



UNIVERSITY
OF TAMPERE

Attitude and Attention in Information Acquisition Decision-Making:

TESTING THE OSTRICH-EFFECT WITH AN INDULGEMENT
SUBSTANCE.

HANNA BJÖRKSTEDT

Master's Thesis, May 2018

Master's Degree Programme in Public Choice, Faculty of Social Sciences

Supervisor Prof. Katri Sieberg

Acknowledgement

First, I would like to give a special thanks to my supervisor and teacher Professor Katri Sieberg for her support, guidance and her wisdom for constructing and developing further my knowledge during my studies. Secondly, I want to address my gratitude to Robert Hollingsworth who provided a great tutorial for grammar issues when writing this paper. I also want to express my gratitude to my other teachers: AJ Bostian, Peter Miller, Eric Sieberg, Anneli Milen, Reija Autio, Giuseppe Attanasi, Ryan Kendall and others whose lectures and comments helped me in choosing the most suitable topic and analysis setting for my motivation. Finally, I would like to thank all my colleagues and friends, especially Seekyung and Tomomi, who helped me to run the experiment. Last but not least, I want to thank my “already independent” little daughters Ida and Ada for all the understanding “when their mother was multitasking” and not giving her greatest attention to them while working and writing this thesis.

Abstract

Individual motivation, awareness and prevention of bad health outcomes play a key role when discussing public spending on health care. Most of these discussions are often related to design good policies and efficient resource allocation, that would incentivize individuals to act to promote health so that society's spending on health care could be minimized in the future. Further, other questions arise when considering changing responsibilities from the public sector to individuals. If people are encouraged to monitor their own health and actions, would it provide more savings in the future and how does individual decision-making function when there is a health outcome as a concern? Do individuals make optimal decisions when consuming indulgent substances such as candies, sodas, alcohol and other consumer goods that drive hedonism? Are our decisions based on rationality and a true desire for valid information or are our decisions driven by our beliefs which might be biased because of our preceding action?

This study tries to address the importance of beliefs in decision-making process by finding links between motivated attention and attitude toward information acquisition. The study uses quantitative methods for testing and analysing the data which is obtained from the laboratory experiment. As the indulgence substance used in the experiment was chocolate, therefore all the information provided for participants (articles) in the experiment were related to chocolate and its health effects.

The statistical analysis of the experiment data shows that the attitude and the threshold were not significant variables in estimating the impact on information acquisition. Although, both were estimated of having slightly negative impact on the information acquisition. This could mean that people do not want to attain the information that might supply a surprise for them. People also seem to be stimulated to attain information by negative information or even more stimulated by positive information of chocolate but less stimulated by neutral information.

In terms of providing information about health issues, we should think about the attention in a way that the information is designed to be the most "indulging" way for people to desire for more knowledge. If we supply the information that does not raise emotions, then our goal is not met if we want to increase the motivated attention.

Keywords: attitude, motivated attention, decision-making, ostrich-effect, health information acquisition

Table of Contents

Acknowledgement.....	1
Abstract	2
1 Introduction.....	4
1.1 Research question and its relevance	8
1.2 The structure of the thesis.....	8
2 Literature review	10
2.1 A brief history of decision-making and emotions related to desire for information	10
2.2 Addiction, procrastination and overconfidence offsetting the utility gain	13
2.3 Motivational aspects of information acquisition and utility (desire for wisdom).....	15
2.3.1 Instrumental value of information and the attractiveness	15
2.3.2 Curiosity and ambiguity aversion defining the clarity.....	15
2.3.3 Timing aspects and the quantity of choices in decision-making	19
2.4 Health promotion aspect of information acquisition	22
3 Research Methodology.....	24
3.1 Theory.....	24
3.2 Research methods and models.....	29
3.2.1 Hypothesis	30
3.3 The experiment’s design	34
3.4 Ethics	37
4 Results	38
4.1 Descriptives	38
4.2 Testing the hypothesis	44
4.2.1 Coefficients for estimated regression models (model 1 and model 2)	44
4.2.2 Logistic regression model for testing the “Ostrich-Effect”	51
4.3 Discussion.....	55
5 Conclusions.....	59
6 References	62
7 Appendix.....	66

Mr.Bain: ...” *The foretaste of pleasure is pleasure begun: every actual delight casts before it a corresponding ideal...*”

In Jevons, W.S.(1871),page 40 : Theory of Political Economy. London: Maxmillan and co.

1 Introduction

Many of the decisions we make daily are related to our actions and have great impacts on our health. Such decisions also create a concern in terms of public spending as our societies provide a great amount of health care services. Individual motivation, awareness and prevention of bad health outcomes play a key role when discussing public spending on health care. Most of these discussions are often related to design good policies and efficient resource allocation, that would incentivize individuals to act to promote health so that society’s spending on health care and clinical treatments could be minimized in the future. As such, a number of questions arise. Should authorities start to manipulate information to encourage people to acquire more knowledge in terms of their own health and promotional actions? Should society require individuals to monitor better their own health, and should policies overall encourage people to share openly information to achieve better knowledge?

Further, other questions arise when considering changing responsibilities from the public sector to individuals. If people are encouraged to monitor their own health and actions, would it provide more savings in the future and how does individual decision-making function when there is a health outcome as a concern? Do individuals make optimal decisions when consuming indulgent substances such as candies, sodas, alcohol and other consumer goods that drive hedonism? Are our decisions based on rationality and a true desire for valid information or are our decisions driven by our beliefs which might be biased because of our preceding action?

In the economic literature, the individual decision-making is often based on preference choices, where the base term, utility, is highlighted as being the outcome variable on which people are grounding their decisions. By grounding their decisions on the utility, people have a clearer insight whether the action they are supposed to do is giving a possible boost or a reduction on their situation. In other words, people count their expected utilities by using their subjective probabilities.

Traditional expected utility theory ¹assumes that consumers will only benefit from their resources and assets at the time they redeem and spend them. According to the theory, people try to maximize their objective utility function which is defined by their own personal preferences and those preferences are valued as material outcomes. The question that arises is whether this theory holds and whether people are also deriving pleasures or pain instantly while they are in the process of shifting between these values before the change happens and the actual reward is reached. Another question is how much the state of cognition matters when valuating these rewards (both negative or positive). In terms of negative impact or mental pain, is there increasing ignorance present in certain situations? In other words, do people hold the belief that delaying negative news and negative views will increase their utility not only at the time but also later might lead to more mental pain. One might therefore ask whether ignorance is bliss or a burden for the future?

However, the new, updated perception that people obtain utility not only from material rewards but also from cognition such as anticipation, although absent previously in economic models, is now relatively accepted among economics. For many years the most economic models were based on general assumptions and simplifications trying to estimate the factors of utility and economic behaviour by defining preferences. During recent decades research has developed and found methods for more complex and precise estimations of human behaviour. One orientation among the wide discipline of economic research is behavioural economics which often uses experimental methods and game theory as a grounding to provide proof for new behavioural theories.

The earliest contribution and findings related to behavioural games were most probably those of Allais (1953) and Ellsberg (1961) paradoxes. These paradoxes show that traditional expected utility theory and its axioms have too much simplification and do not define the real-world situation in terms of economic decision-making. According to these findings people that are participating in behavioural games are not acting according to the traditional theory. The choices made by players do not reflect their interests that they are waiting for from these choices. Approximately a decade after Allais and Ellsberg paradoxes Vernon Smith (1970) started to highlight experimental research as a tool to investigate economic market behaviour. Nevertheless, perhaps the most significant and accurate description of decision-making compared to the traditional expected utility theory was the update provided by Daniel Kahneman and Amos Tversky's (1979) contributions. They formulated and tested a model 'The prospect theory'. The model describes how people behave in decision-making situation

¹ Referring to the von Neumann-Morgenstern utility theorem. The theorem shows that, if a person is behaving rationally when facing different risky choices of situations, behaves in such a way that he strives to maximize the expected value of his own utility function at a given time in the future

when the risks and uncertainty are involved with choices and probabilities. Following the “prospect theory”, people tend not to pay attention to the result itself but rather to the potential value of loss or a gain. According to Kahneman and Tversky (1979), people estimate their losses and profits using certain heuristics such as their previous threshold or other type of framing.

During the last few decades, economic models have been developed more defining sentimental features and cognition aspects of utility such as where utility has been compounded from anticipation (Loewenstein G. , 1987), curiosity (Loewenstein G. , 1994) and also from self-image or ego (Kőszegi, 2006). Furthermore, Elster (1998) has pointed out how emotions depend on beliefs. According to Elster, the key theme of psychological game theory argues that feelings are triggered by beliefs. (Elster, 1998) Psychology research as a driving tool for economics has also shown how optimistic beliefs can have an impact on health. According to research, those people who possess positive views of themselves tend not only be happier but healthier as well (Baumeister;Campbell;Krueger;& Vohs, 2003). Also, the optimistic thoughts and anticipation matters in terms of health (Baumeister et al., 2003).

A suitable approach to evaluate the impact of these “sentiments” is grounded on a work of “psychological games”. One way to interpret these games is as a formulation of utility that depends on the moves of others. Therefore, as stated in many studies the utility can depend directly on beliefs about the beliefs of other players (Rabin, 1993) (Geanakoplos & al., 1989) . However, if utility can be based on second-hand beliefs, why cannot it be determined by the threshold values and intentions based on those thresholds as well? Especially Rabin argued that, the model of reciprocity should also include beliefs and intentions.

Despite the beliefs, social cooperation, incentives, consequences, and deception having already been studied experimentally, (Costa-Gomes & Weizsäcker, 2008) (Camerer, 2003) (Gintis, 2009) (Gneezy, 2005), the wider picture of a heuristic and “restricted rational” individual has not yet been examined fully. The main reason for this might be the inclusion of cognition which makes models much more complex. Therefore, this part has often not been included. However, newer models such as specific utility theory ‘Utility of wisdom’ can contribute important content to explore human behaviour and decision-making. In addition, many of these earlier studies concentrated on interactive strategic decisions and behaviour using game theory-based methods and are thus multidisciplinary. Though behavioural economics and game theory provides an exceptional framework for studying human behaviour and its effect on wider social context, the experimental side of it needs more

research. The stated wider approach needs a lot of multidisciplinary work between different faculties, such as neuroscience, economics and psychology.

