Is knowledge related to behavior?

In the context of fruit consumption

Master's Thesis Marketing

Master Economics and Business,
specialisation Marketing

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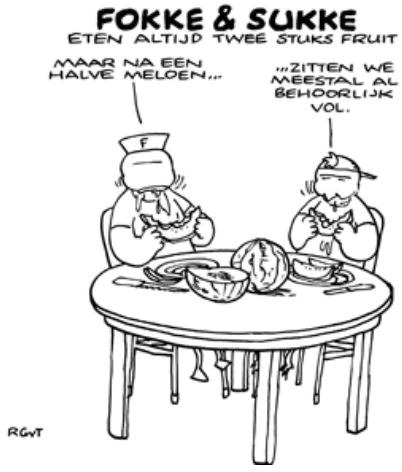
July, 2013



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1. INTRODUCTION

Obesity and chronic diseases such as cardiovascular disease and cancer are a growing problem in the Western population. There is much evidence that the consumption of fruit and vegetables plays an important role in prevention of these diseases and obesity. Not surprisingly, the relationship between diet and health now enjoys widespread media coverage. Programs such as "help, my child is too fat" and "S.O.S. Sonja", various television commercials and initiatives such as "www.voedingscentrum.nl" disseminate information to the public.

Media can play a powerful role in influencing health behavior and yearly many education and intervention programs are designed to trigger consumption of healthy foods. However, in order to be successful in stimulating fruit and vegetable intake in the population it is essential to knowing the determinants of fruit and vegetable consumption.

Nowadays it seems that many individuals are aware of the need to consume fruit and vegetables. However, the current consumption is far below the recommended level. Knowing what types of knowledge, and what other factors besides knowledge, influence behavior, is an important step towards more effective interventions. The question that rises is:

- **Is knowledge about nutrients of fruit, the role of fruit in the prevention of diseases and practical knowledge about fruit, related to fruit consumption?**

In this study I will answer this question based on a sample of students. Food patterns established during college years may have long-lasting influences on students' future health and that of their future family. However, it has been well documented that college students have unhealthful eating behaviors. Therefore investigating whether knowledge can lead to behavior change is relevant for this particular group.

I will investigate the research question by answering the following sub-questions:

1) What are the advantages of fruit and vegetable consumption? *(Chapter 2)*
2) What are the recommended consumption and the actual consumption of fruit and vegetables? *(Chapter 3 & 4)*
3) What is the current level of knowledge about the effects on health of fruit and vegetables? *(Chapter 5)*
4) Why is it relevant to investigate the relationship between knowledge and consumption? *(Chapter 6)*
5) What is known about the link between knowledge and fruit consumption? *(Chapter 7)*
6) What other factors besides knowledge influence fruit consumption?
    a) Barriers *(Chapter 8)*

b) Demographics *(Chapter 11)*
c) Lifestyle patterns, such as physical activity *(Chapter 11)*

7) What theories can predict fruit consumption? *(Chapter 9)*
   a) Theory of Planned Behavior (TPB)
   b) Stages of Change model
8) How does knowledge fit in the Theory of Planned Behavior? *(Chapter 14 & 15)*
9) Are there differences between the effects of different types of knowledge on fruit consumption? *(Chapter 14 & 15)*
   a) Is there a difference between the effects of knowledge about nutrients, diseases and practical issues?
   b) Is there a difference between beliefs about knowledge and actual knowledge?
   c) Is there a difference between correct knowledge and misperceptions?

I will start off with a literature study in which I present the findings thus far. Then I will formulate hypotheses and the set up of a study amongst college students. In the discussion part I will present my findings and place them in the context of current findings. I will finish with a conclusion and recommendations for further study. The focus in this thesis will be on fruit, but in the literature review I will also discuss some of the determinants of vegetable consumption.

2. INFLUENCE OF FRUIT AND VEGETABLES ON HEALTH

There are many ways in which the consumption of fruit and vegetables plays an important role in improving health. Fruits and vegetables are rich in vitamins, minerals, fiber and phytochemicals and a major benefit is the protective role of fruits and vegetables in the prevention of chronic diseases (Hwang, 1999; Hu et al., 2000; Joshipura et al., 1999; Lampe, 1999; Liu et al., 2000; Smith-Warner et al., 2000) such as cardiovascular diseases (Klerk et al., 1998; Ness & Powles, 1997) and cancer (Bingham et al., Glade, 1999, 2003; Ness & Powles, 1997, 1999; Norat & Riboli, 2002, 2003). In the Netherlands, yearly more than one on three people suffers from cancer. Cancer is the second most important cause of death for men, after cardiovascular diseases and the most important cause of death for women (Hoogenboezem & Garssen, 2006). Worldwide, an estimated 7.6 million deaths from cancer occurred in 2008 (WHO, 2008). This rate is expected to grow to 12 million in 2030 (WHO, 2009). Eating more fruit and vegetables may be the single most important dietary change needed to reduce the risk of chronic diseases (Miller et al., 2000). Diets with high amounts of vegetables and fruit (including at least 5 servings or the equivalent of more than 400 grams daily) may prevent 20 percent or more of all cancers (AICR, 1997).

Secondly, the consumption of fruit and vegetables has shown to have a positive effect on weight loss and hence can be an effective way to diminish the obesity rates (Drewnowski, 1998; WHO, 2003). In the Netherlands 60 percent of male adults and 44 percent of female adults between the age 30 and 70 years are overweighted, of which over 13 percent suffers from obesity (Blokstra et al., 2012). Amongst children between 2 and 19 years old over 12 percent is overweight and 3 percent suffers from severe overweight (Groot & Bruggink, 2012). This percentage of overweight adults has grown from 5.1 percent to 11.2 percent between 1981 and 2007. If this trend continues then in 2015 15-20 percent of Dutch adults will be obese (WKOF, 2013). Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, obstructive sleep apnea, certain types of cancer, and osteoarthritis (Haslam & James, 2005). Physical inactivity and sedentary lifestyle are likely to be key determinants of the growing rates of overweight and obesity in Western populations (Jebb & Moore, 1999).

In summary, fruit and vegetable consumption play an important role in the prevention of chronic diseases and diminishing obesity. Therefore, increasing fruit consumption of the Dutch population can lead to significant improvements in public health.

3. CURRENT RECOMMENDATIONS

The consumption of fruit and vegetables has various positive effects on health. However, simply recommending 'more' does not give consumers any information of how much is reasonable and for that reason national agencies quantify the recommendations and set a target consumption. In the Netherlands, the food based dietary guideline for adults for vegetables is 200 grams, or four table spoons, per day. The recommended amount of fruit is two portions or 200 gram. One portion is defined as one piece of fruit (1 apple or a handful of grapes) or one glass of 100% fresh fruit juice. This target is based on the amount of fruit and vegetables needed for a balanced diet and is considered to be consistent with the most recent (Dutch) norms of the Health Council and contributes to the prevention of chronic diseases (Voedingscentrum, 2011). In the UK and United States the recommended amount is to eat five portions of fruit and vegetables a day (WHO, 1990). Since one portion is equal to approximately 80 grams of fruit and/or vegetables this amount is quitte similar to the Dutch recommendations.

4. CURRENT CONSUMPTION OF FRUIT AND VEGETABLES

Despite the health-protective effects of good nutrition a large proportion of the general population in Western countries is not consuming sufficient quantities of fruits and vegetables to obtain these health benefits (DHSS & USDA, 2005; Hulshof et al., 1993; NHMRC, 2003; Serdula et al., 1999; WHO, 2003). Also in the Netherlands the fruit and vegetable consumption is far below the recommendations for all age groups. For adults the median habitual intake of vegetables was 103-140 grams. Only 3-14 percent of the adults (based on their age group) complied with the recommendations of 200 grams per day. For adults aged 19 to 30 years the percentage that complied with recommendations was four percent. The consumption of fruit is also too low. Median consumption varied between 61 and 145 grams for adults. This is far below the recommended amount of 200 grams (or 2 portions) of fruit per day. The guideline for fruit was met by 3-26 percent in the different age groups. For adults aged 19 to 30 years this percentage was only 4 percent. These numbers are derived from a recent food consumption survey by the National Institute for Public Health and the Environment (RIVM), carried out between 2007 and 2010 among children and adults in the Netherlands (RIVM, 2011).

Not only in the Netherlands, but in many countries all over the world it is shown that the current consumption of fruit and vegetables is far below the recommendations (Baker & Wardle, 2003; Baranowski et al., 1999; Beech et al., 1999; Guenther et al., 2006; Hulshof et al., 1993; Krebs-Smith et al., 1996; Neumark-Sztainer et al., 1996; Serdula et al., 1995; Story et al., 1998; Wiecha et al., 2001).

In short, the fruit consumption of the Dutch population is below the recommended amount of two portions of fruit per day. This means the positive effects of fruit on health are not fully utilised by the Dutch population.

5. CURRENT KNOWLEDGE AND AWARENESS

Given the results of the present fruit and vegetables intake it might not be surprising that several studies have found that many people are ignorant of the existing intake recommendations (Krebs-Smith et al., 1995; Parmenter et al., 2000). This is also shown in the study of Wardle et al (2000) amongst adult participants in England. Their average estimation on the recommended intake was 3.26 portions a day, which is below the recommended five portions. In a study of the Health Education Monitoring Survey (HEMS) in the UK the results were also disappointing: When asked to describe what individuals understood by a healthy diet, only 16 percent of respondents mentioned as many as three out of four of the core recommendations (to eat more fruit, vegetables and salad; to cut down on fat; to eat more fiber; to eat more starchy carbohydrate). Some people are confused about the messages and endorse the statement that 'experts never agree about what foods are good for you' (Hansbro et al., 1997).

Next to the unawareness of the recommendated intake quantities, several North American studies indicated that the majority of the population is also unaware of effect of consumption of fruit and vegetables on the prevention of cancer (Cotugna et al., 1992; Krebs-Smith et al., 1995; Patterson et al., 1995). This unawareness of the link between fruit and vegetable consumption and health is also supported by Krebs-Smith et al. (1995), who found that only 40 percent of adults in the US agreed with the statement that eating fruit and vegetables prevents cancer.

In a survey commissioned by the Nutrition Centre it is showed that the majority of the Dutch population agrees that vegetables and fruit are contributing to a better health. This study is done between 2007 and 2010 amongst 2022 Dutch participants between the ages of 20-65 years. With regard to fibers, 66 percent agrees that vegetables contain fibers and 56 percent thinks that fruit is the best way to eat fibers.

In summary, the current level of knowledge and awareness of recommendations is low. It seems that many people are unaware of the recommendations and not everyone is correctly informed about the benefits of fruit consumption.

6. INTERVENTIONS

When people are not aware of the benefits and recommended intakes, why should they change their behavior? Therefore, in order to increase the consumption of fruit and vegetables, the awareness and knowledge of the importance of fruit and vegetables intake must be increased. That is the idea of the World Health Organization and the Food and Agriculture Organization of the United Nations. They encourage countries to conduct targeted campaigns to increase the consumption of fruit and vegetables. They assert that effective health communication '*has the capacity to create awareness, improve knowledge and induce long-term changes in individual and social behaviors*' (WHO, 2003).

Perhaps the biggest intervention program is the "5 A Day for Better Health Program" that was established in 1991 in the United States as a nutrition campaign designed to increase awareness of the need to consume more vegetables and fruit, and to increase average vegetable and fruit consumption in the United States to five or more daily servings. In the Netherlands the "2 fruits / 200 grams of vegetables a day" campaign was launched in 1994 (Hengel, 1994). In 2006, a campaign of the Dutch nutrition centre was launched to increase consumption of fruit and vegetables by taking away barriers such as taste, convenience and price. They used commercials on television and radio, magazines, newspapers and an extensive website to inform the Dutch population. This campaign was financed by the ministry of Public Health, Welfare and Sport.

Not only in the Netherlands, but all over the world, time, energy and money are spent on education programs to increase the knowledge about fruit and vegetables. Underlying this approach is the assumption that providing people with the information necessary to choose healthy foods will ultimately lead to an improvement in diet. In chapter 7 several studies are presented that investigated the effectiveness of interventions. It seems that while many interventions are successful in increasing knowledge, they do not necessarily lead to changes in fruit and vegetable consumption. This raises the question whether a higher degree of knowledge helps to increase consumption. This issue will be discussed in the following chapter.

In summary, all over the world interventions are conducted to increase the consumption of fruit and vegetables. Most of these interventions are based on the idea that increasing knowledge leads to higher consumption. By providing more insight in the relationship between knowledge and consumption the effectiveness of these interventions can be improved.

7. KNOWLEDGE ASSOCIATION WITH INTAKE

7.1 RESULTS FROM PREVIOUS STUDIES

In the previous chapters it was found that despite the efforts to increase knowledge and awareness, the consumption of fruit and vegetables is still too low. There are many studies that investigate the relationship between knowledge and intake. A first study is that of Link and Phelan (1996) who identified knowledge as one of the 'fundamental causes' of differences in health.

However, a whole body of studies has failed to find strong correlations between knowledge and food intake (Axelson et al., 1985; Shepherd & Stockley, 1987; Shepherd & Towler, 1992; Stafley et al., 1996). For example, Foerster et al. (1995) investigated the result of the U.S. National "Five-a-Day"-Program. As I mentioned earlier the extent of this program was impressive, and yet early indications suggest that its impact may be disappointing: Whilst there have been significant improvements in the public's awareness of the link between fruit and vegetables and disease prevention, and people's recognition of the shortcomings of their own diet, actual consumption of fruit and vegetables does not appear to have increased significantly. This is even shown in California where the Five-a-Day campaign originated and has been in existence since 1988. This, together with other studies of factors influencing fruit and vegetable consumption (Laforge *et al*., 1994), emphasizes the resistance to dietary change and found that individuals with more knowledge do not necessarily change their behavior (Putler & Frazao, 1994; Sapp, 1991).

Other studies showed some relationship between knowledge and behavior, but it has frequently been shown to be a relatively minor influence. Axelson et al. (1985) used nine studies to investigate the relationship between dietary intake and nutrition knowledge. They used the meta-analysis approach, which is a statistical analysis of a collection of findings from independent studies for the purpose of integrating those findings (Glass et al., 1981). Although six out of the nine studies reported no significant correlations, when combining these studies in the meta-analysis the results show a significant relationship between nutrition knowledge and dietary intake ($p<0.01$). However, the estimates of the effect-size of this relationship is very small ($r=0.1007$). They concluded that there is a relationship between nutrition knowledge and dietary intake, but the effect-size is small because of the lack of specificity in measurements (as will be discussed in chapter 7.2).

Wardle et al. (2000) also investigated the relationship between knowledge and intake of fruit and vegetables. Knowledge was measured using the Nutrition Knowledge Questionnaire (Parmenter & Wardle, 1999) that covers experts' recommendations regarding healthy eating,

knowledge about the nutrient content of different foods, everyday food choices and links between diets and diseases. They also took demographic differences into account, namely age, gender, ethnic origin, work status, occupation, partner's occupation, level of education and marital status. They found that knowledge was significantly associated with healthy eating, and more importantly, this effect persisted after controlling for demographic variables. Nutrition knowledge explained between 4 and 22 percent of the variation in intake. They therefore conclude that knowledge is an important factor in explaining variations in food choice, but note that this effect size (between 4 and 22 percent) of nutrition knowledge on intake is only small to medium in terms of Cohen (1988).

Richards et al. (2006) investigated whether the consumption of fruit and vegetables by students aged 18 to 24 years old could be influenced by interventions. Their results showed that the consumption for the intervention group increased significantly by one serving a day. However, this intervention contained newsletters, motivational interviewing, computer-based follow-up and a nutrition website. Therefore the link between pure knowledge increase and consumption remains uncertain.

Another intervention included college nutrition courses to enhance nutritional knowledge in college students with the goal to encourage dietary change. Results of these investigations indicate that there is no link between knowledge anc consumption: this type of intervention appears to be successful only in increasing nutrition knowledge and not in changing dietary intake (De Bruijn, 2010; Menozzi & Mora, 2012).

Neill et al. (2000) explored the relationship between the compliance (as a measure of behavior) claimed for messages about dietary changes and the knowledge of the public concerning the health reasons behind each of the messages. After adjusting for demographic variables it was found that 32 percent of the compliance was related to knowledge. This seems to be amongst the highest relationships between knowledge and behavior reported in the literature. However, a bias in this study is that compliance is measured and not actual behavior.

Another interesting study comes from Main et al. (2002). They investigated if knowledge does influence behavior by looking at the exposure of true and false messages. This was based on a study of Auld et al. (1994), who found almost 400 unique misconceptions about fats and cholesterol in disease and as food components. Main et al. (2002) hypothesized that if knowledge does influence behavior, it would seem likely that the relationship would be found for misconceptions as well as those that are scientifically accurate. They found a correlation between agreement and compliance for each message, whether genuine or false and therefore support the hypothesis that nutrition knowledge is related to behavior. In this study the results

were adjusted for the effects of sex, age group and social class. Once again the self-reported compliance as a measure for behavior might bias the results.

Ball et al. (2006) reported in a study amongst 1347 women in Australia that intakes were higher among women with higher nutrition knowledge scores, but only for vegetables, suggesting there is a relationship between vegetable intake and knowledge.

In summary, the findings regarding the relationship between knowledge and consumption of fruit and vegetables are ambiguous. Many studies found no relationship. The majority of the studies that supported a relationship found a relatively small effect of knowledge on consumption. The biggest reported effect size of the relationship between knowledge and fruit consumption is 0.32 (Neill et al., 2000).

7.2 POSSIBLE EXPLANATIONS FOR AMBIGUOUS RELATIONSHIP

Several explanations have been proposed to explain the ambiguous and often missing relationship between knowledge and behavior. Most of them criticize the methods that are used in these studies.

First, instruments used to measure knowledge vary widely per study and are often specially created for that particular study and lacking any psychometric validation (Anderson et al,; 1988; McDougal, 1998). Not only are there different ways to measure knowledge, also there are many techniques for investigating behavior. For example, Shepherd & Stockley (1987) found that nutrition knowledge did not correlate with other variables in their model, but afterwards they conclude that their questionnaire was too short and had not been validated. Therefore a new nutrition knowledge questionnaire was developed and after using this questionnaire it turned out to be better capable of differentiate between groups likely to be high and low in nutrition knowledge (Towler & Shepherd, 1990).

Second, several studies that tested the relationship between knowledge and intake tested this while their sample provided only little variation in knowledge. This makes it difficult to investigate the relationship. For example, in the just mentioned study of Ball et al. (2006) it was found that there is a relationship between knowledge and intake, but only for vegetables. When looking at the data, this might be due to the baseline intake of fruit: The knowledge of recommended fruit intake and perceived intake of fruit were closer to the recommended levels than for vegetables. In other words: There were too little women with insufficient knowledge about fruit.

However, in the context of the last mentioned explanation we should note that if there is in fact a (relatively high) basis knowledge about fruit we should also expect the consumption of fruit to

be high. Evidence points to the opposite. In the US the awareness of fruit and vegetable recommendations increased substantially while the actual consumption has not. In 1991, 8 percent of the individuals reported being aware that the fruit and vegetable intake should be at least five servings a day (Stables et al., 2002). This percentage has increased to 40 percent in 2004 (NCI, 2004). However, trends in consumption show that that intake of fruit has not changed since 1988, and intake of vegetables has decreased slightly during the same period (Casagrande et al., 2007). This suggests a weak relationship between knowledge and behavior.

In short, there are some explanations for the lack of evidence that support the relationship between knowledge and consumption of fruit and vegetables. Despite these explanations, the contradictory findings have led to pronouncements that knowledge about diet and health is of little relevance to food choice so that "simply changing knowledge is unlikely to have the desired effect" on eating patterns (Shepherd & Towler, 1992). This suggests that there are other factors besides knowledge that influence consumption and that offset the effect of a knowledge increase on consumption.

8. BARRIERS TO FRUIT AND VEGETABLE CONSUMPTION

Besides knowledge there may be other factors, or *barriers,* that stop people from eating the recommended amounts of fruits and vegetables. It is found that individual food choices are influenced by a wide variety of environmental and individual variables. Individuals vary in terms of the importance placed on each of these variables. Reported barriers that hinder the consumption of fruits and vegetables are:

8.1 Availability (access)

Emerging evidence suggests that aspects of local food environments, such as good availability and accessibility of supermarkets or food stores (Morland et al., 2002; Rose & Richards, 2004) and the availability of healthful food products in stores are associated with healthier diets among residents. In Chicago for example, there are many neighbourhoods where crisps, sweets, and doughnuts are easy to come by, but an apple is a rare commodity. In an experiment of the American government 1,800 women were moved from their housing. The women who had moved showed a 20% lower rate of obesity and diabetes than those who had not. The authors suggest that their improved environment (which many assume to include better shops) led to better health (The Economist, 2011).

