	Profile Photo						
	Unit Preference						
	Current Weight						
	Height						
	Gender						
	Age						
	Region						
	Body Type (small, medium, large)						
	Activity Level (sedentary, moderetly active, active)						
	Goal Set (lose weight, maintain weight, gain weight)						
	Daily Calorie Calculation						
Food	Food Log	Search for a food by writing					
		Find a food by using barcode scanner					
		Create an entry					
	Water						
	Diet Plans						
	Diary						
	Food Picture						
	Nutrient Details						
	Nutrient Details (Total, goal, left)						
	Calorie Breakdown (total and left carb, fat, protein)						
Exercise	Exercise Log	Search for an exercise					
		Create an entry					
		Quick calorie entry					
Social Network	Newsfeed						
	Messages						
	Forum						
	Facebook						
	Twitter						
Charts	Weight						
Homescreen							

APPENDIX I

THE FEELINGS AND MOODS WITHIN '*OPTIMAL EXPERIENCE'*

Table I.1 Likert scale for the feelings and moods within 'Optimal Experience'

Did the app made you feel...	Never	Rarely	Sometimes	Often	Always
	0	**1**	**2**	**3**	**4**
Curious					
Challenged					
Skilful					
Focused					
Surprised					
Social					
Satisfied					
In control					
Self confident					
Creative					
Motivated					
Engaged					

Table I.2 Likert scale for the feelings and moods within 'Optimal Experience' presented to the participants in Phase 3

Uygulama size ... hissettirdi mi?	Hiç bir zaman	Nadiren	Bazen	Sıklıkla	Her zaman
	0	**1**	**2**	**3**	**4**
Meraklı (Curious)					
Meydan Okunmuş (Challenged)					
Becerikli (Skilful)					
Odaklanmış (Focused)					
Şaşırmış (Surprised)					
Sosyal (Social)					
Tatmin Olmuş (Satisfied)					
Kontrol Sahibi (In control)					
Özgüvenli (Self confident)					
Yaratıcı (Creative)					
Motive Olmuş (Motivated)					
Bağlanmış (Engaged)					

APPENDIX J

LIKERT SCALE FOR GENERAL ASSESSMENT OF THE APPS

Table J.1 Likert scale for general assessment of the apps

	Never	Rarely	Sometimes	Often	Always
	0	1	2	3	4
Were you content with the interface elements?					
Do you think that it is easy to use?					
Did it provide you with clear feedback?					
Were you able to find the features that you want to use easily?					
Were you able to complete the tasks that it requires easily?					
Were you content about the awards / offerings?					

Table J.2 Likert scale for general assessment of the apps presented to the participants in Phase 3

	Never	Rarely	Sometimes	Often	Always
	0	1	2	3	4
Arayüz elemanlarından memnun muydunuz?					
Sistemin kullanımı kolay mıydı?					
Size açık geri bildirim Verdi mi?					
Kullanmak istediğiniz özellikleri kolaylıkla bulabildiniz mi?					
Size verdiği görevleri kolaylıkla tamamlayabildiniz mi?					
Size verdiği ödüllerden menun muydunuz?					

APPENDIX K

APPROVAL ETHICS

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

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29.05.2014

Gönderilen : Doç Dr. Bahar Şener-Pedgley
Endüstri Ürünleri Tasarımı

Gönderen : Prof. Dr. Canan Özgen
IAK Başkanı

İlgi : Etik Onayı

Danışmanlığını yapmış olduğunuz Endüstri Ürünleri Tasarımı Bölümü öğrencisi Nur Nagihan Tuna'nın "Sağlık ve İyi-Oluş İçin Tasarım: Akıllı Cihazlar İçin Kilo Kontrolüne Yönelik Beden Gözleme Uygulamaları Üzerine Araştırma" isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

29/05/2014

Prof.Dr. Canan Özgen
Uygulamalı Etik Araştırma Merkezi
(UEAM) Başkanı
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APPENDIX L