1.1 Research question and its relevance

The primary aim of this research is to examine the individual desire for acquiring information related to health choice in terms of a behavioural economics framework utilizing the specific utility theory (*utility of wisdom*) as a grounding theory. As a secondary aim, this research tries to find answers to the following questions: Does attitude influence information acquisition and with what magnitude? Are people rational according to their own beliefs and attitudes?

When speaking of the relevance of the stated questions, the research also discusses the matter of whether the openness of information stimulates people to gain more information and rather what type of information. If we take this thought further, what kind of information supply could decrease the costs of the welfare state and what might increase them?

This study tries also to address the importance of beliefs for cognition in decision-making process by finding links between motivated attention and attitude toward information acquisition. The study uses quantitative methods for testing and analysing the data which is obtained from the laboratory experiment.

1.2 The structure of the thesis

The thesis is structured as follows. First, after the outline of the broad approach of the study in the introduction, in Chapter 2 there will be a literature review of the issues related mostly to decision-making as a wider perspective followed by narrowing decision-making to the biases and heuristics individuals often make when making choices between different matters. The literature review will then narrow the approach further to motivational issues, categorizing them into different subsections according to different valuations and situational aspects. The last section in the literature review part is dealing with health promotion issues highlighting the binding between individual decision-making (and responsibility) and the possible new policies which push individuals to be more proactive in the future.

The literature review is followed by the research methodology, in which the first section is devoted to the theory framework and the predictions from the theory. The second section describes the methods, models and the hypothesis used in this study. The laboratory experiment's design and its

limitations are explained in the third section of the methodology chapter. Ethics for the experimental research are also discussed in the end of the methodology chapter.

The fourth chapter provides the results, the analysis of the results and discussion sections. The fifth chapter summarizes and concludes this research.

2 Literature review

This chapter highlights first the issues related to information acquisition decisions and cognition in terms of emotions. After giving the wider perspective of the issue, in the second section of the literature review, the context of decision-making is narrowing to the biases and heuristics individuals often make when choosing between different matters.

In the third section, the literature review will narrow the approach further to motivational issues, categorizing them into different subsections according to different valuations, situational aspect and set of choice aspect.

The last section in the literature review part is dealing with health promotion issues highlighting the binding between individual decision-making (and responsibility) and the possible new policies which push individuals to be more proactive in the future.

2.1 A brief history of decision-making and emotions related to desire for information

As referring to Jevons (1871) prior to introduction part the topic of pleasures and decision-making around them is old. Although, from the times of Jevons and Bentham the research has developed enormously adding more sophisticated methods and precision into research. Nevertheless, as Jevons quoted Bentham and further described the pain and pleasure in decision-making, the idea of effecting forces has not changed much.

...” to consider how pleasure and pain can be estimated as magnitudes, we must undoubtedly accept what Bentham has laid down upon this subject. "To a person," he says, "considered by himself, the value of a pleasure or pain, considered by itself, will be greater or less according to the four following circumstances:

- (1) Its intensity.*
- (2) Its duration.*
- (3) Its certainty or uncertainty.*
- (4) Its propinquity or remoteness.*

These are the circumstances which are to be considered in estimating a pleasure or a pain considered each of them by itself."

Bentham goes on to consider three other circumstances which relate to the ultimate and complete result of any act or feeling; these are

(5) Fecundity, or the chance a feeling has of being followed by feelings of the same kind: that is, pleasures, if it be a pleasure; pains, if it be a pain.

(6) Purity, or the chance it has of not being followed by feelings of an opposite kind. And

(7) Extent, or the number of persons to whom it extends, and who are affected by it.

These three last circumstances are of high importance as regards the theory of morals; but they will not enter into the more simple and restricted problem which we attempt to solve in Economics. " (Jevons, 1871)

Jevons (1871) stated that a feeling must be considered as having many levels as well as having different kind of magnitudes which in term are varying quantitatively. As Jevons states, feelings last some time and they may be acute, they may also aggregate, and their intensity can vary. He also questioned the matter that with the same duration the quantity will be proportional to the intensity, so if the intensity of a feeling is constant the quantity of a feeling would increase with its duration. However, the intensity of a feeling will change from time to time and the occasion itself may spice up the feeling to become more powerful and long-term feeling.

As Jevons and Bentham already stated more than 150-years ago, feelings undoubtedly form our decision-making from which there are lot of scientific experimental proofs as stated later in this chapter. Now as shifting from preliminary perspective of feelings the intention is to gather information from earlier studies toward defining more accurately the information acquisition related to feelings, action following the feelings and attitudes.

The recent years have supplied us increasing volume of research on whether additional information stimulates our feelings and further action related to them. Cook and Barney (1964) were among the first ones to show experimentally how feelings are linked to anxiety and choice behavior. They tested how a choice between two different electric shocks would vary. The conclusion was that subjects

chose rather an immediate larger shock over the smaller delayed one. Nevertheless, Loewenstein (1987) concluded similar patterns in his survey. More negative emotions, such as fear have been studied by Janis (1958) and Witte (1992,1994). Janis believed that more (negative) information stimulates anxiety. Subsequently his conclusion changed from his prior belief when he resulted in a research that more information about the upcoming medical procedure actually lowers anxiety (Janis, 1958). Witte also studied fear and its aspects in decision-making. She has developed a theory and written many notable papers on fear appeals on health risk messages. Her most notable work relates to extended parallel process model (EPPM) which she developed when studying AIDS prevention and cognitive and emotional mechanism in decision-making. (Witte, 1992) (Witte, 1994) Witte's conclusion was that cognition leads to fear driving success (in terms of attitude, intention or behavior change). Notions in Witte's later literature related to attention, is pointing an eye to emotions and decision-making in a way that how there might be increasing concerns rising from this type of results. Her main point reflects an issue towards the approach that how people's behavioral change is affected by stakeholders (such as politicians as prestigious leaders) and institutions. Another matter is, how responsively these institutions will utilize behavioral changes and whether they are trying to manipulate people to gain better outcomes. As Witte states, "...we can see the importance of developing strategies for the ethical use of manipulation techniques to promote health and to prevent disease."

One of the aspects of information acquisition studies is relations to wisdom and reasoning skills. The work in belief and attention research in this context is mainly based on psychology research, which in turn has increased the desire toward economics side of research rather to formulate theories and suitable models which try to describe these phenomena. (Akerlof & Dickens, 1982) (Baumeister et al, 2003) (Loewenstein et al, 2012) (Baumeister;Loewenstein & Read, 2003) (Laffont & Mortimort, 2002) (Karlsson et al, 2004) (Rabin, 1993) (Laibson, 2015) Nevertheless, the experimental part of testifying these models to be valid is still tip of on iceberg among economics but fortunately increasing along multidisciplinary research projects. (Holt, 2007) (Kahneman, 2011) (Golman & Loewenstein, 2014)

2.2 Addiction, procrastination and overconfidence offsetting the utility gain

Another aspect thinking about attention related to information acquisition is within addictions. Some people might be forced to do some things and cannot be controlled by themselves. Perhaps the most used model defining addictions which influence decision-making is a dynamic choice theory. (Ainslie, 2001) (Andreou, 2006) (Stanford Encyclopedia of Philosophy, 2018) Nevertheless, in the dynamic choice theory, negative and even self-destructive behavior does not become compulsive but becomes discreetly typical. Although, the typical negative behavior can be related to situations where decision-making is reflecting the complexity of preference choices and where preferences can be often intransitive for decision-maker. These cases often lead to dynamic choice problems. (Ainslie, 2001) (Andreou, 2006) Attention to this aspect has increased research to notice origins and preceding actions of self-destructive addictive behavior. (Andreou, 2006) When searching solutions to prevent addictive and negative behavior in a larger scale the type of theories such as dynamic choice theory can provide lot of insights and give valuable cost-efficient approach when combined with other substance specific cases such as environmental or health aspects. A good example in terms of defining self-destructive behavior is so called “silent addiction” which not necessarily is recognizable from the outside, such as addiction to alcohol or to drugs are. A “silent addiction” refers to addiction such as watching certain kind of programs/series/porn, playing games, taking secretly (and daily) painkillers, chatting in internet or any other “invisible” but still possibly harmful action that impacts on brain activity and activates brains reward center producing pleasure hormones (neurotransmitters).

According to Kang et al.(2009) and Loewenstein (2014), addictions can be overwhelming so that they offset decision-making by limiting “the scope for volitional control of behavior” and are therefore irresistible. A good example of overwhelming addiction is smoking as well as consuming any other indulgent substance which can create addiction. According to George Ainslie’s view, addictive habits such as smoking, are often supported by discounting-induced preference changes. (Ainslie, 1999) (Ainslie, 2001) This means that even if someone who cares about her future health outcome and do not want to consume heavily cigarettes, can easily fall into indulgent smoking which she plans against and then regrets after smoking.

Another good example of discounted-induced preference changes comes from environmental philosophy. As referred already in the previous paragraph, Andreou (2006) states that, agents are sometimes induced to procrastinate by having intransitive preferences, possibly in combination with unclarity in choice situations. This refers to case where entropy is high. It means that the information is not clear or organized in decision-making and therefore the following decision will not be the optimal one. Andreou states that an agent (as an individual decision-maker) or as a collective group

member, can be guided to a course of harm simply because of intransitive preferences (Andreou, 2006). Therefore, such action as environmental destruction or unhealthy actions can occur even that the interpersonal conflicts are not present. This kind of action has structurally similar features such as in a case when somebody is torturing herself. As the self-torturer thinks, the fact that couple of more times, and just a little bit more of sweets/alcohol/cigarettes or other addictive substances can give enormous transient pleasure and at the same time not making any drastic changes in health. Nevertheless, this type of a sustained pleasure can still be interpreted completely different than harmless when looking at it as a continuing process (Andreou 2006). As Andreou points out, although the long-term goal might be valuable, and people need to restrain their temptations along the way to success, the procrastination in decision-making and favoring indulgent over the rational behavior is considered as a threat and shifting utility so that people do not even think about it. Often this type of procrastination has been considered as a form of weakness of will. Although, there has been increasing motivation for analyzing procrastination in terms of utility gains and losses.²

The overconfidence seems also be an issue in decision-making as being categorized one of the well-established biases in cognition (Kahneman, 2011). The term overconfidence refers to a situation where person's self-confidence (subjective confidence) for her decisions is much bigger than the objective accuracy itself for those decisions that she is making. Overconfidence is one example of rating oneself or one's subjective probabilities wrongly. The term cognitive bias is often used defining cases related to similar matters. As a term, the overconfidence among other cognitive biases can refer to distinct views: overestimation of performance, over placement of one's skills relative to others or over precision when expressing the certainty of accuracy in one's beliefs. (Kahneman, 2011)

² To name few authors such as Schelling, Herrnstein, Prelec, Akerlof, Ainslie, Strotz, Rabin, O'Donoghue etc. have modelled various time-discounting and "picoeconomic"-models from implications of the experimental research. Picoeconomics refers to a term used by George Ainslie as a tendency for people to give more value to immediate returns compared to later ones. Preferences are therefore said to be discounting for the future. According to above mentioned authors (the tendency) utility is a convex function in terms of time i.e when the time goes on the utility does not change anymore that much as in sooner return receiving moment.