8.2 Convenience

The latter has an overlap with the next barrier: Convenience. People are sensitive to the effort it takes to get fruit and vegetables. In a study to the successfulness of the Western Australian Health Department's Go for 2&5 fruit and vegetable social marketing campaign it was found that while most adults were aware that fruits and vegetables were good for them, they registered lack of time and difficulty in preparation (particularly for vegetables) as barriers to increasing intake (Pollard et al., 2007). Although there is some overlap with availability, convenience is not only physically, but also mentally. Not surprisingly, "willpower" has been identified as a common barrier to eating healthier food (Lopez-Azpiazu et al., 1999; Lappalainen et al., 1997). Dietary messages that complement lifestyles are more likely to be successful than those that require considerable changes to habit. This effect was illustrated in an evaluation of an array of interventions to increase fruit and vegetable intake in the USA; average fruit intake, but not vegetable intake, increased (Potter et al., 2000). This outcome is likely to be a result of the ease with which fruit (*v.* vegetables) can be consumed, e.g. as snack foods.

8.3 Taste

A big determinant in the choice of food is the taste preferences of the individuals, especially where many different food options are available (Baxter & Thompson, 2002). Taste refers to the sensory appeal of foods, such as palatability, aroma, and texture (Drewnowski,1995). Many studies support the role of taste in the food choice (Glanz et al., 1998; Shepherd & Towler, 1992). Results of a study by Neumark-Sztainer (1999) showed that for adolescents the appeal of food (primarily taste) belonged to the primary factors mentioned for food choice. It is showed that the most energy-dense foods (such as fat and sugar) are usually the most palatable (Drewnoski, 1998), while vegetables come particularly low down the list of food preferences (Gibson et al., 1998; Wardle et al., 2001).

8.4 Cost

Cost is found to be a determinant of food choice (Glanz et al., 1998). It is showed that people are sensitive to the costs of food by a study of Kelly and Stanner (2003). Whilst there have been some successes in changing the population's diet trough an intervention campaign in the UK, these have mostly occurred where consumers have been able to make similar choices at no extra cost (e.g. switching to lower-fat milks and reduced-fat spreads). Furthermore it is found that "healthy" foods are far more expensive than "unhealthy" foods: Drewonowski and Darmon (2005) used French retail prices of 895 foods to show that fats and oils, sugar, refined grains, potatoes and beans provided dietary energy at the lowest cost. The cost per calorie of meats, fish and shellfish, dairy products, vegetables, and fruit was much higher. In a study of low-income families, fruit and vegetable expenditures were relatively low. Also bananas were far more likely to be purchased than were the more expensive berries and other fruit (Leibtag & Kaufman, 2003). Hence, since fruit and vegetables are more expensive than snacks or are extra expenses instead of replacements of other food, this might be the reason that people don't buy it or buy only small amounts.

Taste preferences (Domel et al., 1996; Rescinow et al., 1997; Reynolds et al., 1999) and availability (Cullen et al., 2000; Hearn et al., 1998; Reynolds et al., 1999) have been identified as two of the strongest and most consistent correlates of fruit and vegetable intake in children and adolescents (Blanchette & Brug, 2005).

In summary, the most important reported barriers that influence fruit and vegetable consumption are availability, convenience, taste and costs.

9. THEORIES

In order to investigate the relationship between knowledge and behavior I will use one of the most important and most frequently used theories for predicting behavior, namely the *Theory of Planned Behavior* (TPB) (Ajzen, 1991). Besides this theory I will also explain the *stages of change model* (Prochaska et al., 1992) that can be linked to the TPB and helps us to better understand the predictors of behavior. With these theories I will compose a model that will be tested and provides us with an answer to the question: Is knowledge about fruit related to fruit consumption?

9.1 THEORY OF PLANNED BEHAVIOR (TPB)

According to the Theory of Planned Behavior (Ajzen, 1991) behavior is predicted by intention, which in turn is predicted by attitudes, subjective norm and perceived behavioral control (figure 1). Intention captures the motivational factors that influence behavior, e.g. to consume fruit and vegetables. Attitude refers to the degree to which a person has a favourable or unfavourable evaluation or appraisal of the behavior in question (Bogers et al., 2004). Measures of attitudes are behavioral beliefs, which are subjective evaluations about the specific outcomes or consequences of performing the behavior. Subjective norm refers to the perceived social pressure to perform or not perform a certain behavior. Underlying the subjective norms are the normative beliefs, i.e. perceptions of specific significant others' preferences about whether one should or should not perform the behavior. Perceived behavioral control reflects the perceived ease or difficulty of performing a particular behavior. Ajzen (1991) states that perceived behavioral control realistically reflects actual control. Hence, this perceived behavioral control is strongly connected to the 'barriers' (e.g. availability, cost, convenience) that are mentioned earlier. PBC is thought also to have a direct effect on behavior, which is not mediated trough intention. In general, the more favourable the attitude and subjective norm, and the greater the perceived control, the stronger intention to perform a given behavior should be.

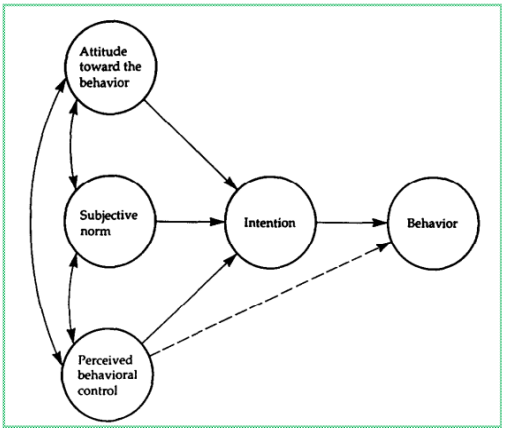


Fig. 1: Theory of Planned Behavior (TPB) (Ajzen, 1991)

This model has shown good predictive power for a variety of different behaviors (Ajzen & Fishbein, 1980) and is used in many studies to investigate the consumption of fruit and vegetables. In general, the TPB is considered to be a sufficient model for developing health

behavior change interventions (Hardeman et al., 2002) and to understand fruit and vegetable consumption (Godin & Kok, 1996; Gaillaumie et al., 2010).

Differences were found between the TPB models for fruit and vegetable consumption. Guillaumie et al. (2010) used 23 studies to study the determinants of intention and actual consumption of fruit and vegetables. They conclude that the TPB performs well to predict actual consumption and intention of fruit and vegetables, but the proportion of variance explained by TPB for fruit consumption (28%) was higher than for vegetables (10%) and was also higher for intention to consume fruit (43%) than intention to consume vegetables (31%). They also found that in the TPB framework for vegetables there was an additional association with taste, supporting the idea that vegetable consumption is more influenced by taste than fruit consumption.

Bogers et al. (2004) found that perceived behavioral control has a stronger relationship with behavior for vegetables than for fruit. As will be explained in chapter 10 the focus of this study is on fruit consumption. Research to date has shown that about a third to a half of the total variance in intention towards fruit consumption can be explained by TPB variables, whereas intention and/or PBC generally explain about a third of the variance in fruit consumption (Blanchard et al., 2009; Bogers et al., 2004; Brug et al., 2006; De Bruijn et al., 2006; Lien et al., 2002). For example in a meta-analysis including 185 interdependent studies on the predictive potential of the TPB for a variety of health-related behaviors, the TPB explained 27 and 39 percent of the variance in behavior and intention, respectively (Armitage & Conner, 2001).

9.2 STAGES OF CHANGE

More insights about the prediction of fruit consumption can be provided by the "stages of change model" by Prochaska et al. (1992). According this model the modification of addictive behaviors involves progression trough five stages – precontemplation (no intention to change behavior), contemplation (awareness of the existence of a problem but no commitment to take action), preparation (intending to take action in the next month), action (individuals modify their behavior), and maintenance (individuals prevent relapse) (figure 2). In each of the different stages a set of different tasks are needed. This means

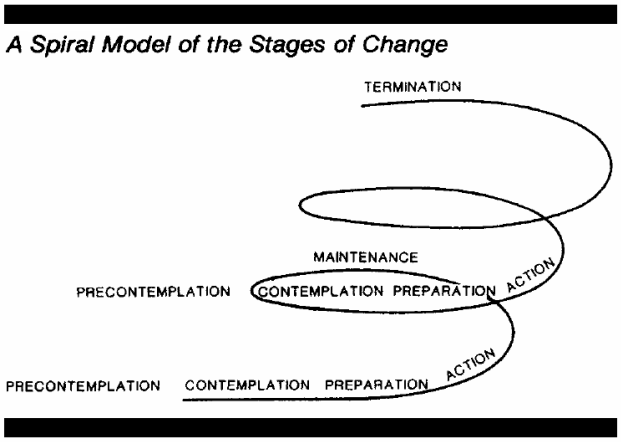


Fig. 2: The stages of change model (Prochaska et al., 1992)

that an intervention method should be adjusted to the stage of our individual in order to be successful (Prochaska et al., 1992a; 1992b). To treat all the individuals as if they were the same would be naïve. Yet, that is what often happens in interventions programs and frequent mismatches occur (Prochaska et al., 1992a). So in which stages does knowledge ("consciousness raising") plays a role then? In figure 3 the findings of Prochaska et al. (1992) are showed. Individuals in the contemplation stage were most open to consciousness-raising techniques. Consciousness-raising is defined as "*increasing information about self and problem: observations, confrontations, interpretations, bibliotherapy*" (Prochaska et al., 1992a). A part of this is the exposure to knowledge about the health benefits of more consumption of fruit and vegetables and the consequences of the lack of consumption of these foods. This is in line with our intuition: Individuals should know that they are doing something wrong before they plan to change their behavior. In further stages action-oriented therapy is more effective, because these individuals are willing to change their behavior (they have knowledge) but can use some help in implementing these changes. They can also be exposed to knowledge in this stage, but this knowledge should be very action oriented, such as cooking tips.

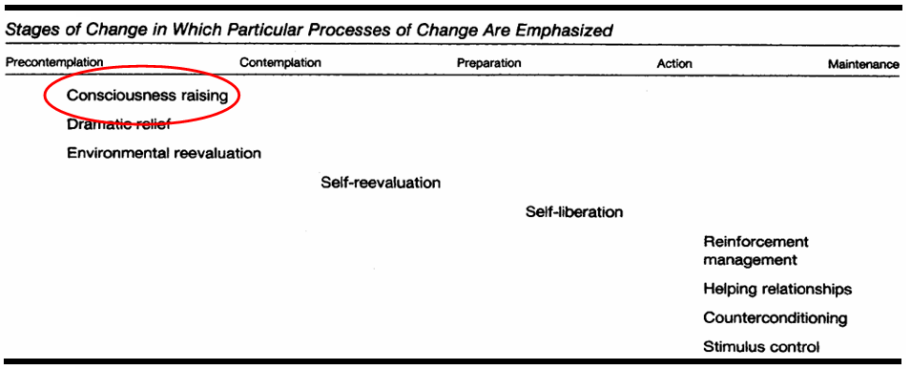


Fig. 3: Specification stages of change model

Thus for individuals in a further stage of behavior methods to overcome barriers play a bigger role. According this theory knowledge is more important in early stages (when individuals have low consumption) than further stages. Actual behavior is also dependent on other factors. Other studies also support the idea that knowledge is usually predictive of a precautionary behavior during the early stages of a health issue when many people are not yet aware of the threat and that its influence declines as information becomes widespread (Jill et al., 1987; Sheeran et al., 1999).

This idea is supported by the findings of Pollard et al. (2007) who evaluated the Western Australian Health Department's Go for 2&5 campaign. This campaign, conducted from 2002 to 2005, included mass media advertising (television, radio, press and point-of-sale), public relations events, publications, a website and school and community activities, aimed to increase

adults' awareness of the need to eat more fruit and vegetables. Greater increases in intakes were seen at adults with lower intakes in the beginning of the intervention. This might be because these adults were in the precontemplation stage and therefore their intake was lower. Adults that already consumed more fruit and vegetables might be some stages further and therefore needed other approaches than consciousness rising. This can also be linked at the TPB: Menozzi and Mora (2012) found that for high fruit consumers the importance of attitude was smaller than for low fruit consumers. This suggests that influencing attitude is more effective for low fruit consumers than for high fruit consumers. This supports the idea of the stages of changes model, namely that individuals move through stages and that when they are in a further stage (where the consumption is high) other factors are more (or less) important than when they are in an early stage (where the consumption is low).

The previous findings are in line with results of a study of Menozzi and Mora (2012) (figure 4). They performed a study on Italian university students (n=692) to explain fruit consumption behavior and determinants based on the TPB. For low fruit consumers the role of attitude in predicting intention is higher than for high fruit consumers. This suggests that for this target group an effective method to increase fruit consumption would be to change their attitude.

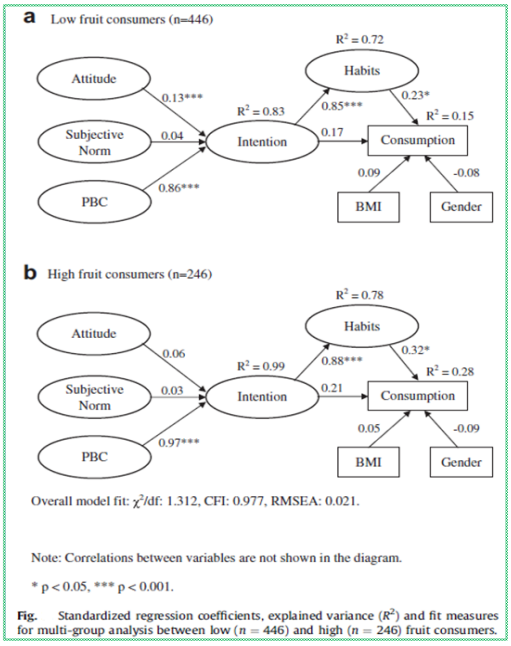


Fig. Standardized regression coefficients, explained variance (R^2) and fit measures for multi-group analysis between low (n = 446) and high (n = 246) fruit consumers.

Fig. 4: Results Menozzi & Mora (2012)

Prochaska et al. (1992) found that the dynamic measures of the processes and stages of change outperform static variables, like demographics and problem history, in predicting the outcome of behavior change. Therefore, this theory is something that is worth to implement in this research.

One comment has to be made; this model is developed to predict *addictive* behaviors, and particularly to *decrease* these behaviors, such as alcohol abuse, smoking, obesity and opiate use. This is not the same as changing fruit consumption, where we want to *increase* a certain behavior. However, I belief this model can be used in this context. That is, although increasing the fruit consumption would indirectly mean that the consumption of other (more unhealthy) foods would have to decrease, the message to "eat more" is perhaps more easy than to beat addictions: Negative messages, encouraging consumers to 'cut down', 'eat less' or 'avoid' certain

foods, are destined to meet with powerful resistance, while the message to eat more fruit and vegetables encourages a higher consumption. It is assumable that individuals have less relapses to earlier stages and moving them to a further stage is relatively easy. In short, despite the nature of this theory (addictive behaviors) it is plausible that individuals move trough similar stages when we try to increase the fruit and vegetables consumption.

In this study, I will focus on the Theory of Planned Behavior, because of the many studies that used this theory in the prediction of fruit consumption. The insights from the stages of change model will be used to form hypotheses (chapter 14) and explain the results in the discussion (chapter 15).

10. RESEARCH DESIGN

Before I continue with the formulation of the hypotheses I will refine some choices of this study, since they affect my hypotheses.

10.1 FOCUS ON FRUIT CONSUMPTION

As has been discussed in chapter 9, there are differences between the TPB frameworks for fruit and vegetable consumption. Therefore, to properly investigate the relationship between knowledge and behavior I choose to focus on only one of the two food groups, namely on the consumption of and knowledge about fruit. The reason is threefold. First, in the Netherlands vegetables constitute a part of the evening meal, whereas fruits are usually eaten between meals, e.g. as snacks. Because meals are often eaten together with other people the choice for vegetables can be more dependent on the behaviors and attitudes of others, whereas fruit is more likely to be a pure individual choice (at least in most cases). Second, it seems that barriers, such as convenience and taste play a bigger role for the consumption of vegetables than for fruit (Bogers et al., 2004; Guillaumie et al., 2010). For example, difficulty in preparation is especially present for vegetables (convenience) and it has been found that vegetables come particularly low down in the list of food preferences (Gibson et al., 1998). Third, although the TPB model performs well to predict actual consumption and intention of fruit and vegetables, as is discussed in chapter 9, the proportion of variance explained by TPB for consumption and intention for fruit was higher than for vegetables (Guillaumie et al., 2010). Because of these three reasons, that is, individuals are more in control of their fruit consumption than vegetable consumption, the role of barriers is lower for fruit consumption than vegetable consumption and TPB is proven to be a better predictor for fruit consumption than for vegetable consumption, it is more difficult to measure the relationship between knowledge and behavior for vegetables than for fruit. I therefore choose to study the consumption and knowledge of fruit.

10.2 COLLEGE STUDENTS

The sample in this study contains mostly students. It is relevant to investigate the relationship particularly for this target group, because on the long run effective interventions for this target group will affect a large part of the population. That is, food patterns established during college are likely to be maintained for life and therefore may have long-lasting influences on not only college students' future health, but also that of their future families (Brown et al., 2005; Kelder et al., 1994). Also, Chung et al. (2006) found that the awareness of the health benefits of fruits and vegetables and the effects of poor dietary practices is less for college students than for adults. Therefore there is more room for improvement of knowledge for college students than

for adults, and when supporting evidence is found for a link between knowledge and consumption this might be an easy way to increase consumption. Finally, typically, college students are at an age of transitioning from parental supervision to independent living where they can make their own food choices. This makes them less dependent on the preferences of their parents (who are typically in charge of the groceries) and more dependent on their own preferences. This is a favourable condition to investigate the relationship between knowledge and fruit consumption.

Several studies investigated the food intake of students. It is well documented that college students have unhealthy eating behaviors, including skipping meals (Huang et al., 1994), frequent snacking on energy-dense food (Skinner et al., 1984), and engaging in unhealthy weight-loss methods (Bull, 1988; Liebman et al., 2001). Generally in good health, young adults often are ambivalent about their future health and the role that nutrition plays (Betts et al., 1995). Not surprisingly, it has been found that fruit and vegetable consumption among college students is below the current recommendations (Chung & Hoerr, 2005; Georgiou et al., 1997; Hiza & Gerrior, 2002; Richards et al., 2006). It has been found that only a small percentage of college students are consuming the recommended number of servings for fruits, vegetables and dairy (Georgiou et al., 1997; Hiza & Gerrior, 2002).

Silliman et al. (2004) investigated the diet and perceived barriers to following a healthy lifestyle of college students in California. They found that breakfast was the most commonly missed meal and 63% of students snacked one to two times per day. Fifty-eight percent of participants ate vegetables and 64 percent ate fruit less than once per day. Most of the students (>40%) listed “lack of time” as the most important barrier to eating well. Other listed barriers were “lack of money” (22%) and “taste preferences” (15%). Note that “lack of knowledge” is not a barrier. This is also to see in another fact: 51 percent of participants rated their “healthiness” of their eating habits as “poor” or “fair”, indicating that they know they are doing something wrong, but nevertheless they don’t eat healthier. Men stated “don’t care” more than women.

10.3 DIFFERENT TYPES OF KNOWLEDGE

In most of the studies that were discussed thus far, knowledge is defined as knowledge about nutrients, or about diseases, or a combination of the two. In some studies the definition of knowledge is unspecific and not clearly explained. As was explained in chapter 7 the inconsistency in measurement might partly explain the ambiguous results regarding the link between knowledge and consumption. To properly investigate the relationship and bring clarity in the ambiguous findings, I will distinguish between different types of knowledge. Based on the

definitions of knowledge in previous studies and the suitability to investigate them, I will distinguish between three types of knowledge, namely:

- Knowledge of nutrient content of fruits (= *nutrient knowledge*)
- Knowledge about the effect of fruit consumption on long term health; such as the prevention of cancer and heart and vascular diseases (= *disease knowledge*)
- Knowledge about practical issues; the ability to put knowledge into practice (= *practical knowledge*)

11. HYPOTHESES

In this chapter the hypotheses are presented. The TPB model will be used as a starting point (chapter 11.1) and will be extended with knowledge variables (chapter 11.2) and other variables (chapter 11.3).