ANSWERS OF THE PARTICIPANTS TO PANAS

Table L.1 Answers of the participants to PANAS Before (B) and After (A) usage

		Myfitnesspal										Noom Coach										Calorie Count									
		P 1		P 2		P 3		P 4		P 5		P 6		P 7		P 8		P 9		P 10		P 11		P 12		P 13		P 14		P 15	
	PA	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**
1	interested	3	2	5	5	4	4	4	4	4	3	3	2	3	4	4	3	3	2	2	4	3	2	4	4	4	4	3	2	4	4
3	excited	2	4	4	5	4	3	3	4	4	3	1	4	4	3	4	2	2	3	2	4	3	3	2	3	4	2	2	3	4	4
5	strong	2	3	3	3	5	4	5	4	4	3	1	3	3	3	3	2	4	3	2	3	3	3	3	3	3	3	4	4	3	4
9	enthusiastic	5	3	5	5	4	4	4	4	4	3	2	3	4	4	4	2	3	2	3	3	3	3	4	4	4	3	2	3	4	4
10	proud	3	3	2	5	2	3	4	3	5	3	2	2	4	3	1	1	2	3	1	2	3	4	3	3	3	2	2	3	3	4
12	alert	4	2	4	5	1	1	2	3	3	3	1	1	3	2	1	1	2	3	4	4	3	2	2	2	1	3	2	2	2	2
14	inspired	3	3	4	5	4	4	3	4	4	3	2	2	3	3	3	1	2	2	2	2	3	3	3	4	3	3	2	2	4	3
16	determined	3	4	3	4	4	4	4	4	4	2	2	3	4	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	4	5
17	attentive	3	3	1	2	2	3	3	3	4	3	4	4	4	3	1	3	2	2	4	3	3	3	2	3	2	3	2	2	2	3
19	active	2	4	1	3	5	5	1	4	4	2	2	2	4	4	1	3	3	3	2	3	3	2	3	2	3	3	3	3	4	4
	NA	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**
2	distressed	4	4	2	1	1	2	5	2	4	3	2	3	4	3	2	1	3	2	5	4	5	3	3	3	1	1	3	2	1	2
4	upset	3	2	1	1	1	1	2	1	1	2	2	1	2	2	1	2	2	2	5	4	3	2	1	2	1	1	2	2	1	2
6	guilty	2	1	3	1	1	1	1	2	1	2	1	1	1	3	1	1	1	1	4	3	2	2	1	3	1	1	1	1	1	2
7	scared	4	1	1	1	1	1	2	3	2	2	1	1	2		1	2	1	1	4	3	2	1	1	2	2	1	1	1	1	1
8	hostile	1	1	1	1	1	1	2	1	3	1	1	1	1	1	1	1	1	1	4	2	1	1	1	2	1	1	1	1	1	1
11	irritable	3	2	2	1	1	1	3	2	2	2	2	1	3	1	1	2	1	2	3	4	2	2	1	2	1	1	1	2	1	1
13	ashamed	4	1	1	1	1	1	2	3	1	1	1	1	2	1	1	1	2	1	5	4	4	2	1	1	1	1	2	2	1	1
15	nervous	5	4	2	3	1	3	4	3	5	3	3	3	1	1	1	1	2	1	5	4	4	2	3	1	1	1	2	1	3	2
18	jittery	3	2	1	1	1	1	4	3	3	2	3	2	3	3	1	1	2	1	5	4	4	2	2	1	1	1	2	1	2	1
20	afraid	2	1	4	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	4	4	2	1	2	1	1	1	1	1	1	1