2.3 Motivational aspects of information acquisition and utility (desire for wisdom)

As discussed in the previous sections, decision-making in terms of information acquisition is rather a complex issue with its features of having both the intrinsic cognitional aspects as well as the extrinsic definable valuations for utility. If we separate more accurately the intrinsic ones from the extrinsic we investigate more deeply the motivation for information acquisition. The desire for information and wisdom can be described by many of these motivational aspects.

2.3.1 Instrumental value of information and the attractiveness

The pure instrumental value of information undoubtedly increases one's utility because it can be seen to result in decisions with superior expected outcomes. The instrumental value is captured by traditional expected utility theory and is used most often when describing the utility of information acquisition. Another aspect is to view information as a part of affecting motivation through its anticipatory components. This means that people seek or avoid information based on their beliefs in findings and the resulting effects for their utility (they anticipate that some information is painful and some pleasurable, which in return increases or decreases their utility). (Benabou & Tirole, 2013) (Galai & Sade, 2003) (Karlsson et al, 2009) In the latest theoretical model Godman and Loewenstein (2014) predicted desire for information to increase as the valence increases for anticipated outcomes. In other words, this means that the person is more willing to acquire information when *the valence* (the value of the definitive answer and the instrumental value, in other words the total of intrinsic plus extrinsic attractiveness) increases.

2.3.2 Curiosity and ambiguity aversion defining the clarity

As the previous paragraph named two parts of motivational aspects operating through valence and influencing on information acquisition, the third view defining desire for information is curiosity as a desire for information as its own sake. In this view, the information itself has a reward of its own and not only because of the anticipation of the reward comes along with utilizing information (Kang et al, 2009). The study from Kang et al. showed that people activate their reward center when acquiring information (the intrinsic motivation can activate hippocampus).

The forth approach describing desire for information is the risk- and ambiguity preference. This approach captures the view in which individual experiences by the missing information toward the decision that she must make. In terms of cognition, psychologists refer these as ambiguity and omission biases³. Further, as it is shown in psychology research, people do consider unknown salient information differently with the available unknown and unknown additional case. (Asch, et.al, 1994) This means that for example in case where people do not know about the risks of the treatment for certain types (or for groups having certain features) are more unwilling to take the treatment because of thinking they might belong to a group of those who have higher risk, so in other words the salience of the information is a key determinant for the action and its exceeding decision. The *salient* (significant) information gaps can therefore either decrease or increase the desire for information and have an effect to activity itself (Golman & Loewenstein, 2014).The theory also argues that the risk and the ambiguity aversion are being different cases from each other's if we are looking at the common estimations for risk aversion occurring in a case of loss aversion. Therefore, the case of *salient information gap* is interpreted as being partly constructed by the sufficiency of information and partly by the importance of information.

As already discussed, the desire for information is constructed piece by piece from different particles related to intrinsic and extrinsic bindings of decision-making to acquire information. In a following table the desire for information is showed by steps toward more salient and clarified parts of knowledge. Unaware person does not know about the question neither the answer nor the precision of either. The belief can be therefore anything based on unawareness. If the belief and information acquisition system is activated the person might have a hint of the subject but still lot of uncertainty and unawareness. The more the person will acquire information the more uncertainty drops, information gap diminishes, and the person pays more attention toward clarity of the information. This might still stimulate emotions of unawareness because of some uncertainty and affect decision-making not to acquire certain information if the clarity is not known. In this case the attention on the other hand is affected by the negative valence (“ignorance is a bliss”).

³ Ambiguity bias refers to a case where people avoid options in where the missing information makes the probability to seem "unknown" and therefore they feel as they are having “worse odds”. The term omission bias, on the other hand, means that subjective judgement is not calibrated equal in terms of action and inaction. People sometimes judge harmful actions as worse, or less moral than equally harmful inactions because actions are more obvious than inactions.

Question	Answer/information	Belief or persuasion	Aggregation direction		
Latent/hidden	-	Unawareness	Ignorance		
Activated	Unknown	Uncertainty	↓ Awareness	↓	
	Known (knowledge)	Certainty	+ ↓ Clarity	Information ↑ gap	↓ Wisdom

Table 1 Desire for wisdom modified from the Godman&Loewenstein (2014)

The theory proposition from Godman & Loewenstein (2014) combines the intrinsic and the extrinsic motivation with distinct types of bindings in decision-making. For example, in the model of self-confidence the prediction of aggregation direction is opposite (Benabou & Tirole, 2013). Further, Köszegi’s model of utility from ego also has the opposite prediction compared to Godman & Loewenstein’s model (Köszegi, 2006). In the opposite predictive models, the prediction is that people acquire the most information about themselves when holding negative beliefs. This prediction is due to a thinking that people might change their prior beliefs when they are facing negative information against their prior belief. One might ask a question that how typical it is for people to change their attitudes and beliefs, if we are assuming that to happen?

To answer the stated question, we must look at belief change process and its determinants. In terms of belief change (in psychology), the internalization has been seen difficult for people if there are no other effects parallel (compliance, identification) (Kelman, 1938). Here internalization means that the change in beliefs occur when a person finds the content which suits best for her and gives her the most intrinsically meaningful outcome in terms of attitudinal change. Further, this can lead to sustained changes in belief/attitude system. In a new state, the behavior of a person is now consistent with the personal value system. Therefore, behaviors which are adopted in this way last longer and are sustained. (Kelman, 1938) The only problem in psychological internalization in terms of preventative means would probably be that attitudes are grown as a result for long term exposure for certain type of actions, environments, methods, processes etc. just to name few, and as said earlier attitudes are extremely difficult to change if there are no other parallel “pushing factors”. The

expectancy-value theory⁴ is based on this kind of internalization of belief system change. The main idea of the theory is that the individual behavior is reflected from the function of individual purpose, which in turn is a function of a general individual attitude toward behavior/operation.

Even that we would not expect the internalization to occur and beliefs or attitudes changing in our expectations as modeling the decision-making process and utility, we still need to formulate the model based on thresholds and consider additional effects.

Despite of different assumptions within models, there are parallel results to Godman & Loewenstein's prediction in some empirical research verifying their theory. The theory of cognitive dissonance and its applications also confirms the idea of predictions combined from Godman & Loewenstein's theory. (Festinger, 1957) Festinger points out that, in some situations, people's attitudes may be more based on past behavior if a cognitive disorder makes it difficult to ignore these attitudes. Therefore, people might feel forced by their own cognition to rationalize their past behavior. Research results from financial portfolio check-ups has also implications following Godman&Loewenstein's prediction of how people behave. In portfolio studies, the holders of portfolios who check their investments' status via internet, tend to look up the value of their portfolio more often in up-markets than in down-markets. (Karlsson;Loewenstein & Seppi, 2009) (Galai & Sade, 2003). This result goes parallel to other previously stated where positive information might have more influence on the motivated attention.

These studies also propose that possessing information has a bigger effect on utility than with pure suspicion. According to Godman & Loewenstein theory, learning of a definitive information increases the attention weight placed on the issue. In the long run, the possessed information may lead to diminish the attention weight. However, when the information is understood and detected with certainty, the immediate increase in attention will occur. This type of process tends to dominate in decision making. In other words, the theory suggests that the surprise parameter is contributing to attention weight. Further, it means that this newly refreshed belief is followed by an immediate boost in attention weight and so on. The theory argues for this giving the resulting belief more impact on utility. We could think the similar case in studies: when someone is having an interest toward an issue and finding something new or controversial compared to her prior beliefs this newly attained information will give a boost to following attention.

⁴ (EVS) developed during -70's and -80's by M. Fishbein and I. Ajzen, both who later updated the theory into the theory of reasoned action and the theory of planned behavior. EVS-theories are still commonly used among education, health communication and economic studies.

Godman & Loewenstein also notice, that at the same time when information would reduce expected uninformative part of information (entropy) it could increase utility through better clarity and again lead to negatively boosted attention which is in beliefs and which on the other hand decreases therefore total utility. So, in other words entropy as reduced from attention is considered as an “anti-information” because of its feature being reflecting informational disorder and also affecting the weighted attention. The concept of entropy is probably the most difficult one to understand in the specific utility model but is attained when one’s cognition realizes the meaning of order aspect for information. As binding the “anti-information” (entropy) to the upcoming experiment results, the entropy can have features of negative and positive information to mix and not giving clear understanding to the reader and therefore affect motivation as well as the belief system. If beliefs are negative (e.g. eating chocolate decreases health outcome), the person may prefer to avoid the information of positive health effects of chocolate. Nevertheless, in Godman & Loewenstein’s (2014), the prediction is that as the intrinsic value of definitive answer (valence) of a negative belief decreases, a person becomes less willing to attain relevant information. This holds especially in cases where the individual is having a bigger discounting factor in terms of time, in other words when the person is myopic. There are findings parallel to this prediction. In Caplan’s (1995) study, the result shows that women who had worsening breast cancer symptoms seem to delay longer visiting physician than those whose symptoms were stabilized or fading away.