11.1 TRADITIONAL TPB VARIABLES

11.1.1Attitude

Many studies support the relationship between attitudes and intention in the context of fruit and vegetables (Blanchard et al., 2009; Bogers et al., 2004; De Bruijn, 2007; Della et al., 2009). Some studies also found a direct link between attitudes and behavior that is not mediated by intention (Blanchard et al, 2009; Brug et al., 1995; Lechner et al., 1997). Differences between findings may be caused by the different definitions and types of attitudes. Blanchard et al. (2009) distinguished two types of attitude when investigating the fruit and vegetable consumption amongst college students, namely affective (e.g. eating 5 servings a day is enjoyable) and instrumental (e.g. eating 5 servings of fruits and vegetables per day is beneficial for health) attitude. They found that only affective attitude ($b = 0.16$, $p < .05$) and perceived behavioral control ($b = 0.59$, $p < .05$) were significant predictors of intention, which in turn was a significant predictor of behavior ($b = 0.32$, $p < .05$). No significant relationship was found between instrumental attitude and other TPB variables. This is contradictory to findings of Gibson et al (1998), who found a relationship between the conviction of mothers' that increasing their children's fruit and vegetable consumption could reduce their risk of developing cancer, and the fruit and vegetable intake of their children.

To investigate the relationship between attitude and intention I will hold on to the definitions of Blanchard et al. (2009) and distinguish between affective and instrumental attitude. Based on the literature I expect affective attitude to influence consumption indirect through intention (Blanchard et al., 2009) and also direct. The latter hypothesis is not supported by Blanchard et al. (2009), but is supported by the finding that taste (which can be seen as an aspect of attitude) influences behavior directly (Lien et al., 2002). I expect a positive relation between instrumental attitude and intention.

H1. Affective attitude has a positive effect on intention

H2. Affective attitude has a positive effect on consumption

H3. Instrumental attitude has a positive effect on intention

11.1.2Subjective norm

With regard to the role of subjective norm (or perceived social pressure) in the theory of planned behavior the findings are ambiguous. Several studies found a significant relationship between subjective norm and intention within the fruit and vegetable context (Brug et al., 2006; Conner et al., 2002; Povey et al., 2000; Sjoberg et al., 2004). Bogers et al. (2004) also found a significant relationship between subjective norm and intention, but this relationship was very weak. There was no direct relationship between subjective norm and behavior. Since this study was based on questionnaires about the daily consumption of at least two pieces of fruit and 200 gram of vegetables (the Dutch recommendations) amongst Dutch women (mean age 41), this is a relevant finding. The weak relationship between subjective norm and intention has also been found in other studies (Armitage & Conner, 2001; Brug et al., 1995; Shepherd, 1989; Shepherd & Stockley, 1985). Blanchard et al. (2009) reported slight effect of perceived social pressure in college students to consume five servings of fruit and vegetables per day.

Some studies have found that subjective norm is no predictor at all: Menozzi and Mora (2012) studied the attitude and behavior of 692 Italian university students and found that subjective norm is not a significant predictor of intention. Similar results are found by De Bruijn (2010), who reported no significant effect of subjective norm on fruit consumption among undergraduate students in the Netherlands. Several food-related studies have argued that the subjective norm component is inadequate and rarely predicts intention, and so have removed it from analysis (Honkanenet al., 2005).

These contradictory results regarding the role of subjective norm in the prediction of intention may be caused by several factors, for example by sampling differences and the measurement and definition of subjective norm and behavior. It is argued that future studies should explore this issue before concluding that a social component may not be needed in fruit and vegetables interventions for college students (Blanchard et al., 2009). Therefore, the hypothesis regarding subjective norm is:

H4. Subjective norm has a positive effect on intention

11.1.3Perceived Behavioral Control (PBC)

The third predictor, perceived behavioral control (PBC) is found to have a significant role in predicting behavior (Armitage & Conner, 2001; Brug et al., 2006; Godin & Kok, 1996; Godin et al., 2010; Shaikh et al., 2008). Bogers et al. (2004) found that PBC is the most important predictor of intention and also has a direct effect on fruit and vegetable consumption. The finding that actual behavior depends both on intention and PBC is also supported by other studies (Ajzen, 1991). Menozzi and Mora (2012) did not find a direct link between PBC and

behavior. However, they did found that the effect of PBC on intention is even stronger than attitude on intention. They therefore suggest that to increase fruit consumption, interventions should improve fruit availability and develop individuals' ability to overcome barriers.

Blanchard et al. (2009) found similar results in their study amongst college students. PBC was not related to behavior, but the association between PBC and intention was 3½ times larger than the association between affective attitude and intention. Therefore they recommend that interventions to increase fruit and vegetable intake should include strategies to increase the student's sense of control to engage in this behavior as a central component.

H5. Perceived behavioral control has a positive effect on intention

H6. Perceived behavioral control has a positive effect on consumption

11.1.4 Intention

The TPB model states that intention will be the strongest predictor of behavior. Many studies support this relationship between intention and the consumption of fruit and/or vegetables (Blanchard et al., 2009; Brug et al., 2006; Guillaumie et al., 2010; Menozzi & Mora, 2012). However, opposite results are also found; Kvaavik et al. (2005) and Bogers et al. (2004) found that (after the exclusion of outliers) intention was *not* related to self-rated fruit and vegetable consumption. Within these studies, perceived behavioral control was the lone predictor of behavior. Ajzen (1991) suggests that intention will be the strongest predictor of fruit and vegetable consumption when it is perceived to be under the persons' volitional control, whereas perceived behavioral control will be the strongest predictor when it is not perceived to be under their volitional control.

H7. Intention has a positive effect on consumption

Bogers et al. (2004) investigated the TPB framework for fruit and vegetable consumption separately. They found that all three constructs (attitude, subjective norm and perceived behavioral control) were significantly correlated, except for perceived behavioral control and subjective norm. I choose not to investigate the intercorrelations of the traditional TPB variables, because the focus on this study is to investigate the relationship between knowledge and other TPB variables. Explaining the traditional TPB variables in more detail is unlikely to provide more insight about the relationship of knowledge and other TPB variables and therefore is beyond the scope of this research.

In summary, I expect the TPB model to hold where intention is the strongest predictor of fruit consumption. Intention is predicted by affective attitude, instrumental attitude, subjective norm

and perceived behavioral control. In extension to the traditional model I distinguish two types of attitude and I expect fruit consumption to be not only directly dependent on intention and perceived behavioral control, but also on affective attitude.

11.1.5Habits

It is recommended to extend the traditional TPB model with new variables to improve the prediction of behavior and intention (Guillaumie et al., 2010). One expansion is adding a fourth variable: habit strength. Habit is a psychological construct, involving both repetition and automaticity (Verplanken & Orbell, 2003). Frequent acts like fruit consumption, which is generally volitional, may become routine and lead to an automatic repetition of behavior (Godin et al., 2010).

This is studied by De Bruijn (2010) who investigated the effect of habit strength in the explanation of Dutch young adults' fruit consumption within the context of the TPB. In his study it was shown that habit strength influences behavior in two ways. Habit strength increased the amount of explained variance in fruit consumption and it moderated in the intention-consumption relationship. The intention-consumption relationship was more than twice as strong at low levels of habit strength than at high levels of habit strength. This implies that stronger fruit consumption habits make fruit consumption less intentional and thus that altered intentions do not necessarily lead to noticeable behavioral changes (De Bruijn et al., 2007, 2008, 2009). This is supported by other studies (Aarts et al., 1997).

Thus, fruit consumption has not only an intentional component, but also a habitual and automatic component. Menozzi and Mora (2012) studied the effect of habits as a mediator in the intention-consumption relationship. They find that the TPB variables (attitudes, subjective norms and perceptions of control) explained 72 percent of intention to consume at least 200g/d of fruit and 15 percent of actual fruit consumption. These figures increase, respectively, to 88 percent and 20 percent after they included habits as a mediator.

Although literature supports both the role of habits as a moderator and mediator in the intention-consumption relationship, I choose to only investigate one of these effects, namely the mediator effect.

H8. The relationship between intention and consumption is mediated by habits

11.2 KNOWLEDGE

Shepherd and Towler (1992) investigated the relationships between nutrition knowledge and attitudes related to fat intake from meat products, dairy products and fried foods. They measured knowledge by a questionnaire including nutrient density sections on protein,

carbohydrate, fat and dietary fibre, and a section of multiple-choice questions. No distinction was made between affective and instrumental attitude. They found nutrition knowledge showed some statistically significant (but small) correlations with components of attitudes. Hence, knowledge can be seen as influencing behavior through attitudes. The authors therefore argue that knowledge is less clearly related to consumption than are more specific beliefs and attitudes.

Guillaumie et al. (2010) investigated a total of 23 studies that assessed the predictive value of social cognitive theories (e.g. theory of planned behavior, social cognitive theory, etc.). These studies included both longitudinal and cross-sectional studies focusing on prediction of fruit and vegetable intake. Their results indicate that the TPB model can be extended with knowledge. That is, in 50 percent of the studies knowledge had a direct effect on the consumption of fruit and vegetables. In their review, the most consistent variables associated with fruit and vegetable intake were habit, intention, PBC and knowledge (these variables were found to be significant in at least 50 % of the studies), but no significant relationship between knowledge and intention was found. The small numbers of the studies included in this research and the absence of a unanimous definition of knowledge should be taken into account when interpreting these results.

An important note here is the difference between knowledge and attitudes. Knowledge is defined as the actual cognition about the nutrition value of fruits and the empirical evidence about the effects on health and the prevention of diseases. Attitude is formed by beliefs about whether the consumption of fruit will actually lead to a better health for the individual and if he or she finds the consumption enjoyable. It seems intuitive that more knowledge about the effects of fruit consumption on health will also lead to a more favourable attitude towards fruit consumption, but this might not always be true. For example because of the optimistic bias; the belief of a person that he or she is less at risk of experiencing a negative event compared to others (Miles & Scaife, 2003). In this case knowledge about the role of fruit in for example the prevention of heart diseases does not lead to a more favourable attitude. This is because the person underestimates the chance of him or her getting a heart disease anyway and therefore has no or only little incentive to reduce this chance even further. Furthermore, more healthy food is sometimes seen as less tasteful; a negative relationship has been found between healthiness and tastiness (Raghunathan et al., 2006).

As is explained in chapter 10 three types of knowledge are distinguished in this study. I will now elaborate on the hypotheses for the separate types of knowledge.

11.2.1Nutrient knowledge

Nutrient knowledge is defined as theoretical knowledge about nutrients, such as the amount of calories in fruit and the recommended daily intake of vitamin C. Although this does not contain information about the health effects of these nutrients, it is plausible to assume that most people are aware of certain information about nutrients; for example, vitamin C helps to keep your body healthy or eating too much fat causes gain weight. Typically, people learn about this health effects at a young age. Therefore it is plausible that they developed habits ever since. This way nutrient knowledge is indirectly related to fruit consumption. This is in line with many of the studies that are discussed in chapter 7, who found some relationship between nutrient knowledge and fruit consumption.

Also I expect a positive relationship between nutrient knowledge and disease knowledge, because it is likely that individuals with more knowledge about the effects of fruit on disease prevention also know more about nutrients, and the other way around. It might be that these individuals have a general interest in health.

H9. Nutrient knowledge has a positive effect on habits

H10. Nutrient knowledge and disease knowledge are positively related

11.2.2Disease knowledge

Disease knowledge is defined as the knowledge about the role of fruit in the prevention of 'long term' diseases, such as forms of cancer, heart diseases and obesity. In general many students are in good health and these diseases are relatively far in the future. Therefore I do not expect a direct relationship between disease knowledge and intention or consumption. However, I expect disease knowledge to be related to instrumental attitude; knowing the general health effects of fruit may influence an individual's perception about fruit consumption of his or her own health. This is in line with previous literature that found knowledge to influence behavior through attitudes. Furthermore, I also expect disease knowledge to influence behavior through habits for the same reason that nutrient knowledge influences habits: although there is no direct effect of knowledge on consumption, knowledge subconsciously influences consumption through the development of habits.

H11. Disease knowledge has a positive effect on instrumental attitude

H12. Disease knowledge has a positive effect on habits

11.2.3Practical knowledge

Of all the types of knowledge, I expect practical knowledge (the ability to put knowledge into practice) has the largest effect on behavior. This is because this type of knowledge takes an action-oriented instead of a theoretical approach. As is explained in the "stages of change"-model action-oriented approach is more effective for individuals in a further stage: they want to change (i.e. have knowledge about health effects) but can use some help implementing these changes. Therefore a first hypothesis will test the relationship between disease knowledge and practical knowledge; individuals who know the health benefits might also be more likely to have gained the knowledge on how to exploit these benefits.

Since knowing how to consume fruit might lower certain barriers and the perception of control I expect practical knowledge to have a positive effect on perceived behavioral control. That way practical knowledge influences both intention and behavior through perceived behavioral control. Since practical knowledge has no direct link with health benefits I do not expect it to influence instrumental attitude (nor affective attitude and subjective norm). It is also plausible to believe that there is a relationship between practical knowledge and habits, because individuals with much practical knowledge are likely to be high consumers and develop habits. Therefore I want to test for the following hypothesis:

H13. Disease knowledge and practical knowledge are positively related

H14. Practical knowledge has a positive effect on perceived behavioral control

H15. Practical knowledge has a positive effect on habits

11.3 DEMOGRAPHIC DIFFERENCES

Earlier I mentioned that it is recommended to extend the traditional TPB model with new variables to improve the prediction of behavior and intention (Guillaumie et al., 2010). With this in mind I will add demographics to this framework as well. It has been found that there are demographic differences in fruit and vegetable intake. These differences might also influence the relationships within the TPB framework. In this chapter I will give an overview of the most important and relevant demographic differences and how they might influence the relationship between knowledge and other variables in the model.

11.3.1Gender

Many studies have noted that women eat more fruits and vegetables than men (Smith & Smith, 1994; Pollard et al., 2007; Thompson et al., 1999; Wardle et al., 2000). In a study of Stables et al. (2002) it was found that women consumed 0.6 more daily servings than did men in both 1991 and 1997 and women are more likely to consume 5 or more daily servings of vegetables and

fruit than were men. Besides these behavioral differences many studies found gender differences in nutritional knowledge, with females having higher nutrition knowledge scores (Crawford & Baghurst, 1990; Parmenter et al., 2000; Shepherd & Towler, 1992; Tate & Cade, 1990). Baker and Wardle (2003) found that about half of the variation associated with gender is because of the lower awareness of the health recommendations or health benefits of men. Another explanation for the gender difference is that men regard fruit and vegetables less positively, since they appear to be less concerned about healthy eating than women (Courntenay et al., 2002; Dean, 1989; Furnham & Kirkaldy, 1997; Lennemas et al., 1997; Wardle et al., 1997). Women tend to have a greater interest in healthy diets and a desire to eat food lower in calories (Fagerli & Wandel, 1990; Rolls et al., 1991). Based on these findings I expect all three types of knowledge to be higher for women than for men. This leads to the following hypotheses, in which women have more knowledge than men:

H16. Women have more nutrient knowledge than men

H17. Women have more disease knowledge than men

H18: Women have more practical knowledge than men

Also I expect the strength the relationship between disease knowledge and instrumental attitude to be higher for women. This is because women are more concerned about their health. When women are more aware of the effects of fruit consumption on health, this is more likely to translate into a behavior change than for men. The effect of disease knowledge on fruit consumption works through instrumental attitude, for which the link between disease knowledge and instrumental attitude is stronger for women than for men:

H19: The relationship between disease knowledge and instrumental attitude is moderated by gender: the relationship is stronger for women than for men

11.3.2Age

Wardle et al. (2000) found that younger people (<35) ate less fruit and vegetables and a higher intake was associated with people over the age of 35. Being in the over-65 age-group did not have significant independent associations with intake. A study of Stables et al. (2002) found that people older than 65 are more likely to consume 5 or more daily servings of fruit and vegetables. One possible explanation for the lower intake amongst younger people is because younger people prefer to spend less time in food preparation (Neumark-Sztainer et al., 1999). This suggests that for older people perceived behavioral control is higher than for younger people. Another explanation is that older people are more concerned with their health than younger people. Therefore it might be that older people are more sensitive to an increase in

knowledge than younger people. However, since I expect the students in my sample to have more or less the same lifestyle there will be no hypothesis about this.

11.3.3Physical activity

Many have pointed out the relations between physical activity and eating behaviors such as fruit consumption (French et al., 2001; Kamphuis et al., 2007). Deshmukh-Taskar et al. (2007) found that active individuals consumed more servings of fruits than inactive individuals. It has been noted that unhealthy lifestyle patterns (e.g., lack of exercise) and less healthful eating patterns (e.g., lower intake of fruits and vegetables and/or higher intake of fats) tend to cluster among individuals (Jago et al., 2005; Robinson et al., 2004; Van Dam et al., 2003). Because of this clustering it is reasonable to expect a relationship between physical activity and fruit consumption, that is: people who frequently practice physical activity consume more fruit. I expect this relation to work indirectly through habits: People who practice physical activity frequently have developed stronger habits towards eating fruit and therefore eat more fruit.

H20. Physical activity has a positive effect on habits

11.3.4Education

It has been found that a higher educational level is associated with greater fruit consumption (De Irala-Estévez et al., 2000) and higher nutrition knowledge (Wardle et al., 2000). More educated adults were more likely to consume 5 or more daily servings of vegetables and fruit (Stables et al., 2002). The difference in education may be because education incorporates the very information that is incorporated in the study. People who are better educated may also be better able to make use of written material like newspaper articles and leaflets, to gain information and implement it in their lifestyles. They might also be better in understanding sometimes complex information about diet-disease links. It can therefore be hypothesized that the relationship between knowledge and intention (or behavior) is stronger for high educated than for low educated people. However, since almost all of the participants in this sample are students from the same university I will not test this hypothesis.

11.3.5Socio-economic status

The education, occupation and income are combined in a person's social position in relation to others, the socio-economic status (SES). It has been found that individuals of low socio-economic status (SES) eat fewer fruits and vegetables (Ball et al., 2004; De Irala-Estévez et al., 2000; Johansson et al., 1999; Subar et al., 1995) than individuals belonging to higher SES groups (Hulshof et al., 2003; Robinson et al., 2004). It has been suggested that social support for healthy eating varies across SES groups, with those of low SES reporting poorer support (Inglis et al., 2005). Also availability and accessibility of affordable healthy foods and food stores may be

poorer in socio-economically disadvantaged neighbourhoods (Morland et al., 2002; Sooman et al., 1993), although Ball et al. (2005) do not find evidence for this explanation in their study. They suggest that other factors not considered here may be important mediators. Wardle et al. (2000) found that people of higher socio-economic status have more nutrition knowledge. Since the participants in this study are most likely for the same socio-economic status I will not test for this demographic variable.

Other demographic variables that might influence the consumption of fruit and vegetables and/or the relationship between knowledge and behavior are for example BMI (Menozzi & Mora, 2012), smoker differences (Stables et al., 2003) and individuals' risk for diseases (Pomerleau et al., 2005).