APPENDIX M

USAGE FREQUENCY OF MYFITNESSPAL FEATURES

Table M.1 Usage frequency of MyFitnessPal Features of 5 participants

	MyFitnessPal	P 1					P 2					P 3					P 4					P 5				
		not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely
Personal Info	User Name		x				x								x			x				x				
	Profile Photo	x					x					x					x					x				
	Unit Preference		x					x								x			x				x			
	Current Weight		x					x					x					x					x			
	Desired Weight		x					x				x						x				x				
	Height		x					x					x					x					x			
	Gender		x					x					x					x					x			
	Age		x					x					x					x					x			
	Region			x				x					x					x					x			
	Activity Level (sedentary, moderetly active, active)		x					x						x				x					x			
	Goal Set (weight goal, nutrition goal, fitness goal)		x					x						x				x							x	
	Program Intensity		x				x						x					x					x			
	Daily Calorie Calculation					x				x					x						x					x
Food	Search for a food by writing				x						x					x				x						x
	Find a food by using barcode scanner	x									x	x					x						x			
	Meal time	x					x					x					x					x				
	Create an entry	x						x								x				x		x				
	Quick calorie entry	x					x						x				x					x				
	Water	x								x			x				x						x			
	Food Note		x				x						x				x					x				
	Diary					x			x							x				x						x
	Classification of food (red, green, yellow)		x				x							x			x						x			
	Nutritional Facts				x						x					x					x				x	
	Nutrient Details (Total, goal, left)				x						x					x				x			x			
	Calorie Breakdown (total and left carb, fat, protein)				x						x					x				x			x			
Exercise	Search for an exercise	x									x				x						x				x	
	Create an entry	x					x								x		x					x				
Social Network	Newsfeed			x			x					x						x					x			
	Messages			x			x					x					x					x				
	Facebook	x					x					x					x					x				
	Twitter	x					x					x					x					x				
Charts	Weight	x						x						x						x		x				
	Neck	x					x					x					x					x				
	Waist	x					x					x					x					x				
	Hips	x					x					x					x					x				
Feedback	Reminder			x				x				x							x					x		
	Any item for .. day			x				x				x							x			x				
	Warning			x						x				x						x						x
	Widget	x					x					x									x					x
	Tips			x				x						x			x									x

APPENDIX N

USAGE FREQUENCY OF NOOM COACH FEATURES

Table N.1 Usage frequency of Noom Coach Features of 5 participants

	Noom Coach		P 1					P 2					P 3					P 4					P 5				
			not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely
Personal	Unit Preference					x		x								x					x				x		
	Current Weight					x			x						x				x					x			
	Desired Weight			x					x						x				x					x			
	Height			x					x						x				x					x			
	Gender			x				x							x				x					x			
	Age			x				x							x				x					x			
	Activity Level (sedentary, moderetly active, active)			x						x				x					x					x			
	walk step goal						x					x			x				x					x			
	Program Intensity						x		x						x					x				x			
	BMI Info			x					x					x				x						x			
	Daily Calorie Calculation						x				x					x					x		x				
Food	Food Log	Search for a food by writing					x					x				x					x						x
		Find a food by using barcode scanner	x					x					x					x					x				
		Meal time		x						x					x							x		x			
		Create an entry	x					x					x					x							x		
	Diary					x			x							x					x					x	
	Classification (red, green, yellow)					x			x							x					x		x				
Exercise	Exercise Log	Search for an exercise	x					x								x		x					x				
		Create an entry	x					x					x					x					x				
		Quick calorie entry	x					x					x					x					x				
	Pedometer						x				x					x					x			x			
	Exercise Coach (map, music, voice output, feedback)		x					x					x					x					x				
Facebook			x					x					x					x					x				
Weight Chart					x			x					x					x					x				
Feedback	Reminder	Food log				x				x							x					x			x		
		Exercise log		x				x							x							x		x			
		Daily task				x					x						x					x			x		
	Homescreen widget		x					x					x					x					x				
	Warning				x			x								x				x				x			
	Motivation		x					x						x						x			x				
	Articles				x						x		x						x						x		
	auto pause/ auto start for steps			x					x				x					x					x				
	Export/email noom data		x					x					x					x					x				
	Voice output setting		x					x					x					x					x				
	Music setting		x					x					x					x					x				
	Location setting			x				x					x					x					x				
	Weekly exercise record			x				x									x	x					x				
Challenge & Awards						x				x					x				x					x			