2.3.3 Timing aspects and the quantity of choices in decision-making

There are also research results where decision-making has studied as adjusted with timing and quantity of decisions. Timing here refers to decisions made in different time of a day, which has seen related with issue of decision fatigue⁵. (Baumeister;Loewenstein;& Read, 2003) Furthermore, the decision fatigue is considered as one of the main factor causing irrationality people have when making decisions. Psychologists often refer to this term when considering effects on erosion of self-control. Most of the study cases define repeated decisions. As earlier stated, people’s willpower often determines our strength, resistance to temptation, and has an enormous influence on our lives (Ainslie, 1999) (Ainslie, 2001). Based on our irrationality of choices we take defines and sets our goals and

⁵ The term decision fatigue comes from psychology and refers to the time aspect in decision-making. The quality of decision might weaken after a too long session.

affect our monitoring of the progress toward these goals. Parallel we also affect our attitudes keeping faith when our goals are not obtained. (Ainslie, 2001) (Baumeister et al., 2003) (Baumeister R. F., 2003) In other words, willpower makes it clearer to seek different things in life- whatever we want to gain, but first we have to learn to harness our self-control. A good example of time adjusted decision-making irrationality comes from the research of analyzing parole decisions made by judges in court (Danzinger;Levav;& Avnaim-Pesso, 2011). According to Danzinger et al. (2011), judges in court showed to make less favorable decisions later in the day than early in the day. This can lead us to a conclusion, that as court sessions extending in time, judges were more likely to deny parole. This can be interpreted as being the easier or maybe safer option compared to positive parole and take the riskier option. Danzinger et al. estimate the percentage of favorable rulings dropping gradually from approximately 65% to nearly zero within each decision session and returning back to approximately 65% after a break.

In an equivalent way, we can think of any other decision-maker to fail in their decision tasks if the timing is not favoring the decision. A suitable example to refer the issue among health-related decision-making could be a case in doctor's practice (a doctor as a decision-maker as giving prescription and advice). Research among health care professionals found the parallel results of timing effect when analyzing physicians prescribing antibiotics for their acute respiratory infection patients (Linder;Doctor;& Friedberg, 2014) In primary care, it is rather a common act to prescribe unnecessary antibiotics for acute respiratory infections, just to make sure that the infection is handled. Physicians actions are like judges' in court denying paroles as in Danzinger et al. findings. According to Linder et al. (2014), "*due to perceived or explicit patient demand, desire to do something meaningful for patients and the desire to conclude visits quickly*" makes this prescription decision occurring. Another aspect to conclude prescribing antibiotics easier is an unrealistic fear of complications (Teixeira Rodrigues et al., 2013). Linder et al. (2014) hypothesized that if there were decision fatigue among doctors, it would mean that the probability of making antibiotic prescriptions would increase as clinic sessions enlengthened. As stated, they found implications parallel to Danzinger et al. research. In terms of cognitive attention in decision-making in this case, the decision fatigue constructed an estimated 26% increase of prescribing antibiotics from the first working hour to the fourth working hour for clinicians.

The quantity of choices (set of choices) is also a very interesting approach to attention and decision-making. The overchoice, or the choice overload is a cognitive process in which people have difficulties making decisions when they are facing too many options. The term introduced by Alvin Toffler in 1970 has gained attention not only among psychology, but also in marketing and in

behavioral economics. (Tversky, 1972) (Tversky & Shafir, 1992) (Gourville & Soman, 2005), (Kotler, 1991), (Chernev, 2003) The newest published research that covers the issue is a meta-analysis, conducted in 2015 which incorporating 99 studies. The research isolated some important results effecting attention. The study concluded that in terms of consumption issues and marketing matters, that reduction in choices for customer sales is most likely to boost sales. This means that overload in terms of affecting attention might work negatively. There were four key factors identified in the study, which were: the choice set complexity, decision task difficulty, preference uncertainty, and decision goal. Those matters seem to restrain the effect of assortment size on choice overload. A prior research by Chernev (2003) documented the overall effect of assortment size on choice as being significant. The newer study also concluded that, when these restraining factors are being included in a model, the significance is still valid. (Chernev et al., 2015)

There seems to be a paradox in that "often people who lack choices want them and often will fight for them", although parallel to that, "people see that making many choices can be psychologically speaking aversive." In terms of attention these studies show that cognitive valuations and self-control in decision-making can have a significant impact on decisions and, as we are aware of, affect not only individuals but populations. When combining concerns of health issues, self-control, motivation and information acquisition, we come closer to the origins of human behavior, can draw links from affecters to respondents and possibly start solving problems (e.g. antibiotic resistance, chronic/lifestyle illnesses etc.). Justification of the multidisciplinary research seems therefore to be more than reasonable when looking at the scale of impact on a wider perspective of decision-making, even that at first the issue of attention and decision fatigue might sound as a minor concern.

2.4 Health promotion aspect of information acquisition

As we now know, the information acquisition is a complex issue with its motivational aspects and belief system constructing characters. How about if we glue the cognitional characters of decision-making into wider approach of decision-making in a society level as just approached to in the end of the last paragraph of timing and quantity of choices in decision-making.

A notable example of this kind of approach is health and health promotion which we know that has a lot of cost reducing and resource allocation challenges because of the scarcity of the resources. In health science literature, perhaps the most cited model defining the determinants of health as well as the health inequalities is the model constructed by Dahlgren and Whitehead in 1991. In the model the elements are centered on the individual and on her biological characteristics. The model shows how different layers might have influence on health (Dahlgren & Whitehead, 1991). These factors include such as personal lifestyle elements; influences from social and community action; living and working conditions; general socioeconomic, cultural and also environmental conditions. In the model all these different stages have a distinct and direct effect on health, but also these factors have interactions via each other's level which contribute and shape the total impact as well as it shapes different levels. Furthermore, as the research suggests the lifestyle factors, which often are considered as health-related behavior, can be originated from the influence of social and community factors, or on the other hand by cultural, socioeconomic or environmental conditions. (Dahlgren & Whitehead, 1991) The main message the model is concluding is that there are lot of factors that need to be tested and adjusted by others.

While in the Dahlgren and Whitehead -model the individual into the core surrounded by other influences, the individual still makes choices and determines the activation level for acquiring information for those choices as discussed in earlier sections. In the individual perspective of health promotion, the main key lies on trust for information, information acquisition and self-motivation. This trust, as well as motivation, could be stimulated by the community influence with change in the scope of values, which in turn makes changes in paradigm itself, even though the process could be very slow. (Meadows D. H., 2008) As Meadows states it, the system (every system, whether it is economy, electoral system, political system, individual understanding or any other system) is always the sum of its parts and every part creates an effect to a system. (Meadows D. , 1999)

In individual level, the system of how we construct our own motivation also depends on many parts as stated in earlier paragraphs. The information spill-over effects (either positive or negative externalities⁶) makes it difficult for an individual to construct one's own belief system and motivation to develop and acquire more information. Furthermore, individual experiences have also significant impacts in this construction process along with aggregated beliefs and attitudes.

If we think about motivation being part of decision-making creating health, should we consider and highlight big changes with big goals and action on our way to gain these goals or should we rather consider small steps which in turn will lead us to big changes in the end when looking at the past?

As noticed earlier when referring to Witte's (1992, 1994) conclusions about the fear appeal the answer might found in ethics and good will: "...we can see the importance of developing strategies for the ethical use of manipulation techniques to promote health and to prevent disease." One of these methods could be in affecting people to improve their literacy understanding, critical thinking by increasing their motivation for acquiring information (no matter whether it is positive or negative) and encouraging people to search information, feel it, touch it and allow discussions of new thoughts without holding strictly on our own attitudes and beliefs.⁷ According to Godman & Loewenstein theory of *utility of wisdom*, the more aware people are about things the more they would pay attention and the more clarity of the information pieces they would gain, the better they will understand the meaning of wisdom and go toward it. In this discussion the society's norms and values play with big bets on how people are constructing their beliefs. If the norms and values do not allow to think and do differently, what innovative ideas can be established and proven as being as good as the old ones, or even better?

⁶ Externality refers to a positive or negative consequence of an economic activity experienced by unrelated third party.

⁷ Perhaps this could be a new meaning of a good will?

3 Research Methodology

3.1 Theory

My study primarily uses quantitative methodology with the theory based on Godman & Loewenstein's (2014) specific utility theory, '*utility of wisdom*'. Their theory follows the Psychological Expected Utility Model (PEU model) originally formulated by Caplin and Leahy (2001). A couple of years later after creating the first PEU model, Caplin and Leahy extended their research to show how different motivations, such as surprise and anxiety, can have different impacts in a principal-agent setting⁸. They mainly studied how distinct attitudes towards information matter in the stated setting.

The other part of the study uses the selective exposure hypothesis which has also made its way into economics even though its roots come from psychology. The selective exposure hypothesis is used in a study to test "Ostrich effect" of the information acquisition and it combines curiosity and motivated attention. As following Caplin's (2003) later work and Witte's (1992) EPPM, the biggest assumption is that people can decide their own preferred amount of information. In other words, people have the ability to make choices how much to acquire information. This assumption can also be valid in this study especially because we have a strong faith on higher educated people who are participating in the experiment which data is utilized in the analyses part in next chapter.

Although, as stated earlier Witte developed a model (EPPM) in which people respond to health warnings. This model is dual sided: people either adopt behaviours consistent with beliefs, or, if the warnings seem too bad and threatening, they purposely ignore them. The model has been slightly modified and used also in finance when studied negative and positive market signals creating incentive for portfolio check-ups. (Karlsson et al, 2009) (Galai & Sade, 2003)

My meaning is to examine whether the beliefs define the information acquisition and do people expose themselves to positive or negative information based on their beliefs (attitude) and actions (threshold). In the experiment, the setting is created so that it follows a minimum-effort game trying to describe the situation which people are facing daily, the lack of time for putting the maximal effort on information acquisition.

⁸ Principal-agent setting refers to case when an agent is hired by a principal to do the work that pleases principal's incentives. By creating the most optimal and motivating incentives for the agent the principal can foster the agent to operate according to principal's benefit.

Desire for information $D_i = D_i^{IV} + D_i^C + D_i^{MA}$ formulated by (Godman & Loewenstein 2014) states that desirability learning from the information is conducted by the 3 different consequences:

- 1) the information may affect the value of action which is chosen from the set of actions, which means that the usefulness of information induces the future action by the instrumental value of it
- 2) the information may change the subjective probabilities associated with different answers/information (π), which means that the gain in utility is defined by the change in probabilities in updating beliefs
- 3) the information may change attention weights (\mathbf{w}), which means that the amount of certain beliefs has an impact on attention and therefore impact on utility

If we want to make predictions about people acquiring (or avoiding) information, we can utilize a specific utility function where the preference for clarity and the role of attention weights are included. The model is the following (Golman & Loewenstein, 2014):

$$u(\pi, \mathbf{w}) = \sum_{x \in X} \pi_X(x) v_X(x) + \sum_{i=1}^m w_i \left(\sum_{A_i \in \mathcal{A}_i} \pi_i(A_i) v_i(A_i) - H(\pi_i) \right).$$

The utility $u(\pi, \mathbf{w})$ is dependent on the beliefs (attitude and/or threshold) in terms of subjective probability measure π and the attention weight \mathbf{w} vector. As stated and assumed in the theory, the knowledge has intrinsic value by the curiosity (the value of information of its own stimulates the reward center) and the motivated attention, and therefore the awareness of sufficient and meaningful question is one of the sources of utility followed by the utility gained from the answer. This specified utility function describes the preferences different between cognitive states that are given with fixed sets of questions which contain the intrinsic value of particular issue.