12. THE CONCEPTUAL FRAMEWORK

All the hypotheses from chapter 11 are represented in this framework:

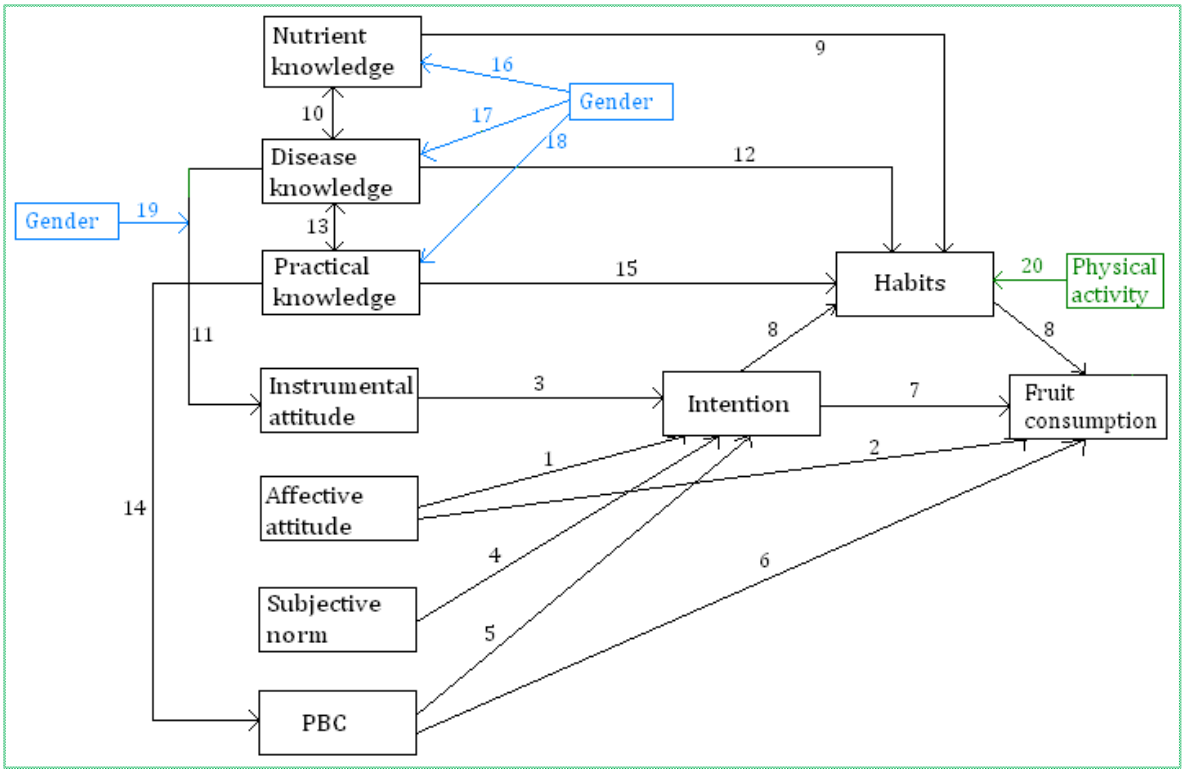


Figure 5: Framework of hypotheses

The framework shows that the TPB model is extended with three types of knowledge, namely knowledge about nutrients, diseases and practical issues. All three types of knowledge are related to habits. Disease knowledge and practical knowledge are expected to also affect instrumental attitude and perceived behavioral control, respectively. Furthermore, gender and physical activity are added to increase the prediction power of the model. In the following chapters the method is explained and the hypotheses will be tested.

13. METHOD

13.1 DESIGN AND SAMPLE

Data was collected by an online Dutch questionnaire. Respondents were recruited by personal emails and emails to groups of students with the link to the questionnaire.

13.2 MEASURES

13.2.1 Fruit consumption

Fruit *consumption* is measured in two ways. First, respondents were asked to indicate on how many days per week they consume fruits (0=never, 7=every day) and how many portions they consume on such a day. An average amount of portions of fruit per day was calculated by multiplying frequency with usual amount and dividing the resultant score by seven. This measure is used in the study from Menozzi and Mora (2012). Second, respondents were asked to indicate on how many days in the past week they consumed the following fruits: apples or pears, citrus fruits (such as oranges, lemons, and grapefruits), tangerines, bananas and other fruits (such as grapes). They further indicated the number of portions on such a day. An average amount of portions of fruit per day was calculated as before. This method is originating from the study of De Bruijn (2010) and has been validated against 7-day diary and biomarkers (Bogers et al., 2004; Van Assema et al., 2002). Prior to completing the TPB questionnaire, students were provided with the definition of a portion size for fruit. To determine the level of fruit consumption the average of the two methods is used. Both methods have their own drawbacks. Asking the respondents about their average consumption (method 1) is sensitive to subconscious misjudgement or conscious overestimation, for example because of the social desirability bias. By asking the respondents about their consumption in the past week (method 2) the unreliability of memory can be a problem. By making the time frame of recalling fruit consumption one week I expect this not to be a big problem. This measure of consumption is relatively specific and uncorrected for seasonal or occasional variation in their consumption. By taking the average of the two methods I expect the drawbacks of each method to outweigh each other.

13.2.2 TPB measures

Direct TPB-measures were assessed regarding eating at least two portions of fruit per day, which is the Dutch norm for fruit consumption. The questions were based on the manual for constructing a TPB questionnaire (Ajzen, 2002) and the survey of De Bruijn (2010). Questions were based on a one-week time frame, which is a balance between specific and general behavior (Ajzen, 2002).

Intention was assessed by two items: (1) “I will try to eat at least two portions of fruit each day in the forthcoming week”; (2) “I plan to eat at least two portions of fruit each day in the forthcoming week”.

Both types of attitude were measured with two or three questions. Regarding *instrumental attitude,* respondents indicated whether for them to eat at least two portions of fruit per day in the forthcoming week was: (1) positive for their health; (2) make them feel healthy. Regarding *affective attitude*, respondents indicated whether for them to eat at least two portions of fruit per day in the forthcoming week was: (1) enjoyable; (2) pleasant and (3) tasteful.

Subjective norm is measured by three items within the following stem: ‘‘during the next week, most people who are important to me (insert item here) eat at least two portions of fruits each day.’’ The 3 items were (1) think I should, (2) approve of me, and (3) support me.

Two items were conducted to measure p*erceived behavioral control (PBC),* namely: (1) “If I wanted to I could eat at least two portions of fruit each day in the forthcoming week”, (2) “Eating at least two portions of fruit in the forthcoming week is difficult for me”.

Habit strength was based on the study of De Bruijn (2010) who used nine statements based on the self-reported habit index (SRHI) (Verplanken & Orbell, 2003). This survey measure of habit strength has shown high test-retest reliability (Verplanken & Orbell, 2003), high internal reliabilities regarding fruit consumption (Brug et al., 2006; De Bruijn et al., 2007) and other health behaviors (De Bruijn et al., 2008, 2009), and has been validated against other measures of habit strength (Verplanken et al., 2005). Given the overlap of the nine statements only three of them were selected. Respondents indicated to what extent they agreed with the following three statements: eating at least two portions of fruit is something (1) “I do automatically”; (2) “that makes me feel strange if I do not do it”; (3)”that takes effort not to do it”.

All of these items were measured using the five-point Likert Scale (1=strongly disagree to 5=strongly agree). The average rating on the different items was used to obtain the final score of each variable. The items were shuffled in the questionnaire.

13.2.3 Knowledge

In assessing respondent’s *knowledge* true and false statements were developed. Five statements were developed for nutrient knowledge, six for disease knowledge, and six for practical knowledge. Statements were made based on the nutrition questionnaire of Towler & Shepherd (1990) and information was used from the Dutch Nutrition Centre (www.voedingscentrum.nl/encyclopedie/fruit.aspx). The statements can be found in appendix 1. Respondent selected one out of five possible answers: “I know it is correct”, “I think it is

correct", "I don't know", "I think it is not correct", and "I know it is not correct". Several different types of score systems where developed and tested in the analyses. For each score system the final score for knowledge was obtained differently (see table 1). All the score systems can be found in appendix 2. Four of them are selected to discuss here:

- Knowledge type 1: All correct answers are rewarded, i.e. *beliefs* (1="I know it is correct" or "I think it is correct")
- Knowledge type 2: Only actual knowledge is rewarded, i.e. *actual knowledge* (1="I know it is correct")
- Knowledge type 3: All incorrect answers are rewarded, i.e. *misperceptions* (1="I think it is not correct" or "I know it is not correct")
- System 4: Only incorrect answers that are answered with certainty are rewarded, i.e. *false knowledge* (1="I know it is not correct")

Type	Points rewarded
1	1 = "I know it is correct" or "I think it is correct
	0 = "I don't know", "I think it is not correct" or "I know it is not correct"
2	1 = "I know it is correct"
	0 = "I think it is correct", "I don't know", "I think it is not correct" or "I know it is not correct"
3	1 = "I think it is not correct" or "I know it is not correct"
	0 = "I don't know", "I think it is correct" or "I know it is correct"
4	1 = "I know it is not correct"
	0 = "I think it is not correct", "I don't know", "I think it is correct" or "I know it is correct

Table 1: Score systems for knowledge

The total amounts of points were summed up to obtain the final score for each type of knowledge. In this case, since there were five statements for nutrient knowledge, the maximum score for nutrient knowledge was five points (and the minimum was zero points). Similarly, for disease and practical knowledge there were six statements and therefore the maximum score was six points. For the descriptive analyses the score for each type of knowledge (nutrient/disease/practical) was expressed as a percentage of the total amount of questions to make it easy to compare the different types of knowledge. For example, for type 1: 100% indicates that all questions were answered correct, 0% indicates that zero questions were answered correct.

In appendix 3 an example can be found of how the knowledge score was calculated.

The analyses were performed using the four different types of knowledge. For the sake of clarity I choose to only discuss the results for knowledge type 2. That is, *actual knowledge,* i.e. only the answers that were filled in *correct and with certainty* are rewarded. The reason is twofold. First, it is most relevant to investigate this type of knowledge, because this type of knowledge is influenced by interventions. Second, it is most likely to provide us with the most interesting results, because when people are not sure about the effects of fruit they are unlikely to act on it. For this reason it is less interesting to investigate the beliefs of people. Indeed, the analyses

provided the most interesting results for knowledge type 2. The results of knowledge type 1, 3 and 4 are only discussed when these are interesting to mention.

13.2.4 Other variables and demographics

In the first section of the questionnaire respondents were asked whether they think they eat a sufficient amount of fruit (0=I don't eat enough fruit, 1=I eat enough fruit). Also they were asked what they think is the recommended amount of fruit per day. At the end of the survey respondents were asked about their gender, age, education (0=HBO, 1=university, 2=work less than 1 year, 3=work more than 1 year), marital status (0=independent, 1=with parents), whether they smoke, whether they practice regular physical activity (0=never or less than once a week, 1=1-2 times a week; 2=3 times a week, 3=4 or more times a week). Also they were asked how many times each week they eat at least four serving spoons of vegetables (0=never or less than once a week; 1=2-3 days a week; 2=4-5 days a week; 3=6-7 days a week). Two items were assessed to investigate the barriers of costs and willpower, namely (1) "I can easily afford to eat at least two portions of fruit each day in the forthcoming week" and (2) "Eating at least two portions of fruit each day in the forthcoming week cost willpower". The items were measured using the five-point Likert Scale (1=strongly disagree to 5=strongly agree).

In order to complete the questionnaire all questions must be answered. The complete questionnaire can be found in appendix 4.

13.3 ANALYSES

Statistical analyses for descriptive were performed using the SPSS program (version 19.0, SPSS Inc., Chicago, IL). Cronbach's alpha was calculated to determine the internal consistency of the subscales for the TPB constructs. Test statistics included t-tests, one way ANOVAs and bivariate Spearman's correlations. Scatter plots with regression lines and the regression analyses were performed using Eviews (version 6.0, IHS Inc., USA). Different OLS linear regressions were conducted. Firstly, intention was regressed onto instrumental and affective attitude, subjective norm and PBC. Second, the complete TPB framework was tested including habits as a mediator in the intention-consumption relationship. Next, to test the hypotheses 9 to 18 the variables were added to the traditional TPB model. First the hypotheses regarding knowledge were tested and second, the moderator effects of gender are tested. To test the proposed moderator effect, an interaction term (example: gender*disease) was added in this step. At last, based on the correlation effects found in the descriptive analyses, several regressions were conducted to test for additional relationships.

The R^2 was used to measure the explained variance of the dependent variables and is used as a measure of the performance of the models. The adjusted R^2 is used to determine whether a given variable should be included in the regression model or not.

Outliers were detected using box plots and histograms. Only if the results without outliers were considerably different from the results including outliers is this mentioned in the description of the results. To test for heteroskedasticity the Breusch-Pagon test was used. In case of heteroskedasticity white standard errors were used.

For all tests the null hypothesis was rejected at the 0.05 level of significance.

14. RESULTS

14.1 SAMPLE

The average age of participants was 22.0 years. Of the 61 respondents 31 were women and 30 were men. Of the respondents 47 (77.0%) were college students, 5 HBO students, 6 of them work less than 1 year and 3 work more than one year. No significant differences were found for the respondents with different education levels or work experience. Therefore all the respondents are included in the analyses.

14.2 CRONBACH'S ALPHA

For all variables the Cronbach's α is calculated to assess the internal consistency of the constructs. In table 2 the alphas are displayed. The alphas for consumption, intention, affective attitude, perceived behavioral control and habit strength are acceptable (>0.7), good (>0.8) or even excellent (>0.9). However, the alpha of subjective norm is poor (>0.5) and that of instrumental attitude is considered unacceptable (<0.5). Notice that the alpha of 0.497 is just beneath the border of 0.5 for acceptability (George & Mallery, 2003). Despite the low alphas of instrumental attitude and subjective norm, I choose not to remove any items: not for instrumental attitude, because there were only two items and not for subjective norm, because the alpha increases only very slightly after removing an item. Since the items were validated in other studies I consider the final scores to give a reliable presentation of the variable.

Variable	No. of items	α
Consumption	2	0.848
Intention	2	0.914
Instrumental attitude	2	0.497
Affective attitude	3	0.864
Subjective norm	3	0.558
PBC	2	0.718
Habit strength	3	0.857

Table 2: Cronbach's alpha TPB variables

Cronbach's alpha of the knowledge types was calculated for each of the different score systems (see table 3). One question of practical knowledge is removed because it was only filled in correctly by two respondents. Not surprisingly it extremely decreased the alpha of practical knowledge. The question stated that canned fruits are as nutritious as fresh fruits. This is true when the fruit is conserved with water, but when sugar or syrup is added to the can it is unhealthier. Since this was not specified in the question (and could lead to confusion) this item is removed from analyses. Five questions remained for practical knowledge.

Variable	No. of items	α
Nutrient knowledge		
Type 1	5	0.161
Type 2	5	0.461
Type 3	5	-0.068
Type 4	5	0.000
Disease knowledge		
Type 1	6	0.186
Type 2	6	0.611
Type 3	6	0.342
Type 4	6	0.000
Practical knowledge		
Type 1	5	0.173*
Type 2	5	0.441*
Type 3	5	-0.139*
Type 4	5	0.303*
*Question 2 of practical knowledge is removed		

Table 3: Cronbach's alpha knowledge types

For all of the score systems and types of knowledge the Cronbach's alpha was low (between -0.139 and 0.611). Recall that knowledge type 2 is chosen to discuss in the analyses. This type of

knowledge has the highest internal consistency (between 0.461 and 0.611). I will further elaborate on the internal consistency of knowledge in the discussion.

14.3 General Descriptives

In table 4 the means and standard deviations of the variables can be found. Recall from chapter 13 that when referring to knowledge, the *actual* knowledge (type 2 – see chapter 13.2.3) is meant. In table 5 the correlations between several variables can be found. The results from the descriptive analyses can be found in appendix 5.

14.3.1 Consumption

Mean fruit consumption was 1.22 (S.D.=0.76) portions of fruit per day. Hence, this is below the recommended amount of two portions of fruit per day. Only 15.3 percent of the respondents meet the Dutch norm of eating at least two portions of fruit per day. The mean fruit consumption based on the past week (μ=1.4) is significantly higher than mean consumption based on average consumption (μ=1.0) (p=0.00) (app. 5.1). As is discussed in chapter 13 both measures have their own drawbacks and a difference between the average outcome is not surprising. The results suggest that people tend to underestimate their average consumption. However, it might also be true that the consumption in the past week was just higher than average, for example because of certain promotional offers in the past week. By taking the average, the biases of each measure can (partly) outweigh each other.

	Mean (S.D.)
Fruit consumption	1.22 (0.76)
Intention	3.37 (1.40)
Instrumental attitude	4.57 (0.61)
Affective attitude	4.21 (0.84)
Subjective norm	3.48 (0.79)
PBC	3.96 (1.12)
Habit strength	2.25 (1.14)
Nutrient knowledge	0.28 (0.23)
Disease knowledge	0.16 (0.20)
Practical knowledge	0.21 (0.21)
Age	22.03 (2.24)
Physical activity	1.15 (0.87)
Education	1.11 (0.61)
Smoker	0.11 (0.32)
Vegetable consumption	1.98 (0.92)
Can easily afford	3.93 (1.22)
Takes no willpower	3.61 (1.43)
Awareness of recc.	0.93 (0.25)
Opinion	0.46 (0.50)

Table 4: Mean scores and standard deviations (in parentheses)

14.3.2 Awareness of recommendations

Almost all respondents (93.4%) are aware of the daily recommendations. Many people who think they eat enough fruit do not meet the recommended amount of two pieces of fruit per day: 45.9 percent of the respondents rated their consumption as sufficient, while only 15.3 percent of the respondents meet the recommendations. No correlation between the awareness of the recommendations and fruit consumption is found.

Table 5: Spearman's correlation coefficient between the study variables (n=61)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Fruit consumption	-																			
2. Intention	0.81 **	-																		
3. Instrumental attitude	0.35 **	0.61 **	-																	
4. Affective attitude	0.53 **	0.68 **	0.73 **	-																
5. Subjective norm	-0.02	0.24	0.37 **	0.24	-															
6. PBC	0.61 **	0.64 **	0.32 *	0.49 **	-0.04	-														
7. Habit strength	0.73 **	0.71 **	0.52 **	0.62 **	0.15 **	0.51 **	-													
8. Nutrition knowledge	0.12	0.05	0.17	0.07	0.08	-0.08	0.28 *	-												
9. Disease knowledge	0.34 **	0.38 **	0.16	0.31 *	0.04	0.25 *	0.32 *	0.27 *	-											
10. Practical knowledge	0.21	0.15	0.16	0.28 *	-0.10	-0.02	0.29 *	0.30 *	0.40 **	-										
11. Gender	0.04	0.06	0.38 **	0.17	-0.14	-0.08	0.14	0.16	0.02	0.14	-									
12. Age	0.13	0.02	-0.18	-0.01	-0.21	0.07	0.09	0.17	0.21	0.29 *	-0.04	-								
13. Physical activity	0.44 **	0.20	-0.04	0.07	-0.23	0.15	0.27 *	0.06	0.15	0.14	-0.14	0.23	-							
14. Education	0.09	0.01	0.00	-0.11	-0.07	-0.17	0.13	0.05	0.07	0.10	0.14	0.36 **	0.12	-						
15. Smoker	-0.04	-0.07	-0.22	-0.05	-0.11	0.06	-0.05	-0.27 *	-0.25	-0.22	-0.15	-0.24	-0.05	-0.05	-					
16. Marital status	0.13	0.25	0.27 *	0.22	0.14	0.17	0.15	-0.01	-0.14	-0.03	-0.11	-0.08	0.23	-0.16	-0.12	-				
17. Vegetable consumption	0.16	0.18	0.21	0.21	0.04	0.05	0.32 *	0.20	0.25	0.19	0.11	0.32 *	0.15	0.15	-0.29 *	0.09	-			
18. Affordability	0.28 *	0.33 *	0.14	0.10	0.04	0.39 **	0.16	0.16	0.21	-0.05	-0.16	0.07	0.13	0.06	-0.18	0.19	0.08	-		
19. Takes no willpower	0.52 *	0.51 **	0.45 **	0.67 **	0.11	0.42 **	0.12	0.12	0.21	0.25	0.02	0.14	0.23	0.14	0.17	0.15	0.25	0.08	-	
20. Awareness of recc.	-0.02	-0.08	-0.04	-0.09	-0.03	0.03	-0.18	-0.13	-0.06	-0.11	0.00	-0.08	-0.17	0.02	0.10	-0.14	0.01	0.02	-0.14	-
21. Opinion	0.67 **	0.49 **	0.32 *	0.52 **	-0.02	0.52 **	0.60 **	0.17	0.18	0.17	0.02	0.15	0.36 **	0.02	0.18	0.25	0.11	0.21	0.42 **	-0.16

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

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

PBC = Perceived Behavioral Control

14.3.3TPB variables

A relatively high mean ($\mu \geq 3.37$) is found for most of the TPB measures, indicating an overall positive attitude towards eating at least two portions of fruit per day. Mean score for habit strength ($\mu=2.25$) indicates that, in general, the sample had an average to weak habit towards eating at least two pieces of fruit per day. It is remarkable that while the mean of subjective norm is relatively high ($\mu=3.48$), indicating that on average people experience that their environment supports fruit consumption, this variable is the only TPB variable that is unrelated to the majority of the other TPB variables (table 5).

14.3.4Perceived barriers

The average perceived barriers of costs ($\mu=3.93$) and willpower ($\mu=3.61$) are low. 23.0% of respondents indicated that they cannot easily afford to eat at least two portions of fruit each day and 27.9% of respondents indicated that it takes them willpower. The mean perceived barriers of costs is lower for students than for working people, and lower for people who live independent than for people who live with their parents. These differences are not significant, which is most likely because of the relatively small sample size of working people and people who live with their parents (app. 5.2).