APPENDIX O

USAGE FREQUANCY OF CALORIE COUNT FEATURES

Table O.1 Usage frequency of Calorie Count Features of 5 participants

	Calorie Count	P 1					P 2					P 3					P 4					P 5				
		not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely	not at all	a little	moderately	quite a bit	extremely
Personal Info	User Name			X				X							X			X				X				
	Profile Photo	X					X					X					X					X				
	Unit Preference					X		X					X				X				X			X		
	Current Weight	X						X					X					X					X			
	Height		X					X					X					X					X			
	Gender		X					X					X					X					X			
	Age		X					X					X					X					X			
	Region	X						X					X					X					X			
	Body Type (small, medium, large)		X					X					X					X					X			
	Activity Level (sedentary, moderetly a		X					X						X				X					X			
	Goal Set (lose weight, maintain weigh	X						X				X						X						X		
	Daily Calorie Calculation					X				X					X						X					X
Food	ood Lo Search for a food by writing					X					X					X					X				X	
	ood Lo Find a food by using barcode sc	X									X	X					X					X				
	ood Lo Create an entry	X									X				X		X							X		
	Water			X			X								X						X					X
	Diet Plans	X					X						X				X					X				
	Diary					X					X			X						X		X				
	Food Picture	X					X					X					X									
	Nutrient Details					X				X				X					X					X		
	Nutrient Details (Total, goal, left)	X									X			X					X					X		
	Calorie Breakdown (total and left car					X	X								X				X					X		
Exercise	Exerc ise Log Search for an exercise					X	X								X					X						X
	Exerc ise Log Create an entry	X					X						X				X					X				
	Exerc ise Log Quick calorie entry					X	X					X					X					X				
Social Network	Newsfeed				X		X						X					X						X		
	Messages	X					X					X					X					X				
	Forum	X					X					X							X			X				
	Facebook	X					X					X					X					X				
	Twitter	X					X					X					X					X				
Weight Charts		X					X					X							X							X
Widget		X					X					X					X					X				

APPENDIX P

FREQUENCIES OF FEELINGS AND MOODS

Table P.1 Frequencies of feelings and moods of 15 Participants

	MyFitnessPal Users					Noom Coach Users					Calorie Count Users				
	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12	P 13	P 14	P 15
Curious	3	4	4	3	4	3	4	3	3	3	2	5	3	4	4
Challenged	2	3	1	4	2	3	4	2	4	2	2	3	1	3	3
Skilful	3	2	4	3	4	2	3	3	3	2	1	3	1	2	3
Focused	3	4	4	4	4	4	3	4	2	2	1	3	2	3	4
Surprised	1	3	2	4	4	3	2	2	2	2	1	4	2	3	5
Social	4	3	1	2	1	1	2	3	3	1	1	2	1	2	2
Satisfied	3	4	3	4	3	3	3	3	3	1	2	3	3	2	4
In control	3	4	4	5	5	4	4	3	3	1	1	4	3	2	3
Self confident	4	3	4	2	3	3	4	4	4	2	1	4	2	3	4
Creative	3	3	2	4	2	2	3	4	4	1	1	4	1	3	1
Motivated	4	4	5	4	4	4	3	4	4	2	1	4	3	3	5
Engaged	3	5	4	4	4	3	3	2	2	1	1	2	2	3	3

APPENDIX Q

GENERAL ASSESSMENT OFAPPS

Table Q.1 General Assessment of Apps by 15 parrticipants

	MyFitnessPal Users					Noom Coach Users					Calorie Count Users				
	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	P 10	P 11	P 12	P 13	P 14	P 15
Were you content with the interface elements?	3	5	4	4	4	3	3	3	2	2	2	3	2	3	4
Do you think that it was easy to use?	3	4	4	3	4	3	3	3	3	2	3	4	3	2	4
Did it provide you with clear feedback?	2	4	3	4	5	4	4	3	3	3	2	3	3	3	3
Were you able to find the features that you want to use easily?	3	4	5	4	4	4	4	2	2	2	3	4	2	4	4
Were you able to complete the tasks that it requires easily?	2	4	4	4	3	3	3	4	2	4	1	3	2	2	5
Were you content about the awards / offerings?	4	5	2	3	2	4	2	2	1	1	1	3	1	1	5