When distinguishing the function from the traditional utility function the most significant difference is that traditional one describes preferences by the material returns as the objects of valuation. The specific utility is calculating within the intrinsic valuation in the model by using the sum of value of information multiplied by the subjective probabilities for these valuations and added with the sum of weighted attention for subjective definitive answers for the “knowledge”, from which the entropy (the expected clear/unclear informative part of information) is reduced.

In the equation the value of prize x (e.g. the value of information) is expressed as $v_X(x)$ and the valence (intrinsic value in belief: the value of definitive answer) of answer A_i as $v_i(A_i)$. Entropy is

stated as $H(\pi_i)$ because it is calculated by the sums of subjective (and marginal as changing the information level) probabilities on the information.

The entropy is therefore reduced from the attention adding pattern of the information value because of its type as reducing compound questions for getting more information and dealing with unclearness if not organized in mind. The extreme case of the entropy might help to understand the concept better. If there are plenty of answers and so to speak too much to deal with, the entropy is high (and clarity is low). On the other hand, if there are only one clear answer to know for sure the entropy is zero (no additional answers to increase the knowledge).

The *utility of wisdom* theory has several predictions combined with their effect directions in a following table:

Question toward information	Answer	Belief/attitude	Motivation		effect and its direction		Wisdom
latent	no answer	based on unawareness/ignorance	-		(no gains/losses because of attitude), stagnation/no development		↔ stable
activated	unknown	uncertainty	valence (instrumental value + motivated attention)	clarity (ambiguity preference + curiosity)	information gap ↕	↕	depending on the situational attention weights and π (subjective prob.)
			if $H(\pi)$ high, ↑ if $H(\pi)$ low, ↓				
	known	certainty					
DESIRE FOR INFORMATION → more wisdom							

The information acquisition decision process and its features are drawn into the following picture to help understand the process better.

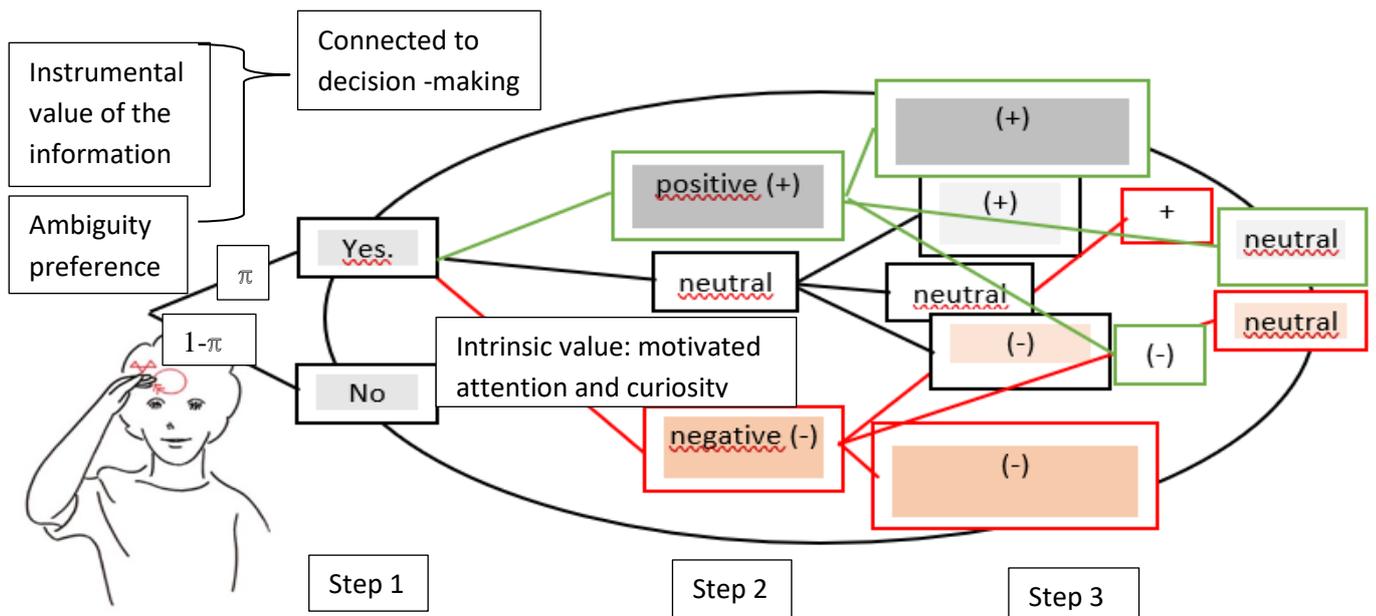


Figure 1

Information acquisition within different type of information (positive, neutral and negative). Beliefs (attitude) impacting as an oval circle behind the decision. The more the person acquires certain type information it leads to attitude to increase of its type of information (e.g. if the person gathers negative information it leads to “negative beliefs for the issue and increases attention to negative information). The optimum state would be rather on the edge (or outside the oval box) where attitude has no powerful impact on decision-making to attain certain type of information and the person would be indifferent for type of information. All information attained would still lead to better understanding of the issue (more clarity, higher valence, lower entropy-> smaller information gap and in the end more wisdom.

Assumptions (1-5) and predictions (6-9) in the model are the following:

1. people put their maximum effort on information acquisition in the experiment situation (normally people have a lack of time for putting their maximum effort on information acquisition)
2. people can choose (they have the ability) their own level how much to attend for a certain information and what type of information
3. people tend to behave as minimizing their risks, i.e. tendency to adjust their choices toward the lowest effort level
4. the timing of acquiring information has no effect (in this study the timing is not considered having any effect, in a real life there is a possibility of effects)
5. knowledge has an intrinsic value by the curiosity (the value of information of its own stimulates the reward center) and the motivated attention,
6. as the salience (the significance of information) increases, the desire for information will increase
7. as the importance of the value of the information (the payoff from the received information) increases, the desire for information will increase
8. when changing the relevant knowledge to one with higher valence (inner and outer attractiveness of the information) and parallel not having decreasing impact on salience (intrinsic importance), the desire for information will increase
9. when the amount of (questions) information in terms of positive and neutral beliefs (and positive valence) is increased, the desire for information will increase

3.2 Research methods and models

The study is conducted into two parts in terms of analysis. Both parts use empirical data to support or disprove a formulated hypothesis by using statistical and econometrical tools of regression analysis. Therefore, the method of the study can be said to be strictly statistical.

In the first part, the analysis consists of Descriptive statistics, Anova-test and Multivariate Linear Regression Analysis. These methods are testing the effects and statistical significances of the independent variables toward the dependent variable (information acquisition/number of articles read). Further, the t-test (ANOVA) showing the significances as analyzing variances for each variable and further formulating the best model with most significant variables and the most explanatory power. Although, the last part of the first analysis is to formulate a most fitting regression model to analyze the impacts of independent variables adjusted with others.

Another part is going to be tested as well with econometrics tools but not with same estimation model. The utilized test here is for obtaining the log odd ratios and significance of different variables toward the type of information, in other words it is testing the “Ostrich Effect”, whether the participants behave according to their attitudes by exposing themselves to positive or neutral information if the belief (attitude and threshold) is higher or selecting the negative information according to their negative attitude (lower belief). By conducting the econometric model for testing the log odds (probabilities) the data is formulated from categorial to binary, where the positive and neutral information is coded as 1 and negative information as 0.

3.2.1 Hypothesis

As stated earlier the desire for acquiring information is constructed from distinct parts of motivation, therefore the hypothesis is set as following,

- 1) the *null hypothesis* claims that there is no statistically significant difference in the explaining variables (β_i) and information acquisition, i.e. threshold, attitude/belief do not influence on information acquisition (*utility of wisdom*)
- 2) the *alternative hypothesis* supports the statement that belief and threshold play a significant role in information acquisition process

The interpretation of the hypothesis testing is, that if there is a correlation found with the dependent(outcome) variable and the independent (explaining) variable which is significant ($p < 0.05$ in confidence interval level of 95%) then the relation is valid. The regression analysis is practical for purposes when we need to know the relation between the independent (β_i) variable and dependent (y) variable. Parallel we can explore the form of the relationship and give estimations of dependent variable with different values of independent ones, but the causality must be tested strictly. In multivariate regression analysis there are many independent variables which are adjusted by others. Often many statistical tests calculate correlations between variables and when two variables are found to be correlated, it can be tempting to assume that the correlation shows that one variable causes the other even if that is not the case. Also, the cofounders should be tested for multicollinearity and finding out the possibility of effects determined not by individual impact but by strengthening or weakening effect by another variable. (Verbeek, 2006) (this could be done by looking at confounding variables within multiplication of variables in pairs in the econometric model or by VIF (variance inflation factor) but is now left out because of the time constrain for this being as a master's thesis research). Possible cofounders here are the age + years of schooling, years of schooling + socioeconomic level/income decile, attitude + threshold (number of chocolate eaten), myopiness1 in first preference choice + myopiness2 in second preference choice, title type + conclusion type, total type of the article + both title and conclusion types (see the appendix).