14.3.5Differences in fruit consumption based on demographics

Table 5 shows that fruit consumption was positively related with physical activity ($\rho=0.44$, $p<0.01$). A t-test support the link between physical activity and fruit consumption: people who practice physical activity 3 or more times a week eat on average 1.7 portions of fruit per day, while this is only 1.0 portion for people who practice physical activity less than 3 times a week (app. 5.3). No significant differences are found between the consumption of groups based on gender or other demographics.

14.4 KNOWLEDGE DESCRIPTIVES

14.4.1Current level of knowledge

In table 6 the percentage of correct scores for the different types of knowledge can be found. In this section four different score systems are distinguished to measure the knowledge. As is discussed in chapter 13 type 1 and 2 measures the correct knowledge and type 3 and 4 the misperceptions. Roughly, type 1 and 3 measures the score of what people *think* is (in)correct, type 2 and 4 the score of what people *know* is (in)correct.

Score system	Nutrient knowledge	Disease knowledge	Practical knowledge
Type 1	69% (0.20)	60% (0.20)	55% (0.21)
Type 2	28% (0.23)	16% (0.20)	21% (0.21)
As % of correct	*40.6%*	*26.7%*	*38.2%*
Type 3	16% (0.14)	23% (0.20)	39% (0.18)
Type 4	1% (0.04)	4% (0.08)	6% (0.12)

Table 6: Mean scores and standard deviations (in parentheses) of the knowledge variables

For each type, the average level of nutrition, disease and practical knowledge differ significantly from each other (app. 5.4). It seems that on average people are best informed about nutrient knowledge. That is, the average score for correct knowledge (type 1 and type 2) is highest for nutrient knowledge. Also, the average score for misperceptions (type 3 and type 4) is lowest for knowledge about nutrients. On average, people have the least correct beliefs about practical knowledge (type 1) and the most misperceptions about practical knowledge (type 3 and 4 are highest for practical knowledge). People have the least *actual knowledge* about diseases. That is, the score for type 2 is lowest for disease knowledge.

Table 6 also shows that while on average people have correct beliefs about the majority of the statements (mean scores type 1 > 50%), not much people are absolutely certain about their knowledge. There is a gap between what people *think and know* (type 1) and what people *know* (type 2): For all three types of knowledge when people answered correct, only between 26.7% and 40.6% of them do this with absolute certainty. This gap is the largest for disease knowledge, where only around 1/4 of the correct answers is filled in with certainty.

14.4.2 Insights in respondents' knowledge

In appendix 6 the questions and answers of respondents' knowledge can be found. A few remarks can be made. Within disease knowledge a remarkable high percentage of respondents are correct with regard to the effect of fruit consumption in the prevention of heart- and vascular diseases (80.3 thinks or knows correct) and to improve one's bowel movements (82.5% thinks or knows correct). Only 42.6% of the respondents thought that fruit helps preventing cancer and only 3.3% of the respondents knew this with certainty. Only very little people know the right size of a portion of fruit: for the question "5 strawberries represent 1 serving of fruit" only 1.6% knew the right answer (21.3% thought this statement was correct).

14.4.3 Relation knowledge and fruit consumption

Only disease knowledge is directly related to fruit consumption ($\rho=0.34$, $p<0.01$). Although I will further elaborate on this relationship in the regression analyses, it is interesting to see that scatter plots (appendix 7) show no clear relationship between knowledge and consumption: for every level of knowledge, respondents have both low and high levels of consumption. The scatter plots also show that there is little variation in the level of practical knowledge: all the scores are between 0 and 3 points (while the maximum score was 5).

14.4.4 Relation knowledge and demographics

Table 5 also shows the correlations between different types of knowledge and demographics. These correlations have been tested with t-tests. Two significant results are found. First, practical knowledge is related to age ($\rho=0.29$, $p<0.05$). Indeed, a t-test confirms that people

above the age of 20 have more correct knowledge about practical issues (μ=25%) than people of 20 years and younger (μ=11%, p=0.02) (app. 5.5). Second, nutrient knowledge is related to whether the respondent is a smoker (ρ=-0.27). A t-test shows that on average smokers know less about nutrients (11.4%) than non-smokers (30%) (p=0.045) (app. 5.6). No correlations have been found between physical activity and knowledge, or between gender and knowledge.

14.4.5Correlations different types of knowledge

In appendix 8 an extended version of the correlation matrix is displayed, in which also correct *beliefs* (type 1) and misperceptions (type 3 and 4) are displayed. The conclusion that can be drawn from this is that in most of the cases correct knowledge has impact whereas misperceptions do not. For example, correct knowledge about diseases (type 2) is positively related to fruit consumption, but incorrect knowledge (type 4) is not negatively related to fruit consumption. One of the exceptions is for practical knowledge, where both correct beliefs (type 1) are positively related to fruit consumption, and false beliefs (type 3) are quite similar but negatively related to fruit consumption.

Furthermore, it seems that knowledge is clustered among respondents, because there are positive correlations between the three different types of knowledge.

14.5 REGRESSION ANALYSES

In this section the results from the regression analyses will be discussed. First, the results of the 20 hypotheses will be presented. Second, additional findings will be presented. Last, a framework with the final results is presented, followed by a short summary. The results will be discussed in more detail in chapter 15 (“Discussion”). The results of the first part of the regression analyses can be found in appendix 9.1.

14.5.1Affective attitude (H1 – H2)

H1. Affective attitude has a positive effect on intention

In line with the hypothesis it was found that affective attitude has a positive effect on intention (β=0.42, p=0.04).

H2. Affective attitude has a positive effect on consumption

When consumption is regressed onto affective attitude, a positive and significant effect of affective attitude on consumption is found (β=0.47, p=0.00). However, once intention is added to the regression, this relationship is no longer significant (β=0.01, p=0.95). This indicates that affective attitude influences consumption only indirectly (through intention) and not directly.

14.5.2 Instrumental attitude (H3)

H3. Instrumental attitude has a positive effect on intention

In line with the hypothesis, instrumental attitude is positively related to intention (β=0.67, p=0.01).

14.5.3 Subjective norm (H4)

H4. Subjective norm has a positive effect on intention

Contrary to the hypothesis, no significant effect of subjective norm on intention is found (β=0.14, p=0.40).

14.5.4 Perceived behavorial control (H5 – H6)

H5. Perceived behavioral control has a positive effect on intention

The results from the regression show that, in line with the hypothesis, perceived behavioral control (PBC) has a positive effect on intention (β=0.53, p=0.00). Many studies found that PBC has the strongest effect on intention, but here the strongest effect on intention comes from instrumental attitude (β=0.67, p=0.01). In line with previous studies the relation between PBC and intention (β=0.53) is larger than the relation between affective attitude and intention (β=0.42).

H6. Perceived behavioral control has a positive effect on consumption

When consumption is regressed onto PBC, a positive and significant effect is found (β=0.38, p=0.00). However, once intention is added to the regression, this relationship is no longer significant (β=0.09, p=0.29). This indicates that PBC influences consumption only indirectly (through intention) and not directly.

14.5.5 Intention (H7)

H7. Intention has a positive effect on consumption

A positive effect of intention on consumption is found (β=0.42, p=0.00). 60 percent of variance in consumption is explained by intention.

14.5.6 Habits (H8)

H8. The relationship between intention and consumption is mediated by habits

In line with the hypothesis, habits have a positive effect on consumption (β=023, p=0.00). When habits are included in the model, the effect of intention on consumption decreases from 0.42 to 0.29. This indicates a mediator effect of habits. Indeed, intention has a strong and positive effect on habits (β=0.56, p=0.00). The results support the role of habits as a mediator in the relationship between intention and consumption. While intention alone explains 60 percent of the variance in fruit consumption, this percentage increases to 66 percent when habits are included in the model. The adjusted R squared increases as well.

14.5.7Summary of the traditional TPB framework (including habits)

In figure 6 the results from the regression analyses of the traditional TPB model are shown. The model seems to hold pretty well. In line with expectations, intention is the largest predictor of fruit consumption. Instrumental attitude, affective attitude, and perceived behavioral control explain 63 percent of the variance of intention. Contradictory to the traditional TPB model, subjective norm has no effect on intention. Instrumental attitude has the largest effect on intention. Habits have a mediating effect in the relationship between intention and fruit consumption. With this model 66 percent of variance in fruit consumption is explained.

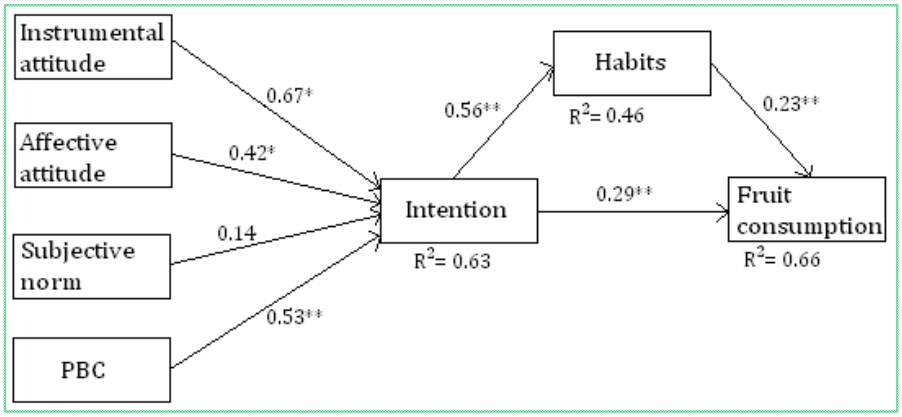


Figure 6: Results from the regression analyses for traditional TPB model

14.5.8Nutrient knowledge (H9 – H10)

H9. Nutrient knowledge has a positive effect on habits

A relation between nutrient knowledge and habits (β=027, p=0.00) has been found in addition to the relationship between intention and habits.

H10. Nutrient knowledge and disease knowledge are positively related

In line with the hypothesis, nutrient knowledge has effect on disease knowledge (β=0.26, p=0.048) and disease knowledge has effect on nutrient knowledge (β=0.33, p=0.01).

14.5.9Disease knowledge (H11 – H13)

H11. Disease knowledge has a positive effect on instrumental attitude

Against expectations, the effect of disease knowledge on instrumental attitude is not significant (β=0.10, p=0.11).

H12. Disease knowledge has a positive effect on habits

When conducting a regression with habits as dependent variable and disease knowledge as the only independent variable, disease knowledge is positive and significant related to habits (β=0.34, p=0.01). However, once intention is added to the regression this effect becomes insignificant (β=0.09, p=0.35), suggesting that disease knowledge influences habits through intention (as will be discussed in chapter 14.5.12), but not directly.

H13. Disease knowledge and practical knowledge are positively related

In line with the hypothesis, disease knowledge is related to practical knowledge: disease knowledge has a positive effect on practical knowledge (β=0.33, p=0.00) and practical knowledge has a positive effect on disease knowledge (β=0.35, p=0.02). This means that, in line with the hypotheses, knowledge is clustered among respondents through disease knowledge. That is, disease knowledge is related to nutrient knowledge and practical knowledge, but nutrient knowledge and practical knowledge are not directly related. 20 percent of variance in disease knowledge is explained by nutrient and practical knowledge.

14.5.10 Practical knowledge (H14 – H15)

H14. Practical knowledge has a positive effect on perceived behavioral control

The effect of practical knowledge on perceived behavioral control is not significant (β=-0.04, p=0.80).

H15. Practical knowledge has a positive effect on habits

The results from the regression analyses do not support a relationship between practical knowledge and habits (β=0.24, p=0.08).

14.5.11 Gender (H16 – H19)

H16. Gender has a positive effect on nutrient knowledge

No effect has been found (β=0.37, p=0.23).

H17. Gender has a positive effect on disease knowledge

No effect has been found (β=0.24, p=0.45).

H18: Gender has a positive effect on practical knowledge

No effect has been found (β=0.42, p=0.14).

These results are supported by the descriptive analyses, where no significant differences between the level of knowledge of men and women were found.

H19: The relationship between disease knowledge and instrumental attitude is moderated by gender: the relationship is stronger for women than for men

No moderator effect of gender in the relationship between disease knowledge and instrumental attitude is found (β=0.16, p=0.14).

Furthermore, a strong direct relationship was found between gender and instrumental attitude (β=0.41, p=0.01), indicating that women have higher instrumental attitude than men. Since this relationship was not hypothesized, it should be interpreted with care.

14.5.12 Physical activity (H20)

H20. Physical activity has a positive effect on habits

A positive effect of physical activity on habits is found (β=0.41, p=0.01). However, once intention and nutrient knowledge are added as explanatory variables, the effect of physical activity becomes insignificant (β=0.30, p=0.10). Therefore, in the final model habits are explained by intention and nutrient knowledge. No relation is found between physical activity and nutrient knowledge (β=0.23, p=0.18). In conclusion; against expectations, there is no effect of physical activity on habits.

One additional result is found regarding physical activity, namely a direct effect of physical activity on fruit consumption (β=0.22, p=0.00) in addition to the effects of intention and habits. Since this was not hypothesized this result should be interpreted with care. However, recall that the results from the descriptive analyses support this relationship. With the addition of physical activity as an explanatory variable of fruit consumption, 72 percent of fruit consumption is explained.

14.5.13 Framework of tested hypotheses

The results of the tested hypotheses are displayed in the framework below (figure 7). The significance of the found relationships are indicated with one star ($p<0.05$) or two stars ($p<0.01$). The dotted lines indicate the insignificant relationships. The corresponding regression analyses can be found in appendix 9.2.

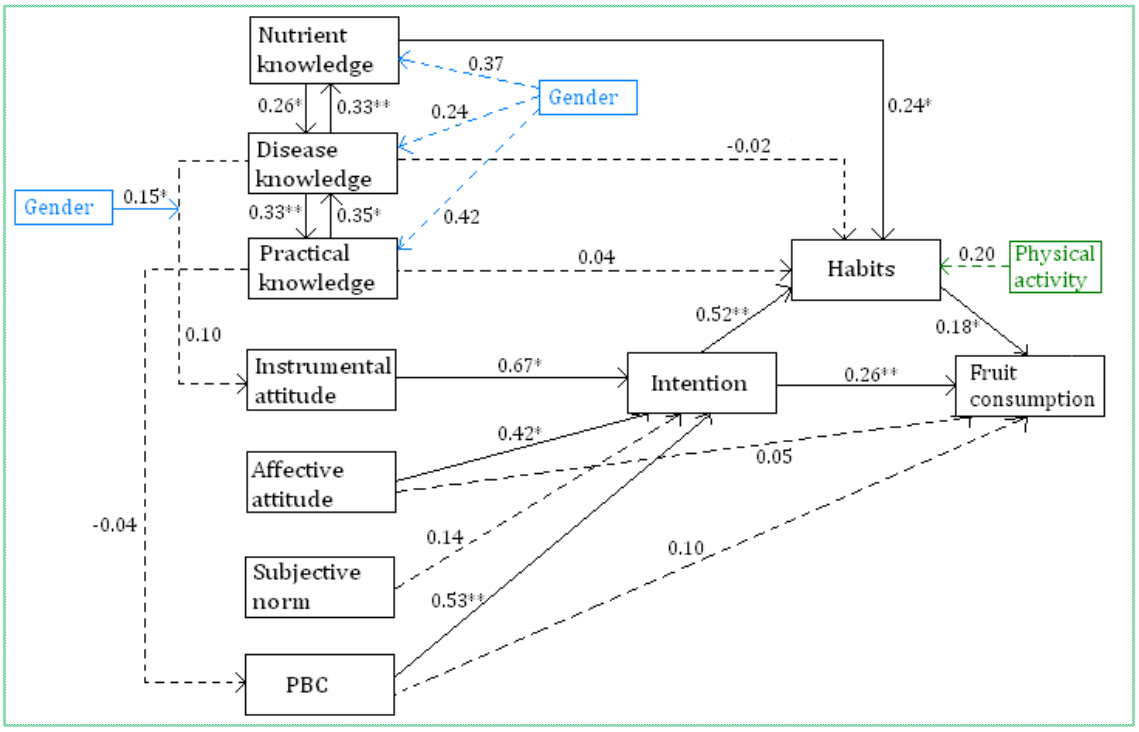


Figure 7: Framework with results of the tested hypotheses (N=61)

In summary, the TPB model seems to hold pretty well. The only exception on the traditional TPB model is that subjective norm is not related to intention. The mediating effect of habits in the intention-consumption relationship (as was found by Menozzi and Mora (2012)) is confirmed. Almost all hypotheses about the relation between knowledge and other variables are rejected: Only nutrient knowledge has an effect on habits. This effect is half as small as the effect of intention on habits. In line with expectations, knowledge is clustered amongst respondents. No differences between knowledge levels are found based on gender. Against expectations, there is no effect of physical activity on habits. However, a direct effect on fruit consumption was found, as will be discussed hereafter.

14.5.14 Additional findings

On top of the tested hypotheses the regression analyses provided us with other insights. I will discuss the three most relevant findings of which the results can be found in appendix 9.3.

First, in the literature review it was explained that perceived behavioral control is often connected to the perceived barriers of an individual. Three barriers are included in this study, namely costs (affordability), willpower, and taste (affective attitude). Notice that affective attitude is a somewhat broader variable than taste, but it has strong overlap with taste. The results indicate that affordability ($\beta=0.26$) and taste ($\beta=0.64$) affects perceived behavioral control. Willpower is only related to perceived behavioral control when affective attitude is not included in the regression. When affective attitude is added the significance of the regression coefficient of willpower disappears. Also an effect is found for affective attitude on willpower: The higher the affective attitude, the lower the perceived barrier of willpower. The results suggest that when a respondent enjoys eating fruit the barrier of willpower is no longer there (app. 9.3.1).

Second, a direct relation was found between disease knowledge and intention ($\beta=0.26$, $p=0.010$). When disease knowledge was added as an explanatory variable, the regression coefficient of affective attitude becomes insignificant. The regression with disease knowledge instead of affective attitude has a slightly higher R squared ($R^2=0.64$ instead of 0.63). This suggests that disease knowledge is a similar or even better predictor of intention than affective attitude. In the final model, disease knowledge is added as an explanatory variable of intention. The effect sizes and significance of instrumental attitude and perceived behavioral control are almost similar in the new regression. Since the effect of disease knowledge on intention was not hypothesized, this result should be interpreted with care (app. 9.3.2).

Third, the results thus far contain the effects of *actual* knowledge on other variables. The effects of other types of knowledge are also tested. Recall: the correct beliefs (type 1), false beliefs (type 3) and false knowledge (type 4). It seems that the effects that were found for correct knowledge (type 2: the effects that are discussed so far) are *not* found for the other types of knowledge. For example, while correct knowledge about nutrients is related to habits ($\beta=0.38$, $p=0.01$), correct *beliefs* or misperceptions about nutrients are not related to habits ($\beta=0.18$, $p=0.21$) (app. 9.3.3).

Fourth, the relationships between knowledge and other variables are retested amongst two different groups. Namely, group 1: the respondents who rated their consumption as sufficient and group 2: the respondents who rated their consumption as poor. Only the respondents who eat too little fruit are included. The respondents who eat enough fruit are removed from this analysis. The first group is an approach of people in an early stage of the “stages of change”-model; that is, people who are unaware of a problem. The second group is an approach of people in a further stage; those who are aware of a problem. No differences were found for all of the relationships, but one: It was found that practical knowledge is related to habits for people

of group 2 (those who are in a further stage) (β=0.20, p=0.03), but this type of knowledge is not related to habits for people in group 1 (in an early stage) (β=-0.14, p=0.43). This suggests that practical knowledge indirectly influences fruit consumption when people are in a further stage, but not when they are in an early stage. This is in line with the stages of change model. In the regressions for both groups, intention and nutrition are positively and significantly related to habits. However, this result should be interpreted with great care. First, since the size of both groups differ substantially (group 1: N=18, group 2: N=33). Second, this approach to determine the stage of an individual is not validated (app. 9.3.4).

Furthermore, for the sake of completeness, the direct effects of knowledge on fruit consumption were tested. No direct relationships were found.

Finally, the differences between demographics and knowledge that were found in the descriptive analyses were tested. No significant effects were found; there is no effect of age on practical knowledge and no effect of being a smoker or not on nutrient knowledge.

14.5.15 Final model

In figure 8 the final model for the full sample (n=61) is displayed. Most of the insignificant effects are left out of this model, as they are already discussed in the previous framework and could lead to confusion. The red lines indicate the effects that were not hypothesized and therefore should be interpreted with care. They are included in the model, because the effects are relatively large and there is a plausible explanation for them (as will be discussed in the next chapter). The corresponding regression analyses can be found in appendix 9.4.

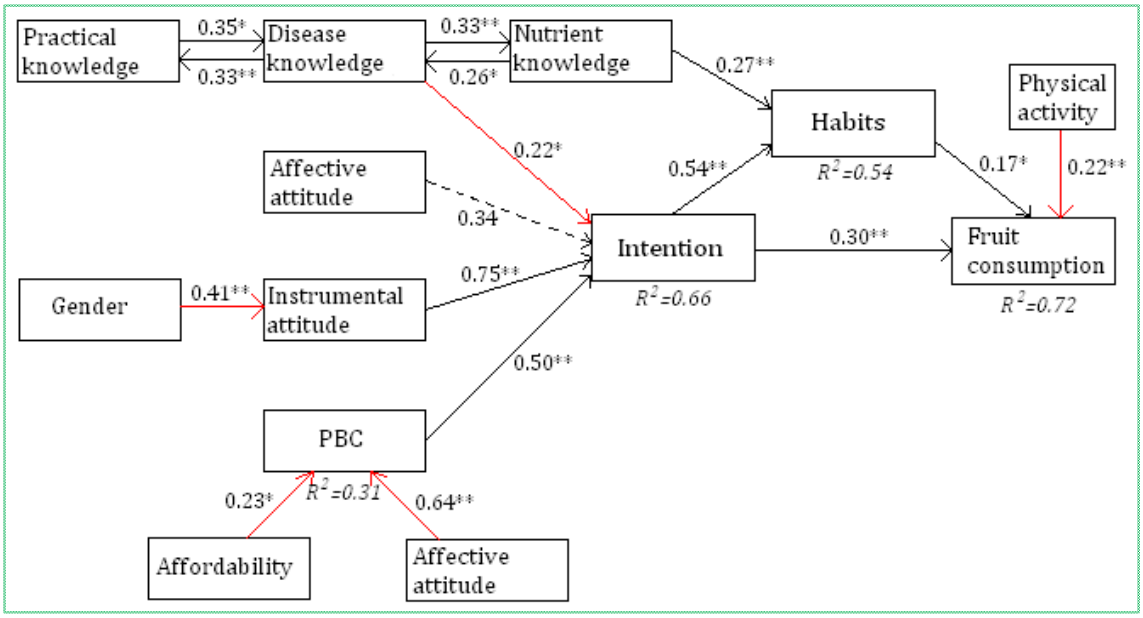


Figure 8: Framework with results of regression analysis (n=61)

With this model 72 percent of fruit consumption can be explained. The largest effect of fruit consumption comes from intention (β=0.30). Intention is explained by disease knowledge, instrumental attitude and perceived behavioral control. The largest effect on intention comes from instrumental attitude (β=0.76), then perceived behavioral control (β=0.51) and at last disease knowledge (β=0.22). The effect of affective attitude on intention becomes insignificant once disease knowledge is added as an explanatory variable. Affective attitude still influences fruit consumption indirectly through perceived behavioral control.

Many of the proposed hypotheses regarding knowledge were not supported by the data. However, the results indicate some (indirect) effects of knowledge on fruit consumption. Next to the effect of disease knowledge on intention, nutrient knowledge has an effect on habits (β=0.27). Furthermore, the correlations between nutrient knowledge, disease knowledge and practical knowledge indicate that knowledge is clustered amongst respondents.

15. DISCUSSION

Recall that the goal of this thesis is to investigate whether knowledge about nutrients of fruit, the role of fruit in the prevention of diseases and practical knowledge about fruit, is related to fruit consumption. An extensive literature review led to a model based on the Theory of Planned Behavior that predicts fruit consumption. Questionnaires filled in by 61 Dutch students enabled me to investigate this model and the relations between nutrient knowledge, disease knowledge, practical knowledge and fruit consumption. It was found that the current fruit consumption of Dutch students is below the recommended amount. Knowing the relationship between knowledge and fruit consumption can help to conduct effective interventions for this target group.

In this section, the results of my study are presented and the last two sub-questions will be answered, namely:

8. How does knowledge fit in the Theory of Planned Behavior?
9. Are there differences between the effects of different types of knowledge on fruit consumption?
    a. Is there a difference between the effects of knowledge about nutrients, diseases and practical issues?
    b. Is there a difference between beliefs about knowledge and actual knowledge?
    c. Is there a difference between correct knowledge and misperceptions?

In addition to the results of testing this model, several other findings are presented in this section. First, some general findings regarding the consumption and knowledge of respondents are discussed. Second, the TPB model is discussed and compared with the hypotheses. Third, the major conclusions are given with theoretical and practical implications of my study. Finally, reliability of the results and recommendations for further research are discussed.

15.1 GENERAL FINDINGS

15.1.1 Current consumption

In line with the results of previous studies, it was found that Dutch students do not eat enough fruit. The average consumption is 1.2 portions of fruit per day, which is below the recommended amount of two portions. Only 16 percent of the respondents meet the recommendations. This is higher than the average percentage of 4 percent found by the RIVM (2011). People who practice physical activity frequently eat significantly more fruit than people who rarely practice physical activity.

15.1.2 Current awareness of recommendations and knowledge

Contrary to the studies that are presented in chapter 5, which found that most people are ignorant of the recommendations, nearly all respondents in this study (94%) are aware of the recommended amount of two portions of fruit per day. This is most likely the result of the high education level of the sample and extensive campaign of the Nutrition Centre that was widely promoted in the last couple of years. Surprisingly, while respondents are aware of the recommended amount, almost half of the respondents think they eat enough fruit, indicating that many respondents overestimate their own consumption.

The awareness of the different types of knowledge leaves room for improvement. On average, the majority of the statements were answered correctly when *beliefs* are measured. When *actual* knowledge was measured only about 1/5 of the statements was answered correct. Small differences between different types of knowledge exist; People were best informed about nutrient knowledge and most misperceptions exist for practical knowledge.

In conclusion, for Dutch students both the consumption of fruit and the level of knowledge are low, indicating that knowledge can be raised and fruit consumption should be raised.

15.2 How does knowledge fit in the Theory of Planned Behavior?

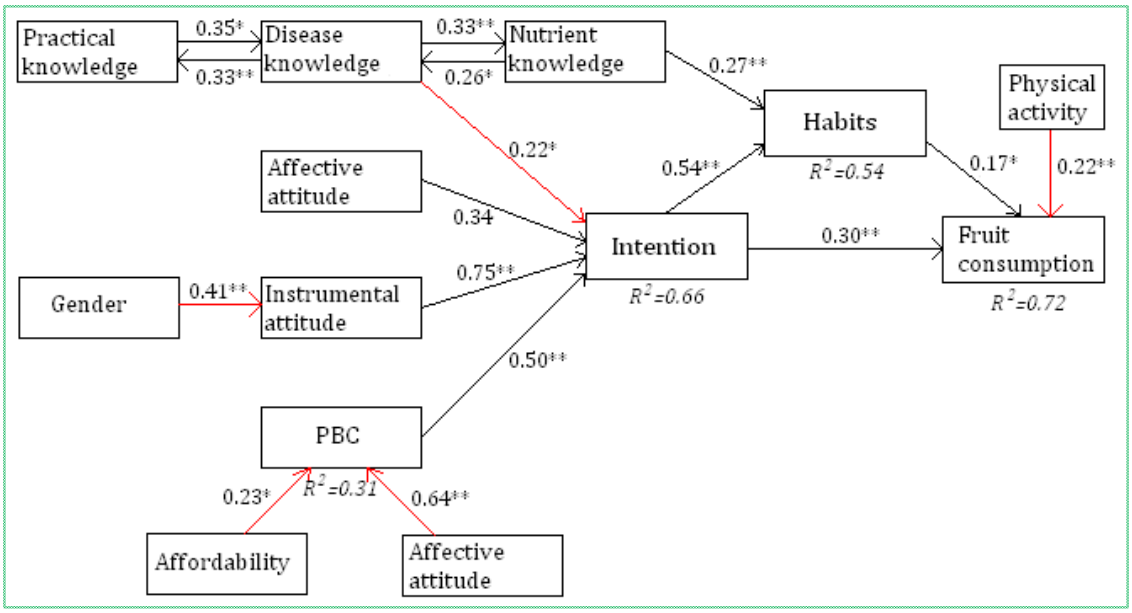


Figure 9: Final model

The final model can be found in figure 9. As is shown in this figure, the Theory of Planned Behavior can be extended with knowledge. The explanation power of the final model is high: 72 percent of the fruit consumption and 66 percent of intention is explained. This is much higher than is found in previous literature, where typically about 1/3 of variance in consumption is

explained and 1/3 to 1/2 of variance in intention is explained by TPB variables (Blanchard et al., 2009; Bogers et al., 2004). In this section the hypotheses are discussed.

15.2.1 Affective attitude (H1 – H2)

Initially, the traditional TPB framework was tested and (in line with hypotheses) affective attitude (i.e. the enjoyability of fruit consumption) had a positive effect on intention. The relationship disappears when disease knowledge is added; suggesting that disease knowledge is a stronger motivational factor than affective attitude. Not in line with hypotheses, no direct link was found between affective attitude and consumption. Previous findings on this topic are ambiguous and not finding support for these relationships is not surprising. Affective attitude still affects fruit consumption through perceived behavioral control (see chapter 15.2.4).

15.2.2 Instrumental attitude (H3)

Instrumental attitude is found to be the biggest determinant of intention, indicating that the perceived healthiness of eating fruit is the most important motivation for students to consume fruit. This is in line with the TPB model and many previous studies (Blanchard et al., 2009; Bogers et al., 2004). However, the internal consistency of the used measure in my study (α=0.497) is low, indicating that the items might measure two different aspects. This should be taken into account when generalizing the results and could explain differences with other studies, such as Blanchard et al. (2009), who found no effect of instrumental attitude on intention.

15.2.3 Subjective norm (H4)

Subjective norm refers to the perceived social pressure to perform or not perform a certain behavior. Subjective norm was found not to affect intention. The results of previous studies about this relationship are ambiguous. Although the high average level of subjective norm amongst respondents indicates that most students live in an environment where fruit consumption is supported, this does not lead to the intention to consume more fruit. Apparently, true motivation comes from within; initially, affective attitude ("I enjoy eating fruit") and instrumental attitude ("eating fruit is good for my health") affect intention, whereas subjective norm ("others like it when I eat fruit") does not.

15.2.4 Perceived behavorial control (H5 – H6)

Perceived behavioral control reflects the perceived ease or difficulty of performing a particular behavior. In line with the hypothesis, it directly affects intention. The effect size is relatively large (0.50) as is supported by many previous studies. Not in line with hypotheses, no direct link was found between PBC and consumption. This might be because fruit consumption is

generally under the volitional control of students. The perceived difficulty of consuming fruit thus affects intention, but it rarely directly affects fruit consumption. This idea is based on Ajzen (1991), who suggests that intention will be the strongest predictor of consumption when it is perceived to be under the persons' volitional control, whereas PBC will be the strongest predictor when it is not perceived to be under their volitional control. Previous findings on the relationship between PBC and fruit consumption are ambiguous.

It seems that about 1/3 of the PBC of students is determined by costs and taste (assuming that taste is an important determinant of affective attitude). The finding that costs affect PBC is not surprising, since students are generally low in money. More than 22 percent of the respondents indicated that fruit is too expensive for them. Initially, willpower had a direct effect on PBC. This effect is mediated by affective attitude, indicating that the true barrier is enjoyability: when students enjoy eating fruit it takes no willpower. The effect of affective attitude on PBC is more than 2.5 times as high as the effect of costs, indicating that enjoyability (under which taste) is more important to students than costs.

15.2.5Intention (H7)

In line with the traditional TPB model of Ajzen (1991) intention is the strongest predictor of fruit consumption. Notice that intention is not fully translated into behavior: when habits are not included in the model the effect is 0.42. This indicates that there are other factors besides motivation that determine the actual fruit consumption of students.

15.2.6Habits (H8)

In line with Menozzi and Mora (2012) a mediating effect is found for habits in the intention-behavior relationship. This suggests that stronger habits result in less conscious behaviour.

15.2.7Nutrient knowledge (H9)

Nutrient knowledge is found to be related to habit strength. An explanation might be that nutrient knowledge led to higher fruit consumption in the past and resulted in habit strength. This is plausible, since most people learn about the healthiness of fruit in their childhood, typically at elementary school. Since knowledge about nutrients does not include knowledge about the effects of these nutrients on health, it seems that most people are aware of some of the effects they have on their health. For example, they have good associations with vitamin C and bad associations with fat.

15.2.8Disease knowledge (H10 – H12)

Contradictory to the hypothesis, disease knowledge is not related to instrumental attitude. Also, no direct relationship was found between disease knowledge and habits. Instead, disease

knowledge is found to occupy a more central role in the model, as it is directly related to intention.

Apparently, students care more about their health than I expected: Disease knowledge directly affects intention. Once students know about the health effects of fruit consumption they intend to consume more fruit. Surprisingly enough, it does not make them feel healthier, because there is no effect of disease knowledge on instrumental attitude.

One explanation might be that short-term effects on health, such as vitality and resistance, are underlying instrumental attitude. Since these are effects that are more noticeable by students. These health effects were not incorporated in disease knowledge. This seems a plausible explanation, because it is likely that most students are aware of these short-term health effects and that explains the high average instrumental attitude. This finding is in line with the results of the survey of the RIVM (2011) that showed that majority of Dutch population agrees that fruit contributes to a better health.

The lack of evidence for the relationship between disease knowledge and instrumental attitude can also be caused by the low internal consistency of instrumental attitude; it could be that disease knowledge has effect on some aspects of instrumental attitude, that are not exposed in this study.

15.2.9Practical knowledge (H13 – H14)

Contradictory to the hypotheses, practical knowledge is not related to perceived behavioral control. This suggests that lack of knowledge about practical issues is not a barrier to consume fruit. Also, practical knowledge is not related to habits, indicating that it is not a motivation to consume fruit either. Clearly, contrary to the hypotheses, practical knowledge is not the largest determinant of fruit consumption. Why?

First, these results might be caused by the little variation in practical knowledge. This might bias the results.

Second, practical knowledge is an action-oriented approach. According to the “stages of change”-model, people are only sensitive to knowledge about practical issues when they are in a further stage and are willing to change their behavior. Since almost half of the students rated their consumption as sufficient, and only 15 percent of the students meet the recommended amount, this indicates that many students are in the precontemplation stage (in which they have no intention to change their behavior). This could explain why no relation is found between practical issues and fruit consumption. This is slightly supported by the results that found a relationship between practical knowledge and habits for people who rated their

consumption as poor (and eat too little fruit), and no relationship for people who rated their consumption as sufficient (and eat too little fruit). Hence, the latter group is in an earlier stage where they are not open to action-oriented knowledge.

However, this explanation does not fully apply, since the stages of change-model also states that knowledge raising does not work in further stages. Therefore one would expect the relationships between knowledge and other variables would also not be significant.

In line with hypotheses, all three types of knowledge are correlated to each other through disease knowledge. An explanation is that some students are more interested in food and health than others.

15.2.10 Gender (H15-H18)

The relationship between disease knowledge and instrumental attitude does not reach significance and is not moderated by gender. This indicates that for both men and women, more disease knowledge does *not* lead to higher instrumental attitude.

A direct effect of gender on instrumental attitude is found: Women have higher instrumental attitude than men. The most likely explanation is that women are more concerned about their health, which is supported by many studies. Another explanation is regarding the knowledge of women. It was found that women do not have more nutrient, disease or practical knowledge than men, but they might have more knowledge about short-term effects on health, such as the effect on vitality and resistance. This type of knowledge is not measured in this study, but might be underlying instrumental attitude. The effect of gender on instrumental attitude indirectly leads to higher fruit consumption of women than men, which is supported by many studies. No significant differences are found between the fruit consumption between men and women in this study, indicating that this effect is only small.

15.2.11 Physical activity (H20)

In line with the hypothesis, physical activity has a direct effect on fruit consumption: the degree to which one practices physical activity increases fruit consumption. This has probably to do with the clustering of healthy behavior amongst respondents. Practicing physical activity regularly is part of a healthy lifestyle as is eating fruit.

15.2.12 Different types of knowledge

The results indicate that actual knowledge indirectly affects fruit consumption. That is, knowledge about diseases and nutrients affect intention and habits respectively. This effect was not found for beliefs about these types of knowledge. The same goes for incorrect knowledge. Since there are positive effects of correct knowledge on intention and habits, one could expect

negative effects of incorrect knowledge. This is not supported by my results, indicating that correct knowledge can be beneficial for fruit consumption, but misperceptions are not harmful.

15.2.13 Effects of knowledge in the context of previous studies

The results regarding the relationship between knowledge and consumption fit well in the collection of previous studies that investigated this relationship. It is not in line with Link and Phelan (1996) who identified knowledge as one of the 'fundamental causes' of health differences, since the effects of instrumental attitude and perceived behavioral control on fruit consumption are higher, but the study takes it place between several other studies that found a small relationship between knowledge and food intake (Axelson et al., 1995; Wardle et al., 2000, etc.). The found effects of disease knowledge and nutrient knowledge (0.22 and 0.27, respectively) are beneath the biggest reported effect size of 0.32 of the relationship between knowledge and fruit consumption (Neill et al., 2000).

15.3 IMPLICATIONS OF THIS STUDY

This study suggests that just as the entire Dutch population, the fruit consumption amongst college students is too low. The positive effects of fruit consumption on health are therefore not fully exploited. The proposed model explains 72 percent of fruit consumption and hence, increasing the variables in this model might significantly improve the fruit consumption of students. In this chapter the results from this study are used to prescribe measures that increase the fruit consumption amongst students.

15.3.1 Increasing instrumental attitude

Although students are generally in good health and cancer and other chronic diseases are rare amongst young adults, the results show that they care much about their health. First, the most important factor that influences fruit consumption is instrumental attitude. This implies that increasing this attitude is the most effective way to increase fruit consumption. However, since the average instrumental attitude amongst students is relatively high, it cannot be increased much and is unlikely to cause a major increase in fruit consumption.

15.3.2 Increasing knowledge about diseases and nutrients

More gains can be achieved by increasing knowledge: Nutrient and disease knowledge indirectly affect fruit consumption and the average knowledge scores are low.

The largest effect of knowledge on fruit consumption comes from disease knowledge: it directly affects intention, but it is also related to nutrient knowledge, which in turn affects habits. Especially the awareness of the role of fruit consumption in the prevention of cancer and the level of cholesterol can be improved. Not only because the current awareness is lowest for these

topics, but also because the influence of spreading information is higher when many people are not yet aware of this issue (Jill et al., 1987; Sheeran et al., 1999). Short television commercials or handing out information brochures on the university are simple ways to inform students.

The results also indicate that increasing knowledge about nutrients indirectly affects fruit consumption. While the effect of disease knowledge on fruit consumption is conscious, the effect of nutrient knowledge on fruit consumption seems more unconscious, namely through habits.

15.3.3 Decrease barriers

Besides instrumental attitude and disease knowledge, perceived behavioral control has a strong effect on intention to consume fruit. This suggests that interventions should develop students' ability to overcome the barriers of costs and affective attitude. The first can be reached by decreasing costs, for example by promotions or subsidies. Decreasing the barrier of affective attitude is more difficult, since taste is a component, which is more difficult to influence. Also it might be through allergies that people do not consume fruit. Promoting the variety of fruits, for example the consumption of fresh fruit juices or (a limited amount of) vitamin pills, might help overcoming this barrier.

15.3.4 Target groups

Since no differences are found between the knowledge of groups based on demographics or other characteristics, all types of students will benefit from an intervention to increase knowledge. However, given the strong relationship between physical activity and fruit consumption, increasing consumption is more important for those who practice physical activity rarely, since they eat less fruit. Therefore, targeting people at the gym will be less useful than targeting people at a snack bar or through television commercials.

15.4 LIMITATIONS OF THE STUDY

In this section some limitations of this study will be discussed that must be taken into account when generalizing the results.

15.4.1 Validity of data collection

The answers were collected by online questionnaires. The questionnaires were in Dutch and were checked by outsiders before they were filled in by respondents. One respondent noticed the possibility to switch back to the previous screen. Since first respondents were asked about the recommendations and later they were told this was two portions, it might be that respondents corrected their answer. The latter might be the reason that nearly all respondents filled in the correct amount of recommendations. However, because the answers were anonym and the media attention for the recommendations is very high, I consider this unlikely.