In this research the best econometric model is constructed so, that those variables which might have cofounding effects weakening or strengthening their impacts on the response variable have been tried to rule out in terms of looking only one variable at the time and then changed to another (possible cofounder) and checked the individual impact on response variable. The best regression models are

usually the ones where the predictor variables each correlate highly with the dependent variable and the multicollinearity is low (correlation with each other). This kind of models are often called as being “low noise models” and will be statistically robust ones. Multicollinearity should be tested even that it does not bias much results. It creates mainly large standard errors in independent variables. (Verbeek, 2006)

The econometric model has been tried to formulate as having the BLUE (best linear unbiased estimators) for the explanatory variables which do not include confounding effect in a final model. Unfortunately, because of the sample size (only 42) the power of the test cannot be seen very good. Although, the probability of rejecting the null hypothesis depends upon the standard error of our OLS (ordinary least squares) -estimator β_i and, thus among other things, upon the sample size. The larger the sample size the smaller the standard error and the more likely we are to reject. This will imply the type II error (rejecting the null hypothesis as being not true) become increasingly unlikely if we have larger sample size. In this case, by having a having a small sample size we could use a significance of 10% when testing the explanatory variables. If we had a large sample size, we could operate differently by using even stricter significance of 1% to attain more precise estimations. (Verbeek, 2006)

The first analysis of different variables affecting information acquisition is done with using linear regression analysis and the stepwise method for choosing the best variables. Analysis is performed with utilizing the statistical program R for finding the best fitted model explaining the relation of variables. In a stepwise model at each step, a variable is added in or subtracted from the model containing explanatory variables. In the analysis of variance setting, the variance for certain variable is divided into components which are resulting from different sources of the variation. ANOVA provides a test of means compared in groups. These tests (t-tests) are useful for testing three or more means (groups or variables) for statistical significance which shows whether the observation is differing from the others. (Verbeek, 2006) As stated earlier in this chapter the meaning is to test which of the variables have significant impact on the outcome variable (amount of information), respectively measured as number of articles chosen and read by participants.

In the second part of testing the variables impacts toward the type of the information is differing from the first testing part. Furthermore, the statistical modelling approach to the second part of the study is testing the log odds ratio of a range of factors influencing on the type of information acquired. As assumed and based on the theory, the attitude and the threshold play a key role in estimating whether the certain type of information acquired is following the factors such as positive attitude, and

higher threshold or differentiating from them. The approach is a logic induction of evidential support in epistemologically speaking. (Stanford Encyclopedia of Philosophy, 2018)

The core of the analysis in the second part concentrates on testing the difference between the negative and positive information acquisition in terms of attitude and/or chocolate threshold. In other words, the second part of analysis (logistic regression) is utilizing the type of the information as dependent variable and other variables as explaining variables. Because of the type (quality) of information is binary variable, the general linear regression model is not suitable, and the model must be changed to be analyzing log odds of the independent variables impacting the binary outcome variable. For simplifying the analysis procedure, the data is formulated (editing data by adding new variable and coding it as 0=negative and 1=positive or neutral) so that the negative type of information is treated separately from the neutral and positive information.

The hypothesis setting is the following,

- 1) the *null hypothesis* claims that there is no statistically significant difference in the explaining variables (β_i) for different types of information, i.e. higher threshold, higher attitude/belief do not influence on neutral and positive type of information (no ostrich-effect)
- 2) the *alternative hypothesis* supports the statement that belief and threshold play a significant role in information acquisition process as positive or neutral information follows by positive or neutral belief (with positive attitude or bigger threshold)

The primary method for this research was an experiment and the gathered data from the experiment was analysed quantitatively by using R.

The empirics for the ostrich-effect part of the study uses data of the type of information as a base for acquisition decisions. In this way, the research interprets the ostrich effect to mean that participants who like or ate more chocolate are simply less likely to have more information of negative things than positive or neutral ones. Whether participants attend to positive or negative information depends on the relative magnitude of the “discomfort” for attending to bad and positive value for their related action (and their health). If participants are heterogeneous, then some may attend while others may not. In positive option of information, however, all the participants will have an incentive to

acquire distinct type of information because of the direct “mental gain” from good news and because of the value of possible good health outcome (successful decision). The test for the type of information provides us information about, if the attitude and threshold give participants incentive to hold on their beliefs by not wanting to have surprise by attaining to negative information but rather increasing the total attitude toward more positive one for the issue. If the attitude or threshold seem not to matter they are supposed to be insignificant and not providing impact on positive and neutral type of information. This research tests mainly the first step of the information acquisition even that the data provides the possibility of testing the second step as well (where the participants attain more chocolate and more information about the chocolate). I hold the possibility for testing the second step as additional and only state results for that if the time constraint allows me to do so.

3.3 The experiment's design

The setting for the experimental research to test the information acquisition and selective exposure hypothesis (the Ostrich effect) was done in a following way:

The experiment was organized during February and March 2018. Total of 3 occasions were organized in three distinct locations in University of Tampere campus in Finland. The timing (during daytime between 10.30 and 14.00) for the experiment was conducted so that it would follow the natural setting even that considered as a laboratory experiment.

The participants were recruited among university students in the University of Tampere, because of the time and budgeted constraints of the study and easy access for controlled laboratory testing in university facilities. The aim was to get students from different faculties and from different study stages to participate so that the effect of study background and the level of years of schooling could be also measured. The sample size aimed to reach 50-80 participants and the total amount budgeted for all expenses was approximately 200euros (funded by the researcher). The total number of participants (42) was lower than expected. The number of observations should have been rather higher to attain significant and more accurate results for estimating different effects (referring to “law of large numbers”).

The experiment contained three particles and was conducted in three parts. Particles here refer to a 1) instructions/consent/questionnaire form, 2) the articles/information related to indulgent substance and 3) the indulgent (chocolate).⁹

In the first part of the experiment participants we informed about the duration (total of 15minutes) and the flow of the experiment and offered coffee/tea and a small pouch of chocolates. Each pouch contained 10 pieces of chocolate. After receiving related particles, participants were given few minutes to read instructions, sign their consent form and ask questions related to procedure. During the experiment subjects were not allowed to talk with each other. When everybody had signed their consent form they were simultaneously given permission to continue answering the demographics part and the first page of the questionnaire where they were subjectively answering for the questions of preference choice in lottery win (this was the measure of myopiness in the research), attitude

⁹ For instructions, consent form and questionnaire form, see the Appendix.

toward chocolate, state of hunger, and the number of chocolate eaten during the first part of the experiment.

The second part of the experiment contained the information acquisition/article reading and there was a time limit of ~5minutes to select and read the chosen material. All the articles (summaries)¹⁰ utilized in the experiment were selected from reliable, well-known scientific sources and all of them were similar in style, font-size and fitted into one page except the article number 10. The article number 10 contained a bit more text than the others and therefore had to be printed as 2-sided. All the articles were related to chocolate and its health effects. After the 5 minutes passed the participants were told to write down in a questionnaire which ones of the articles they chose and read. They were also asked to write down the reason for their decision and the number of chocolate eaten during the second part of the experiment.

The third part of the experiment consisted of a similar task than the second part. Again, subjects were asked to pick an article/articles they preferred and mark down the number of it when they had done the reading. The time provided for the third part was equal to the second part (~5minutes).

In the end of the experiment participants were asked to give feedback and some of the feedback. The total duration of the experiment was approximately 15minutes.

Articles (information which participants acquired) in the experiment were evaluated by their title and conclusion and the total quality type of articles were categorized by aggregating the title and conclusion type together. The quality here refers to an evaluation of an article to be negative, positive or neutral in terms of information containing in the article. As the indulgence substance used in the experiment was chocolate, therefore all the articles were related to chocolate and its health effects. Colors are stating the evaluation for the total type of the article, title type and the conclusion type. Evaluation of the total type of articles are calculated by the title plus the conclusion type. If title is neutral and conclusion positive the total outcome is positive. This aggregation logic follows similar with negative plus neutral having a total of negative. The total type of positive articles is 1, 4 and 8, respectively negative ones 2,6,9 and 10, and finally neutral articles 3, 5 and 7.

The evaluation of article types was based on perception of the author and a peer opinion from random participants. Evaluation of the articles was obtained from 2 of the participants one month after the experiment. Originally 5 of the peers were asked to give their evaluation, but only 2 answers were submitted back to the experimenter. The perception of the type of titles and conclusions did not

¹⁰ For the articles, see the Appendix.

differ significantly between the participants evaluation and the authors evaluation. The only significantly different evaluation was from the article number 3, which peers evaluated respectively, the other as positive and the other respondent as negative and the authors perception was neutral as in terms of giving both pro and con effects of chocolate on health. Therefore, the quality evaluation of the title types and conclusions can be stated as being valid and reliable according to common perception.

Justification for the stated design for the experiment is based on individual behavior in where a participant makes decisions based on her own preferences and subjective probability without others influencing on the decision for acquiring the certain information. Nevertheless, there are limitations in a setting where normal circumstances are not valid such as in pure natural setting where people are aware of their goals toward information acquisition, there are pure motivations for acquiring information of a topic according to people's own preferences. In this type of an experiment people might feel forced to read the information even they do not like the topic at all. Also, people could feel stressed about situation when there is a restricted time, and some might even think they are being tested for the information even that they have read instructions and know that this is not the case. The subjectivity of defining one's attitude and preferences is also a matter. Some people can state easier their preferences and attitudes because of their cognition. Overall, restrictions in the experiment deal mainly with the design the most natural setting and the subjectivity of participants action. Another feature to consider the experimental setting diversifying from the real life is the noise. In some cases there are lot of "noise" variables affecting to information acquisition, so that the concentration toward the issue is not the optimal one. Therefore, the one variable which was testing a "noise" was hungriness. The state of hungriness, thirst or otherwise noisy environment might have at least some effect on information acquisition.

3.4 Ethics

The reliability and credibility of this research requires to follow good scientific practice. This responsibility for abiding by good scientific practice rests with each individual researcher and therefore the ethics of this study conducted by utilizing the Guidelines of the Finnish Advisory Board on Research Integrity as following:

The participation in the experiment is entirely voluntary as stated in the beginning of each experiment. The information obtained from participants is kept anonymous and participants are informed about the matter in the beginning of the experiment and in the consent form when signing it and reading the instructions¹¹. Participants will be given a short instruction for the experiment procedures and they are informed afterwards of the results for this research if interested of the results. Any affiliations, sources of funding or possible conflicts of interests are being announced prior to the experiment. All communication with participants will be done with honesty and transparency and misleading information must be avoided. According to beneficence statement of the research the knowledge related to preference choices, attitudes and their implications in social science research will give more information and will develop science.

The experiment will be framed as neutral as possible for participants not to mislead them to favour any specific strategy trait in the experiment. This will be done by not telling the participants any specific information of the hypothesis or effects that is studied to be at present.