15.4.2Validity of TPB measures

The traditional model of Theory of Planned Behavior holds well in this study. The used measures for traditional TPB variables are validated and used in many different studies and I therefore accept them as reliable. The internal consistency of the measures for perceived behavioral control and subjective norm are weak and suggests that different aspects of these variables are measured in this study. As is explained in chapter 14, I do not consider this to bias my results, but it should be taken into account when comparing the results with results from previous studies (that might have used a different definition of these variables). One respondent reported she was allergic for fruit and this influences the level of affective attitude. This might have lowered the internal consistency of affective attitude, but the alpha of this variable is still considered good. Therefore no correction is made for this. Fruit consumption is measured as the average of two methods and I expect the drawbacks of each method to outweigh each other. However, in both methods self reported compliance is used as a measure for fruit consumption and not actual fruit consumption. This might bias the results and should be taken into account.

15.4.3Validity of knowledge measures

Each type of knowledge is measured by five or six statements that were developed specifically for this study. The measures are not validated. Five or six statements are a relatively low amount of questions to fully reflect one's knowledge and there would be more variation in knowledge when more questions were asked. The latter would be favourable for the reliability of the regression analyses. Despite these drawbacks I expect the measure to give a sufficient representation of the respondents' knowledge for this study and the variation in knowledge is enough to provide us with a general idea of the relationship. The statements were clearly formulated and based on one of the most reliable, easy-accessible and well known sources when it comes to information about diets and food, namely the Dutch nutrition centre. Furthermore, more questions could lead to unreliable outcomes because the students get tired and neglect their answers. The internal consistency of the knowledge measures was low. I do not consider this a problem, because the knowledge scale can be seen as a representation of the knowledge of an individual: the items in their totality represent the knowledge and a higher score represents a higher knowledge. The fact that the knowledge questionnaire was short and has not been validated should be taken into account when generalizing the results.

15.4.4Causality

A drawback of the used method is the problem of causality. For the found relations between variables, the direction is unclear. For example, although it could be that nutrient knowledge affects habits, it could also be the other way around: people who consume fruit frequently (have high habit strength) are more open to information about nutrients of fruits and thus habits

affect nutrient knowledge. To properly test whether indeed knowledge affects behavior a different method should be used.

15.4.5 Additional value of knowledge in the TPB model

Although the results from the regression analyses show relationships between nutrient knowledge and habits and disease knowledge and intention, the role of knowledge in the determination of fruit consumption seems small. First, with the traditional TPB model (including habits) 66 percent of variance in fruit consumption was explained. In the final model 72 percent of variance in consumption was explained. This indicates that adding the knowledge variables, gender, barriers and physical activity increases the explained variance in fruit consumption with only 6 percent. The majority of fruit consumption is thus determined by the traditional TPB variables. Second, scatter plots and Spearman's correlations show no clear relationship between knowledge and consumption.

15.5 RECOMMENDATIONS FOR FUTURE RESEARCH

There are several recommendations for future research. In this chapter I will discuss the four of which I think are most important.

15.5.1 Retesting the roles of different types of knowledge in the TPB model

The distinction between the different types of knowledge is a valuable addition to the existing literature. In many studies, different types of knowledge are used interchangeably and this may be the cause of the contradictory findings. Therefore I recommend that future studies also make a distinction between different types of knowledge. Furthermore, not many studies incorporated knowledge in the TPB model. Given the large predictive power of the TPB model and the results in this study, I recommend more research to verify the relationships.

More different knowledge types can be distinguished to further specify the effects of knowledge on consumption. For example, the role of "short-term disease knowledge" can be investigated. It could be that knowledge about short-term health effects of fruit consumption is related to instrumental attitude. Given the large effect of instrumental attitude on intention, it is valuable to know what influences instrumental attitude.

15.5.2 Testing the "stages of change"-model in the context of fruit consumption

Also, some (weak) supporting evidence is found for the existence of the stages of change model in the context of fruit consumption. I recommend testing the relationships between knowledge and other variables in different stages, in particular the effect of practical knowledge on fruit consumption. These insights can help improving interventions: when it is found that these relationships differ amongst individuals in different stages, the intervention can target only the individuals who are in a stage that is sensitive to a knowledge increase.

15.5.3 Investigate the 'gap' between intention and consumption

The biggest determinant of fruit consumption is intention. Most of the factors that can be influenced by interventions are related to intention. The results of this study show that only around 40 percent of intention is translated into fruit consumption. To more effectively increase fruit consumption it is very useful to know what happens in the stage between intention and fruit consumption. What other factors cause that intention is not fully translated into consumption? When this is known increasing intention will be more effective.

15.5.4 Investigate the other barriers that are related to perceived behavioral control

In this study the barriers of costs, willpower and taste (i.e. affective attitude) are investigated. As was expected, they are related to the perceived behavioral control (PBC) and 31 percent of PBC is explained. Because of the big role of PBC in changing fruit consumption it is worthwhile to investigate what other barriers – such as availability and convenience – are related to it and hence, what other barriers interventions should decrease.

16. CONCLUSION

I investigated whether there is a relationship between knowledge and the consumption of fruit. This question is relevant since fruit consumption in the Netherlands is below the recommended amount of two portions of fruit per day and increasing fruit consumption can lead to significant improvements in public health. Knowing whether or not there is a relationship between knowledge and consumption is useful for the development of effective interventions.

Previous literature about this relationship is ambiguous. In this study a distinction is made between three types of knowledge: knowledge about nutrients (nutrient knowledge), knowledge about the role of fruit in the prevention of diseases (disease knowledge) and knowledge about practical issues (practical knowledge). The reason is twofold. First, many previous studies are unclear about their definition of knowledge and this distinction helps to bring clarity in the ambiguous findings. Second, this distinction provides more clear and specific gaps in the knowledge that should be tackled by interventions.

The sample consisted mostly out of college students. Since food patterns established during college years are likely to be maintained for life, this group is especially worthwhile to investigate. The Theory of Planned Behavior (TPB) and stages of change model are used as a framework to investigate this issue.

The fruit consumption of Dutch students is below the recommended daily intake. Nearly all respondents are aware of the current recommendations. This indicates that awareness of recommendations might have helped in the past, but other factors must be considered to increase fruit consumption in the future.

In this study a relationship between nutrient knowledge and habits and disease knowledge and intention is found. This suggests that increasing the knowledge about diseases and nutrients might indirectly lead to higher fruit consumption. Since the average levels of knowledge are low, there is plenty of potential for interventions. Although correct knowledge has a positive effect on intention, misperceptions do not have a negative effect.

Other important determinants of fruit consumption of college students are taste and costs. Evidence is found for the clustering of healthy behavior amongst respondents; those practicing physical activity regularly eat significantly more fruit. Focusing on those with an unhealthy lifestyle when conducting an intervention program might be a good start.

The average low level of knowledge indicates that there is much to learn about fruit for Dutch students. Might it be true that increasing their knowledge will lead them to meet the recommended consumption of fruit? I suggest we try.

17. APPENDIX

17.1 QUESTIONNAIRE QUESTIONS FOR KNOWLEDGE

Nutrient knowledge

1. Fruit contains little or no fat.
2. 3 apples contain the daily recommended amount of vitamin C for adult men.
3. 1 banana contains 5 times more vitamin C than 1 kiwi.
4. A piece of apple pie contains 4 to 5 times more calories as 1 apple.
5. Avocado contains a relatively high amount of fibre compared to other sorts of fruit.

Disease knowledge

1. Fruit plays a role in the prevention of 20% or more forms of cancer.
2. Eating fruits decreases the level of cholesterol.
3. Eating fruits helps prevent heart- and vascular diseases.
4. Eating fruits helps against muscular pain after sport.
5. Eating fruits helps preventing obesity.
6. Eating fruit improve one's bowel movements.

Practical knowledge

1. Eating frozen fruits has the same effect on health as eating fresh fruits.
2. Eating canned fruits has the same effect on health as eating fresh fruits.
3. All nutrients from fruit are represented in vitamin pills.
4. The recommend amount of 2 portions of fruit per day may be substituted by 2 glasses of 100% fresh fruit juice.
5. 5 strawberries represent 1 serving of fruit.
6. Varying fruits has a more positive effect on health than consuming similar fruits.

17.2 SCORE SYSTEMS FOR KNOWLEDGE

	Pointsystem
1	1 = "I know it is correct" or "I think it is correct" 0 = "I don't know", "I think it is not correct" or "I know it is not correct"
2	1 = "I know it is correct" 0 = "I think it is correct", "I don't know", "I think it is not correct" or "I know it is not correct"
3	1 = "I think it is not correct" or "I know it is not correct" 0 = "I don't know", "I think it is correct" or "I know it is correct"
4	1 = "I know it is not correct" 0 = "I think it is not correct", "I don't know", "I think it is correct" or "I know it is correct
5*	2 = "I know it is correct" 1 = "I think it is correct" 0 = "I don't know", "I think it is not correct" or "I know it is not correct"
6*	2 = "I know it is not correct" 1 = "I think it is not correct" 0 = "I know it is correct", "I think it is correct"", or I don't know"
7*	2 ="I know it is correct" 1 ="I think it is correct" 0 ="I don't know" -1 ="I think it is not correct" -2 ="I know it is not correct"
8*	1 = "I know it is correct" or "I think it is correct" 0 ="I don't know" -1 ="I think it is not correct" or "I know it is not correct"

Systems 5-8 have been left out from the results, because it did not lead to new insights.

17.3 EXAMPLE KNOWLEDGE CALCULATION

	Statement	Correct answer	Answer respondent	Score type 1	Score type 2	Score type 3	Score type 4
1.	Fruit contains little or no fat.	True	Ik weet zeker dat dit waar is	1	1	0	0
2.	3 apples contain the daily recommended amount of vitamin C for adult men.	False	Ik denk dat dit waar is	0	0	1	0
3.	1 banana contains 5 times more vitamin C than 1 kiwi.	False	Ik weet zeker dat dit niet waar is	1	1	0	0
4.	A piece of apple pie contains 4 to 5 times more calories as 1 apple.	True	Ik denk dat dit waar is	1	0	0	0
5.	Avocado contains a relatively high amount of fibre compared to other sorts of fruit.	True	Ik weet zeker dat dit niet waar is	0	0	1	1
	Total score			**3**	**2**	**2**	**1**

17.4 QUESTIONNAIRE

Start vragenlijst

Alvast bedankt dat je deze vragenlijst wilt invullen. Deze vragenlijst wordt gebruikt voor onderzoek naar het gedrag en de houding omtrent fruit onder studenten. Het kost ongeveer 10 minuten om de lijst in te vullen. Bij elke vraag is 1 antwoord mogelijk. Vul het antwoord in wat het best bij jou past. Je antwoorden blijven anoniem.

Consumptie

Dit eerste deel gaat over jouw fruitconsumptie. Een portie betekent: 1 stuk fruit, zoals 1 appel, 1 banaan, of een handje vol aardbeien of druiven, of 1 glas 100% fruit sap. Vink het antwoord aan wat het beste bij jou past.

***1. Hoe veel dagen per week eet je gemiddeld fruit?**

Nooit of minder dan 1 dag per week	1 dag per week	2 dagen per week	3 dagen per week	4 dagen per week	5 dagen per week	6 dagen per week	Elke dag
◯	◯	◯	◯	◯	◯	◯	◯

***2. Hoeveel porties (of stuks) fruit eet je op zo'n dag?**

1	2	3	4 of meer
◯	◯	◯	◯

***3. In de afgelopen week, hoe vaak en hoe veel heb je van onderstaande fruitsoorten gegeten?**
(indien je een fruitsoort niet hebt gegeten, zet dan in beide kolommen een 0 neer)

	Hoe veel dagen?	Aantal stuks/porties op zo'n dag:
Appel of peer		
Citrus vruchten, zoals sinaasappel, citroen, grapefruit		
Mandarijnen		
Banaan		
Kiwi		
Overige vruchten, zoals druiven		
100% vruchtensap		

***4. Denk je dat je voldoende fruit eet?**

- ◯ Nee, ik eet te weinig fruit
- ◯ Ja, ik eet voldoende fruit
- ◯ Ja, ik eet ruim voldoende fruit

*** 1. Wat is volgens jou de aanbevolen dagelijkse hoeveelheid fruit?**

Aantal stuks fruit per dag:

Hieronder staan een aantal beweringen over fruit. Dit is een onderzoek, geen test, dus vul het antwoord in wat het beste bij jou past. Als je het antwoord niet weet, vink je "ik weet het niet" aan.

***1. Fruit bevat weinig tot geen vet**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***2. Het eten van bevroren fruit heeft dezelfde gezondheidseffecten als vers fruit**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***3. Het eten van fruit uit blik heeft dezelfde gezondheidseffecten als vers fruit**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***4. Het eten van fruit vermindert de kans op minstens 20% van de vormen van kanker**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***5. Drie appels voldoen aan de dagelijkse hoeveelheid vitamine C voor volwassen mannen**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***6. 1 banaan bevat 5 keer meer vitamine C dan 1 kiwi**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***7. Het eten van fruit werkt cholesterol verlagend**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***8. Alle voedingsstoffen uit vers fruit zitten ook in vitamine pillen**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***9. Het eten van fruit vermindert de kans op hart- en vaatziekten**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***10. Het eten van fruit helpt tegen spierpijn van het sporten**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***11. De aanbevolen hoeveelheid van 2 porties fruit per dag mag vervangen worden door 2 glazen 100% vers fruit sap**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***12. Het eten van fruit helpt overgewicht te voorkomen**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***13. 5 aardbeien staan gelijk aan 1 portie fruit**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***14. Het eten van fruit is bevorderlijk voor de stoelgang**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***15. Een stuk appeltaart bevat 4 a 5 keer zo veel calorieën als 1 appel**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***16. Het eten van verschillende soorten fruit heeft een positiever effect op gezondheid dan het eten van dezelfde soort fruit**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

***17. Avocado bevat relatief veel vezels in vergelijking met andere soorten fruit**

Ik weet zeker dat dit niet waar is	Ik denk dat dit niet waar is	Ik denk dat dit waar is	Ik weet zeker dat dit waar is	Ik weet het niet
◯	◯	◯	◯	◯

Experts raden aan dagelijks minstens 2 porties fruit te eten. Een portie is 1 stuk fruit (zoals 1 appel, 1 banaan, of een handje vol aardbeien of druiven) of 1 glas 100% fruit sap. Op de volgende twee pagina's worden een aantal vragen gesteld over jouw mening over het eten van fruit in aankomende week.

***1. Als ik zou willen zou ik komende week dagelijks minstens 2 porties fruit kunnen eten**

Helemaal niet mee eens	Gedeeltelijk niet mee eens	Neutraal	Gedeeltelijk mee eens	Helemaal mee eens
◯	◯	◯	◯	◯

***2. Ik ben van plan om komende week dagelijks minstens 2 porties fruit te eten**

Helemaal niet mee eens	Gedeeltelijk niet mee eens	Neutraal	Gedeeltelijk mee eens	Helemaal mee eens
◯	◯	◯	◯	◯

***3. Ik kan het makkelijk betalen om komende week dagelijks minstens 2 porties fruit te eten**

Helemaal niet mee eens	Gedeeltelijk niet mee eens	Neutraal	Gedeeltelijk mee eens	Helemaal mee eens
◯	◯	◯	◯	◯

***4. Ik ga proberen om komende week dagelijks minstens 2 porties fruit te eten**

Helemaal niet mee eens	Gedeeltelijk niet mee eens	Neutraal	Gedeeltelijk mee eens	Helemaal mee eens
◯	◯	◯	◯	◯

***5. Het eten van minstens 2 porties fruit per dag in de komende week is voor mij moeilijk**

Helemaal niet mee eens	Gedeeltelijk niet mee eens	Neutraal	Gedeeltelijk mee eens	Helemaal mee eens
◯	◯	◯	◯	◯

***6. Het eten van minstens 2 porties fruit per dag in de komende week kost mij doorzettingsvermogen**

Helemaal niet mee eens	Gedeeltelijk niet mee eens	Neutraal	Gedeeltelijk mee eens	Helemaal mee eens
◯	◯	◯	◯	◯

***1. Het eten van minstens 2 porties fruit per dag in de komende week :**

	Helemaal niet mee eens	Gedeeltelijk niet mee eens	Neutraal	Gedeeltelijk mee eens	Helemaal mee eens
Vind ik lekker	◯	◯	◯	◯	◯
Is goed voor mijn gezondheid	◯	◯	◯	◯	◯
Doe ik graag	◯	◯	◯	◯	◯
Laat me me gezond voelen	◯	◯	◯	◯	◯
Zou ik met plezier doen	◯	◯	◯	◯	◯

***2. Dagelijks minstens 2 porties fruit eten is iets wat:**

	Helemaal niet mee eens	Gedeeltelijk niet mee eens	Neutraal	Gedeeltelijk mee eens	Helemaal mee eens
Ik automatisch doe	◯	◯	◯	◯	◯
Onwennig zou voelen als ik het niet zou doen	◯	◯	◯	◯	◯
Moeite zou kosten om het niet te doen	◯	◯	◯	◯	◯

***3. De meeste mensen die belangrijk voor me zijn:**

	Helemaal niet mee eens	Gedeeltelijk niet mee eens	Neutraal	Gedeeltelijk mee eens	Helemaal mee eens
Vinden dat ik komende week minstens 2 porties fruit per dag moet eten	◯	◯	◯	◯	◯
Zouden het goedkeuren als ik komende week minstens 2 porties fruit per dag eet	◯	◯	◯	◯	◯
Eten komende week minstens 2 porties fruit per dag	◯	◯	◯	◯	◯

Tenslotte volgen enkele persoonlijke vragen.

***1. Wat is je geslacht?**

- ◯ Man
- ◯ Vrouw

***2. Hoe oud ben je?**

Leeftijd:

***3. Hoe vaak sport je?**

- ◯ Nooit of minder dan 1 keer per week
- ◯ 1-2 keer per week
- ◯ 3 keer per week
- ◯ 4 of meer keer per week

***4. Geef aan wat voor jou van toepassing is:**

- ◯ Ik werk
- ◯ Ik volg een universitaire studie
- ◯ Ik volg een hbo-opleiding
- ◯ Ik volg een mbo-opleiding
- ◯ Anders, namelijk:

5. Indien je bij vraag 4 hebt ingevuld dat je werkt, hoe lang werk je nu?

- ◯ Minder dan 1 jaar
- ◯ Langer dan 1 jaar

***6. Rook je?**

- ◯ Ja
- ◯ Nee

***7. Wat is je burgerlijke staat?**

- ◯ Ongehuwd, uitwonend
- ◯ Ongehuwd, thuiswonend
- ◯ Getrouwd / samenwonend met partner
- ◯ Anders, namelijk:

*** 8. Hoe vaak per week eet je gemiddeld minimaal 4 opscheplepels groenten?**

1 keer per week of minder dan 1 keer per week	2-3 dagen per week	4-5 dagen per week	6-7 dagen per week
◯	◯	◯	◯

Einde

Bedankt voor het invullen van deze vragenlijst!