The researcher follows the overall stated rules that are defined by the research community (integrity, meticulousness and accuracy in conducting research, in recording and presenting results, and in evaluating the research and its results). The researcher takes also due account of other researchers' earlier studies and releases and cites their research appropriately by using the citation of APA (American Psychological Association) style which is often used in social sciences.

¹¹ For the consent form, see the Appendix

4 Results

4.1 Descriptives

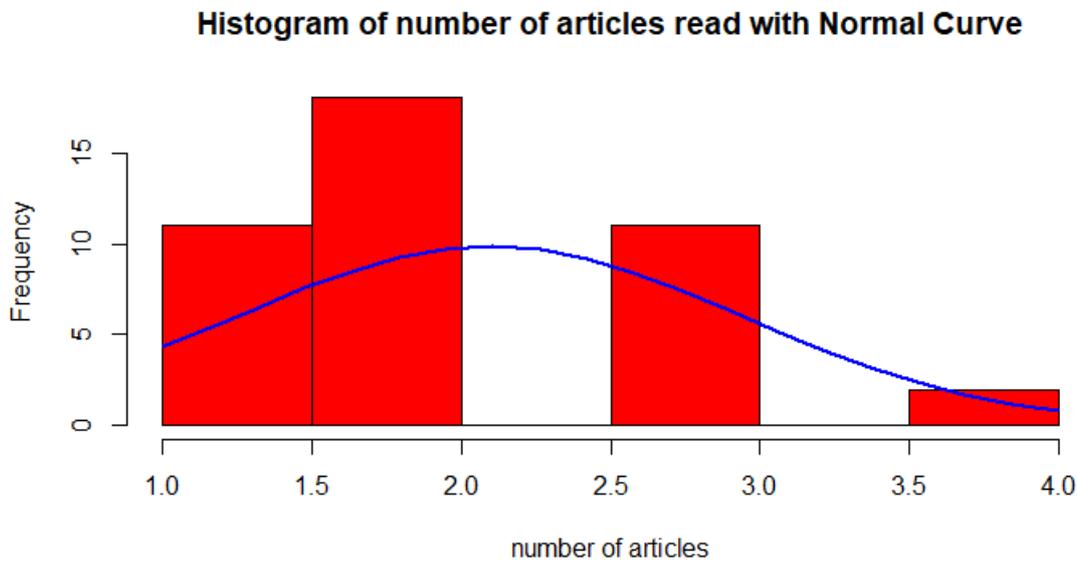
A theoretical laboratory experiment was developed for this study where participants were given accessibility for having chocolate during the experiment. As stated earlier in methodology part, the chocolate was as the indulgent/consumption substance in this experiment which was treated as a threshold and as an affecting factor toward information acquisition. Other measured variables, which were thought to influence information acquisition or the acquisition of certain type of an information were the level of hunger and attitude toward chocolate. The amount of information and its type (negative, positive or neutral) related to chocolate was considered as the treatment which were compared as stated earlier. The number of chocolates consumed in a half way of the experiment was also measured (consumption during reading) as well as the preference choice in terms of myopiness (discounting factor in choices being as 20% or 40%) for the possible later research purposes. The basic demographics measured were such as age, gender, nationality, number of years studied, field of studies and socioeconomic class/income decile. Many of the variables measured in the experiment are stated in the appendix, but not used or analysed further in analysis part of the study because of rather concentrating on the core of the study (attitude and threshold). The further research might contain more specific results of these variables (such as socioeconomic class, myopiness or the type of title being as the dependent variable) analysed with more demanding methods such as multinomial logistic regression which suits for situations where the result (dependent variable) has more than two outcome categories (such as the type of information originally has in data, negative-neutral-positive).

The justification for using logistic regression with binary outcome variable and combining positive and neutral information type into one category is coming from the Godman & Loewenstein theory where they weaken assumptions to allow attention weight to have increasing differences in (surprise combined with salience) and in (surprise and importance). Therefore, the predictive power for the threshold avoiding information even that it would be important (the ostrich-effect) tend to decrease. However, the conclusion can still be valid for the cases associated with positive and neutral attitude. The willingness to acquire more information should also get stronger as the salience or the importance of an information increases. Assumptions and predictions for the theory are stated briefly in page 28 within theory chapter.

In the first pilot experiment, the design of the questionnaire form was not completed to its final contents as in the final experiment. Therefore, the values for the attitude and hunger -variables are missing and the data shows NA values for 11 subjects. The total number of participants were 42 from which 11 was attained in a pilot research without the questions about attitude and state of hunger. When performing the preliminary “first econometric models” with R, the models were tested so that the pilot data which did not include the attitude and the level of hunger were left out when testing for these variables. Other individual variable effects were tested with full data coverage and their impacts (coefficients), confidence levels and significances are shown in Table 2. The dependent variable (information acquisition=number of articles), that we are testing the impact on, was slightly skewed (right-tailed) and the mean was 2.095 articles (see the following figure).

	Individual effect			
<u>variable</u>	<u>coefficient</u>	<u>CI 95%</u>		<u>significance</u>
gender	0.2	-0.3335096	0.7335096	No
age	-0.009863526	-0.04257826	0.02285121	No
yofs	-0.02599215	-0.1309269	0.07894262	No
sec	0.01382676	-0.1173257	0.1449792	No
myop1	0.2857143	-0.2431773	0.8146059	No
myop2	0.5636364	0.05739966	1.069873	Yes (0,03)
hunger	0.09791731	-0.005850892	0.2016855	No (0,0635)
attitude	-0.01131222	-0.1380441	0.1154197	No
nofcho	-0.08030838	-0.2806817	0.120065	No
title length	0.06043777	0.004891086	0.1159844	Yes (0,0337)
t.type1N				
t.type10	-0.6428571	-1.18158902	-0.1041253	Yes (0,0206)
t.type1P	0.6349206	0.04179636	1.2280449	Yes (0,0365)
conc. Type				
conc.type10	0.04166667	-0.6512144	0.7345477	No
conc.type1P	0.54166667	-0.0971381	1.1804714	No (0,0903)
total type	0.3703704	-0.1770418	0.9177825	No (0,179)

Table 2 Individual effects (not adjusted with others)



From the demographics part of the experiment, there are some things that need to be stated about the data. Age of the participants varies between 21 and 54, mean being as 31.4 years, the number of different nationalities represented was 15, out of which Finland was represented by 19 participants, Ethiopia by 5 of the participants, and Germany, Bangladesh, Japan and Russia by 2 of each country and the rest were only one by the country. One noticeable thing is that the variable nationality was unbalanced because most of the participants were from Finland and the variable was not normally distributed. By factorizing the variable within most representative nationalities, we could estimate a better impact of the nationality for information acquisition, but as being not so informative variable and not in a core of this research, it was taken out from both analysis to shorten tables and the results part. Nevertheless, the variable was included in the first model when running regression models with R and it showed no significance toward information acquisition.

Different faculties were factorized by social sciences (16), health & medical sciences (7), economics (8) and other than stated studies (11). The mean of the number of years studied was 19.02 years, the minimum being as 14 and the maximum as 27 years. In the stated income decile (as being categorized from 1 to 10), the mean was 4.643 (distribution in figure 2). In the experiment there were 22 male participants and 20 females.

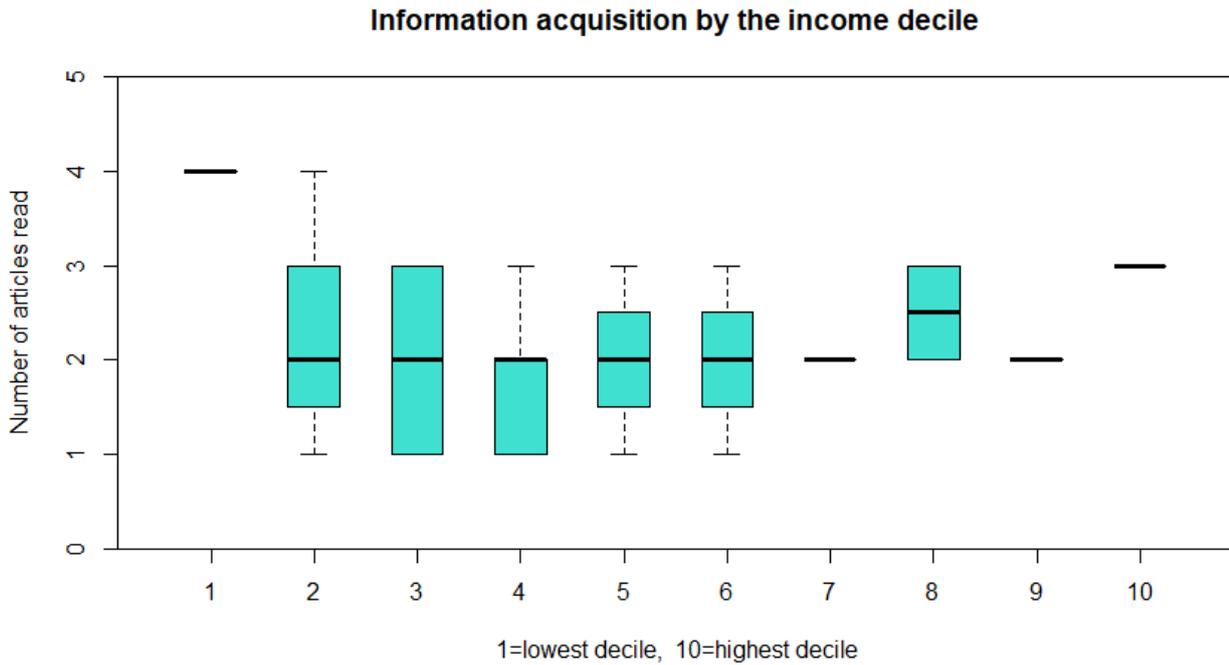
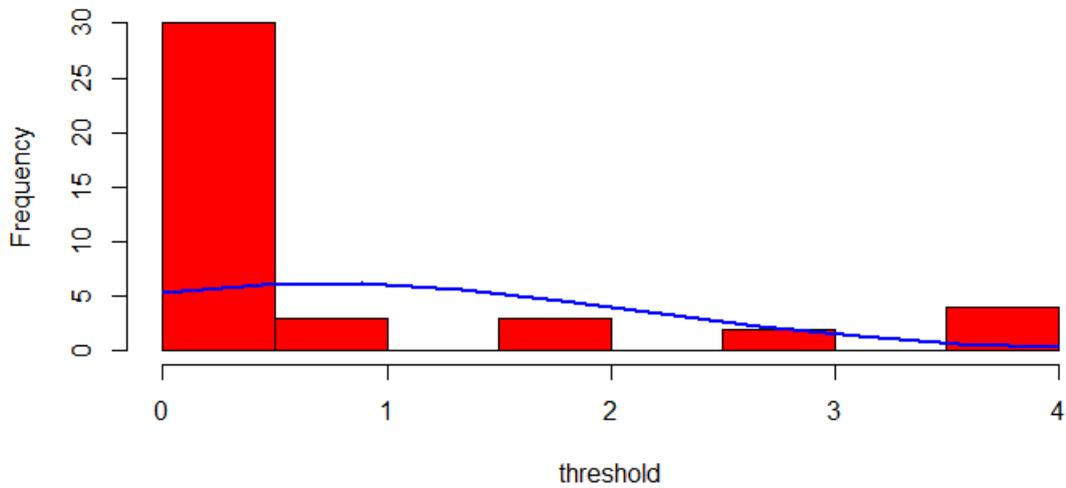