Wil je meer weten over fruit? Kijk dan op www.voedingscentrum.nl

17.5 RESULTS DESCRIPTIVE ANALYSES

17.5.1 Comparing the mean of consumption method 1 and 2

Results one-sample T-test		N=61
Variable	Mean	Sign.
Consumption Method 1	1.000	0.000
Consumption Method 2	1.436	0.000

17.5.2 Comparing the cost barrier for students/working people and independent/with parents

Results independent sample T-test			
Sample	N	Mean affordability	Sign.
Students	52	3.87	0.235
Working people	9	4.33	

Results independent sample T-test			
Sample	N	Mean affordability	Sign.
Live independent	55	3.85	0.123
Live with parents	6	4.67	

17.5.3 Comparing the fruit consumption for high and low physical activity

Results independent sample T-test			
Sample	N	Mean consumption	Sign.
Practice physical activity <3 times a week	41	0.991	0.001
Practice physical activity ≥3 times a week	20	1.682	

17.5.4 Comparing the mean levels of knowledge

Results ANOVA test		N=61
Variable	Mean	Sign.
Nutrient knowledge Type 1	0.689	0.002
Disease knowledge Type 1	0.601	
Practical knowledge Type 1	0.554	

Results ANOVA test		N=61
Variable	Mean	Sign.
Nutrient knowledge Type 2	0.279	0.014
Disease knowledge Type 2	0.164	
Practical knowledge Type 2	0.210	

Results ANOVA test		N=61
Variable	Mean	Sign.
Nutrient knowledge Type 3	0.164	0.000
Disease knowledge Type 3	0.235	
Practical knowledge Type 3	0.387	

Results ANOVA test		N=61
Variable	Mean	Sign.
Nutrient knowledge Type 4	0.010	0.011
Disease knowledge Type 4	0.038	
Practical knowledge Type 4	0.056	

17.5.5 Comparing the practical knowledge of different age groups

Results independent sample T-test			
Sample	N	Mean practical knowledge	Sign.
Age ≤ 20	17	0.106	0.007
Age > 20	44	0.250	

17.5.6 Comparing the nutrient knowledge of smokers and non-smokers

Results independent sample T-test			
Sample	N	Mean nutrient knowledge	Sign.
Non-smoker	54	0.300	0.047
Smoker	7	0.114	

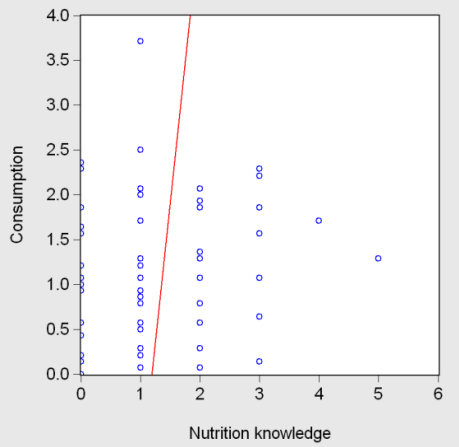
17.6 QUESTIONS AND ANSWERS KNOWLEDGE (RESULTS QUESTIONNAIRE)

	Question	Correct answer	% think correct	% know correct
Nutrient knowledge				
1.	Fruit contains little or no fat.	True	88.5%	55.7%
2.	3 apples contain the daily recommended amount of vitamin C for adult men.	False	34.4%	4.9%
3.	1 banana contains 5 times more vitamin C than 1 kiwi.	False	73.8%	34.4%
4.	A piece of apple pie contains 4 to 5 times more calories as 1 apple.	True	86.9%	34.4%
5.	Avocado contains a relatively high amount of fibre compared to other sorts of fruit.	True	60.7%	9.8%
Disease knowledge				
1.	Fruit plays a role in the prevention of 20% or more forms of cancer.	True	42.6%	3.3%
2.	Eating fruits decreases the level of cholesterol.	True	47.5%	6.6%
3.	Eating fruits helps prevent heart- and vascular diseases.	True	80.3%	23.0%
4.	Eating fruits helps against muscular pain after sport.	False	45.9%	4.9%
5.	Eating fruits helps preventing obesity.	True	59.0%	16.4%
6.	Eating fruit improve one's bowel movements.	True	82.5%	44.3%
Practical knowledge				
1.	Eating frozen fruits has the same effect on health as eating fresh fruits.	True	36.1%	11.5%
2.	Eating canned fruits has the same effect on health as eating fresh fruits.	True	3.3%	0.0%
3.	All nutrients from fruit are represented in vitamin pills.	False	83.6%	39.3%
4.	The recommend amount of 2 portions of fruit per day may be substituted by 2 glasses of 100% fresh fruit juice.	False	52.5%	13.1%
5.	5 strawberries represent 1 serving of fruit.	False	21.3%	1.6%
6.	Varying fruits has a more positive effect on health than consuming similar fruits.	True	83.6%	39.3%

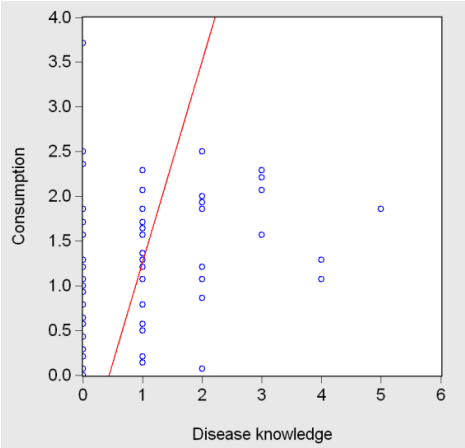
*Question 2 has been removed from analyses

17.7 SCATTER PLOTS

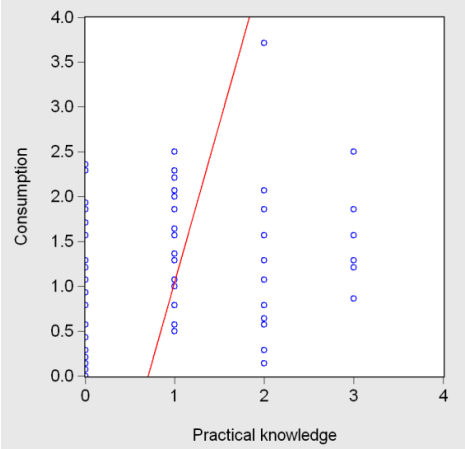
7.1 Nutrient knowledge & Consumption



7.2 Disease knowledge & Consumption



7.3 Practical knowledge & Consumption



17.8 EXTENDED CORRELATION MATRIX

Spearman's correlation coefficient between the study variables (n=61)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1. Fruit consumption	-																												
2. Intention	0.81 **	-																											
3. Instrumental attitude	0.35 **	0.61 **	-																										
4. Affective attitude	0.53 **	0.68 **	0.73 **	-																									
5. Social norm	-0.02	0.24	0.37 **	0.24	-																								
6. PBC	0.61 **	0.64 **	0.32 *	0.49 **	-0.04	-																							
7. Habit strength	0.73 **	0.71 **	0.52 **	0.62 **	0.15 **	0.51 **	-																						
8. Nutrition kn. type 1	0.18	0.18	0.13	0.18	-0.06	0.13	0.22	-																					
9. Nutrition kn. type 2	0.12	0.05	0.17	0.07	0.08	-0.08	0.28 *	0.32 *	-																				
10. Nutrition kn. type 3	0.01	0.00	0.00	0.02	0.03	-0.11	0.07	-0.52 **	-0.17	-																			
11. Nutrition kn. type 4	0.01	0.17	0.19	0.14	-0.28 *	-0.23	0.10	-0.03	0.19	0.17	-																		
12. Disease kn. type 1	0.25	0.29 *	0.19	0.35 **	-0.03	0.12	0.31 *	0.12	0.06	0.20	0.08	-																	
13. Disease kn. type 2	0.34 **	0.38 **	0.16	0.31 *	0.04	0.25 *	0.32 *	-0.06	0.27 *	0.22	0.14	0.38 **	-																
14. Disease kn. type 3	0.11	-0.10	-0.09	-0.11	-0.22	0.04	-0.02	0.37 **	0.28 *	0.22	0.11	0.44 **	-0.12	-															
15. Disease kn. type 4	0.02	-0.09	0.01	-0.10	-0.05	0.04	-0.03	0.09	0.22	0.16	0.12	-0.18	0.04	0.44 **	-														
16. Practical kn. type 1	0.32 *	0.27 *	0.16	0.18	-0.06	0.05	0.35 **	0.30 *	0.31 *	0.00	0.05	0.12	0.21	0.14	-0.01	-													
17. Practical kn. type 2	0.21	0.15	0.16	0.28 *	-0.10	-0.02	0.29 *	0.12	0.30 *	0.17	0.09	0.10	0.40 **	0.11	0.30 *	0.33 **	-												
18. Practical kn. type 3	-0.29 *	-0.22	0.16	-0.05	-0.06	-0.01	-0.25 *	-0.15	-0.30 *	0.10	0.02	0.04	-0.16	-0.09	-0.02	-0.75 **	-0.15	-											
19. Practical kn. type 4	0.05	-0.05	0.02	0.15	-0.06	-0.07	0.04	0.07	0.05	-0.02	-0.12	0.05	0.13	-0.08	0.30 *	-0.01	0.32 *	0.10	-										
20. Gender	0.04	0.06	0.38 **	0.17	-0.14	-0.08	0.14	0.14	0.16	0.05	-0.07	0.08	0.02	-0.03	0.14	0.24	0.14	-0.21	0.08	-									
21. Age	0.13	0.02	-0.18	-0.01	-0.21	0.07	0.09	0.24	0.17	-0.18	-0.10	-0.07	0.21	0.10	0.23	0.21	0.29 *	-0.15	0.09	-0.04	-								
22. Physical activity	0.44 **	0.20	-0.04	0.07	-0.23	0.15	0.27 *	0.17	0.06	-0.08	0.20	0.01	0.15	0.23	-0.06	0.28 *	0.14	-0.21	0.03	-0.14	0.23	-							
23. Education	0.09	0.01	0.00	-0.11	-0.07	-0.17	0.13	0.22	0.05	0.08	-0.04	0.09	0.07	-0.09	0.01	0.31 *	0.10	-0.28 *	0.04	0.14	0.36 **	0.12	-						
24. Smoker	-0.04	-0.07	-0.22	-0.05	-0.11	0.06	-0.05	-0.02	-0.27 *	0.02	-0.08	-0.14	-0.25	0.11	-0.06	-0.25	-0.22	0.31 *	0.07	-0.15	-0.24	-0.05	-0.05	-					
25. Marital status	0.13	0.25	0.27 *	0.22	0.14	0.17	0.15	0.02	-0.01	-0.17	-0.08	0.07	-0.14	-0.05	-0.04	0.01	-0.03	0.09	-0.18	-0.11	-0.08	0.23	-0.16	-0.12	-				
26. Vegetable consumption	0.16	0.18	0.21	0.21	0.04	0.05	0.32 *	0.09	0.20	0.08	-0.10	0.24	0.25	-0.12	0.08	0.26 *	0.19	-0.08	0.04	0.11	0.32 *	0.15	0.15	-0.29 *	0.09	-			
27. Can easily afford	0.28 *	0.33 *	0.14	0.10	0.04	0.39 **	0.16	0.07	0.16	0.01	-0.05	0.01	0.21	-0.17	-0.13	0.19	-0.05	-0.23	-0.24	-0.16	0.07	0.13	0.06	-0.18	0.19	0.08	-		
28. Takes no willpower	0.52 *	0.51 **	0.45 **	0.67 **	0.11	0.42 **	0.12	0.28 *	0.12	-0.04	-0.21	0.25	0.21	0.06	0.03	0.28 *	0.25	-0.13	0.18	0.02	0.14	0.23	0.14	0.17	0.15	0.25	0.08	-	
29. Awareness of recc.	-0.02	-0.08	-0.04	-0.09	-0.03	0.03	-0.18	-0.07	-0.13	0.22	0.06	-0.21	-0.06	-0.08	-0.18	0.09	-0.11	-0.18	-0.04	0.00	-0.08	-0.17	0.02	0.10	-0.14	0.01	0.02	-0.14	-
30. Opinion	0.67 **	0.49 **	0.32 *	0.52 **	-0.02	0.52 **	0.60 **	0.11	0.17	0.01	-0.06	0.22	0.18	0.14	0.09	0.05	0.17	0.02	-0.01	0.02	0.15	0.36 **	0.02	0.18	0.25	0.11	0.21	0.42 **	-0.16

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

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

PBC = Perceived Behavioral Control

17.9 RESULTS REGRESSION ANALYSES

9.1 Regression results hypotheses

Results from the regression analyses. Used method: Least Squares. Included observations: 61

Hyp.	Dependent variable	Independent variable	Coefficient	Prob.	Breusch-Pagan test
1,3, 4,5	**Intention** R^2=0.630 Adj. R^2=0.603	Constant	-4.048	0.000	0.218
		Instrumental attitude	0.672	0.012	
		Affective attitude	0.415	0.037	
		Subjective norm	0.143	0.402	
		Perceived behavioral control	0.530	0.000	
2,6	**Consumption**	Constant	-0.767	0.077	-
		Affective attitude	0.471	0.000	
	Consumption	Constant	-0.284	0.347	-
		Perceived behavioral control	0.379	0.000	
	Consumption R^2=0.609 Adj. R^2=0.588	Constant	-0.370	0.296	-
		Affective attitude	-0.007	0.948	
		Perceived behavioral control	0.088	0.228	
		Intention	0.376	0.000	
7	**Consumption** R^2=0.598 Adj. R^2=0.591	Constant	-0.188	0.252	0.201
		Intention	0.417	0.000	
8	**Consumption** R^2 = 0.661 Adj. R^2 = 0.649	Constant	-0.273	0.078	0.544
		Intention	0.292	0.000	
		Habits	0.226	0.002	
	Habits R^2 = 0.463 Adj. R^2 = 0.454	Constant	0.380	0.186	0.093
		Intention	0.556	0.000	
9	**Habits** R^2 = 0.536 Adj. R^2 = 0.520	Constant	0.065	0.820	0.140
		Intention	0.538	0.000	
		Nutrient knowledge	0.267	0.004	
10,13	**Disease knowledge** R^2 = 0.201 Adj. R^2 = 0.174	Constant	0.257	0.287	0.249
		Nutrient knowledge	0.258	0.048	
		Practical knowledge	0.350	0.015	
	Nutrient knowledge	Constant	1.072	0.000	0.052
		Disease knowledge	0.326	0.008	
11	**Instrumental attitude**	Constant	4.471	0.000	-
		Disease knowledge	0.104	0.112	
12	**Habits**	Constant	1.921	0.000	-
		Disease knowledge	0.336	0.005	
	Habits R^2 = 0.471 Adj. R^2 = 0.453	Constant	0.395	0.170	0.192
		Intention	0.524	0.000	
		Disease knowledge	0.093	0.350	
13	**Practical**	Constant	0.721	0.000	0.071

	knowledge	Disease knowledge	0.334	0.003	
14	**Perceived behavioral control**	Constant	3.996	0.000	-
		Practical knowledge	-0.036	0.798	
15	**Habits**	Constant	1.997	0.000	-
		Practical knowledge	0.243	0.083	
16	**Nutrient knowledge**	Constant	1.200	0.000	-
		Gender	0.371	0.229	
17	**Disease knowledge**	Constant	0.900	0.000	-
		Gender	0.243	0.454	
18	**Practical knowledge**	Constant	0.833	0.000	-
		Gender	0.417	0.136	
19	**Instrumental attitude**	Constant	4.497	0.000	0.218
		Disease knowledge	-0.008	-0.993	
		Disease knowledge*Gender	0.157	0.142	
19*	**Instrumental attitude**	Constant	4.371	0.000	0.168
		Gender	0.412	0.007	
20	**Habits** $R^2 = 0.558$ Adj. $R^2 = 0.534$	Constant	-0.058	0.844	-
		Intention	0.517	0.000	
		Nutrient knowledge	0.243	0.008	
		Physical activity	0.300	0.100	
20*	**Nutrient knowledge**	Constant	1.131	0.000	-
		Physical activity	0.229	0.184	
21	**Consumption** $R^2 = 0.718$ Adj. $R^2 = 0.703$	Constant	-0.416	0.006	0.160
		Intention	0.299	0.000	
		Habits	0.168	0.013	
		Physical activity	0.218	0.001	

9.2 Regression results of compleet hypotheses-framework

Hyp.	Dependent variable	Independent variable	Coefficient	Prob.	Breusch-Pagan test
1,3, 4,5	**Intention** $R^2=0.630$ Adj. $R^2=.603$	Constant	-4.048	0.000	0.218
		Instrumental attitude	0.672	0.012	
		Affective attitude	0.415	0.037	
		Subjective norm	0.143	0.402	
		Perceived behavioral control	0.530	0.000	
8,9,12, 15,20	**Habits** $R^2=0.510$	Constant	-0.084	0.784	0.346
		Intention	0.520	0.000	
		Nutrient knowledge	0.240	0.016	
		Disease knowledge	-0.023	0.825	
		Practical knowledge	0.043	0.690	
		Physical activity	0.199	0.107	
2,6,7, 8,21	**Consumption** $R^2=0.732$	Constant	-0.509	0.102	0.306
		Intention	0.262	0.000	
		Habits	0.180	0.010	
		Affective attitude	-0.050	0.575	
		Perceived behavioral control	0.102	0.102	
		Physical activity	0.215	0.002	

10,13	**Disease knowledge** $R^2 = 0.201$ Adj. $R^2 = 0.174$	Constant	0.257	0.287	0.249
		Nutrient knowledge	0.258	0.048	
		Practical knowledge	0.350	0.015	
	Nutrient knowledge	Constant	1.072	0.000	0.052
		Disease knowledge	0.326	0.008	
11	**Instrumental attitude**	Constant	4.471	0.000	0.131
		Disease knowledge	0.104	0.112	
13	**Practical knowledge**	Constant	0.721	0.000	0.071
		Disease knowledge	0.334	0.003	
14	**Perceived behavioral control**	Constant	3.996	0.000	0.312
		Practical knowledge	-0.036	0.798	
16	**Nutrient knowledge**	Constant	1.200	0.000	0.331
		Gender	0.371	0.229	
17	**Disease knowledge**	Constant	0.900	0.000	0.085
		Gender	0.243	0.454	
18	**Practical knowledge**	Constant	0.833	0.000	0.014
		Gender	0.417	0.136	
19	**Instrumental attitude**	Constant	4.493	0.000	0.218
		Disease knowledge*Gender	0.150	0.030	

9.3 Additional findings

9.3.1 PBC & Barriers

	Dependent variable	**Independent variable**	**Coefficient**	**Prob.**	**Breusch-Pagan test**
	Perceived behavioral control $R^2 = 0.316$ Adj. $R^2 = 0.280$	Constant	0.407	0.576	-
		Affordability	0.225	0.029	
		Takes less willpower	0.055	0.696	
		Affective attitude	0.596	0.003	
	Perceived behavioral control $R^2 = 0.314$ Adj. $R^2 = 0.290$	Constant	2.04	0.000	-
		Affordability	0.241	0.029	
		Takes less willpower	0.269	0.005	
	Takes less willpower	Constant	-0.983	0.181	-
		Affective attitude	1.089	0.000	

9.3.2 Disease knowledge & Intention

	Dependent variable	**Independent variable**	**Coefficient**	**Prob.**	**Breusch-Pagan test**
	Intention $R^2 = 0.625$ Adj. $R^2 = 0.605$	c	-3.937	0.000	0.242
		Affective attitude	0.430	0.030	
		Instrumental attitude	0.758	0.002	
		Perceived behavioral control	0.512	0.000	
	Intention $R^2 = 0.637$ Adj. $R^2 = 0.618$	c	-3.732	0.000	0.298
		Disease knowledge	0.256	0.010	
		Instrumental attitude	0.986	0.000	
		Perceived behavioral control	0.591	0.000	

9.3.3 Knowledge types

	Dependent variable	Independent variable	Coefficient	Prob.	Breusch-Pagan test
	Habits	Constant	1.808	0.000	-
		Nutrient knowledge (type 2) = actual correct knowledge	0.381	0.011	
	Habits	Constant	1.618	0.003	-
		Nutrient knowledge (type 1) = correct beliefs	0.184	0.212	
	Habits	Constant	2.164	0.000	-
		Nutrient knowledge (type 3) = false beliefs	0.532	0.621	
	Habits	Constant	2.282	0.000	-
		Nutrient knowledge (type 4) = false knowledge	-3.075	0.369	-

9.3.4 Stages of respondents

	Dependent variable	Independent variable	Coefficient	Prob.	Breusch-Pagan test
Group 1 (N=18)	**Habits** $R^2 = 0.594$ Adj. $R^2 = 0.507$	Constant	0.011	0.986	0.512
		Intention	0.577	0.002	
		Nutrient knowledge	0.366	0.028	
		Practical knowledge	-0.138	0.429	
Group 2 (N=33)	**Habits** $R^2 = 0.467$ Adj. $R^2 = 0.412$	Constant	0.744	0.002	0.078
		Intention	0.148	0.038	
		Nutrient knowledge	0.234	0.011	
		Practical knowledge	0.203	0.028	

9.4 Regression results final framework

	Dependent variable	Independent variable	Coefficient	Prob.	Breusch-Pagan test
	Consumption $R^2 = 0.712$ Adj. $R^2 = 0.703$	Constant	-0.471	0.006	0.159
		Intention	0.299	0.000	
		Habits	0.168	0.013	
		Physical activity	0.218	0.001	
	Intention $R^2 = 0.656$ Adj. $R^2 = 0.632$	Constant	-3.703	0.000	0.248
		Disease knowledge	0.219	0.027	
		Affective attitude	0.335	0.085	
		Instrumental attitude	0.754	0.002	
		Perceived behavioral control	0.504	0.000	
	Habits $R^2 = 0.536$ Adj. $R^2 = 0.520$	Constant	0.065	0.820	0.140
		Intention	0.538	0.000	
		Nutrition	0.267	0.004	
	Perceived behavioral control $R^2 = 0.314$ Adj. $R^2 = 0.291$	Constant	0.362	0.612	0.073
		Affordability	0.225	0.028	
		Affective attitude	0.643	0.000	

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