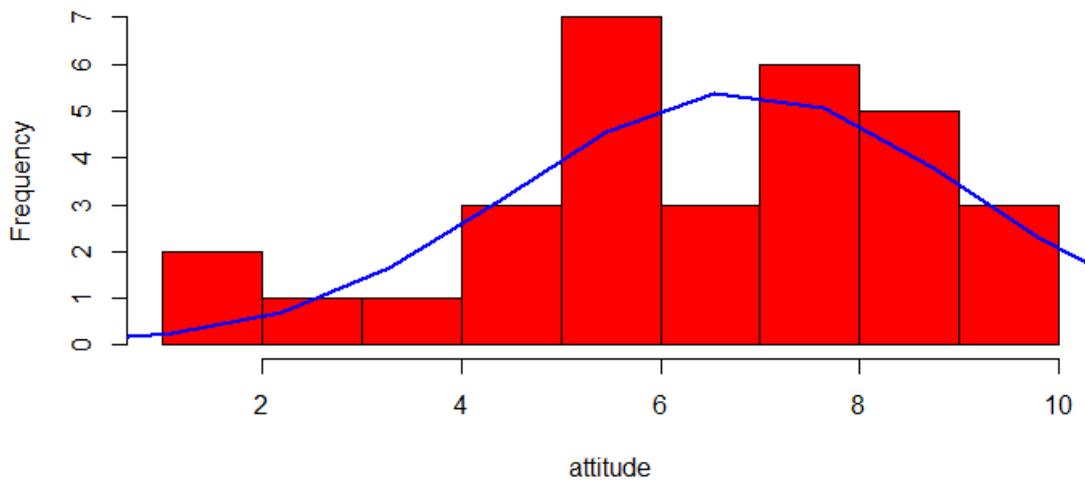
Figure 2 Information acquisition by income decile in boxplots

In terms of our original interest (attitude, threshold) having an impact on information acquisition, we can state that from the data description, the data provides us fairly low impact from the threshold part as being the number of chocolate taken before reading the articles. The threshold was strongly skewed (right-tailed). The threshold mean was only 0.7381, minimum being as 0 and maximum only as 4 pieces of chocolate (10 pieces were given to all in the beginning of the experiment). Therefore, the precise impact on whether to the number of articles read or to the type of the article seems to be weak even though we could find significance. (see the skewness in number of articles read (dependent variable), threshold and attitude (independent variables) in the following figures)

Histogram of threshold with Normal Curve



Histogram of attitude with Normal Curve



On the other hand, the “subjective” attitude variates from 1 to 10 as its mean being 6.806, which refers to most participant rather having a positive attitude toward chocolate (attitude being skewed toward chocolate, left-tailed). See the distribution in Figure 3. Nevertheless, the attitude seems to be more informative in this case because rather being not so skewed variable as the threshold.

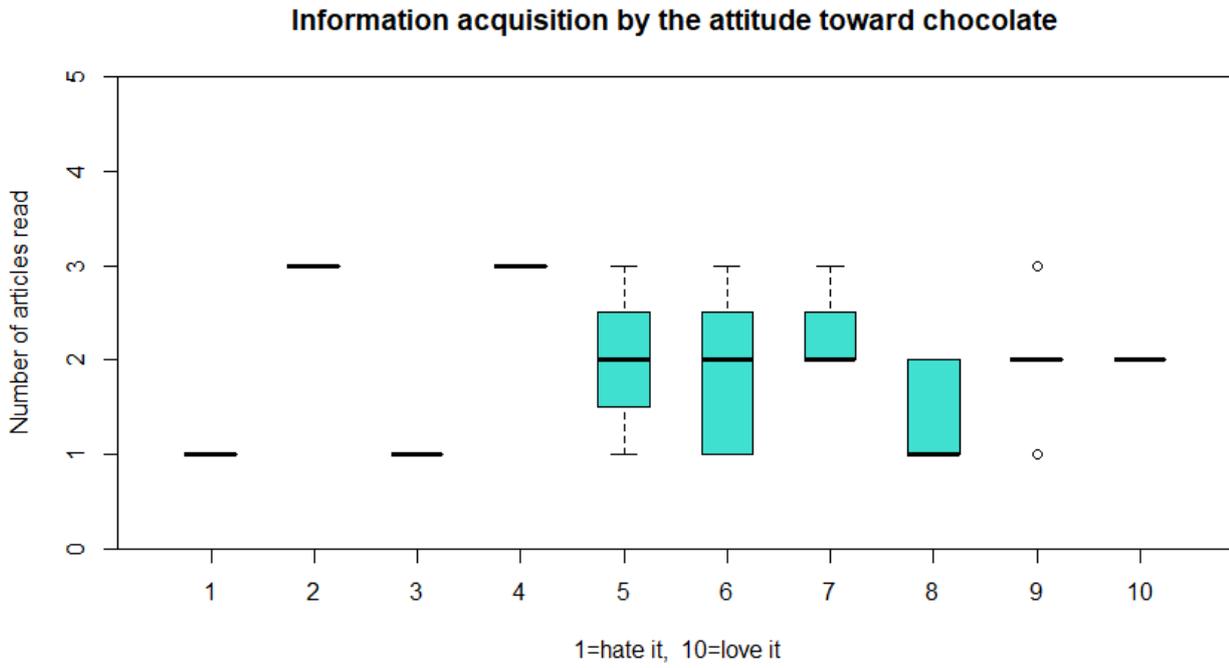


Figure 3 Attitude & information acquisition in boxplots

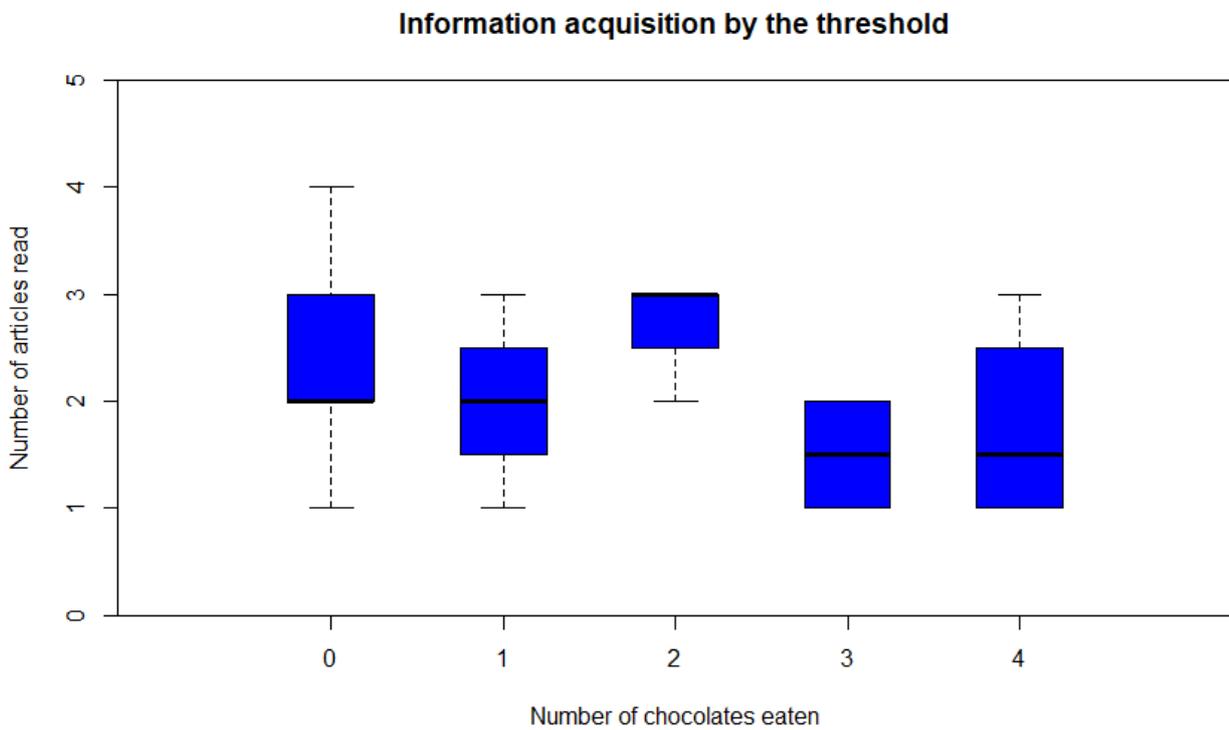


Figure 4 Information acquisition distribution by the threshold in boxplots

4.2 Testing the hypothesis

4.2.1 Coefficients for estimated regression models (model 1 and model 2)

When constructing the regression model and choosing variables for the model to run with R, the primary interests are the threshold (the number of chocolate that participants ate before they read the articles), the attitude and the type of the information, as following Golman and Loewenstein predictions and their theory. Secondary interests were other (possibly surprising) variables which show their significance toward desire for information. As stated earlier, the outcome variable is the amount of information (number of articles read) as defining the desire for information.

When stating the econometric model (general linear regression with OLS assumptions) in mathematical terms, the following model was used:

$$y_i = \alpha + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n + \varepsilon_i ,$$

where y_i = number of articles read, α = regression intercept, β_p = weight parameter for different independent variables and ε_i = residuals (unexplained variation).

The first thing after regressing the most explanatory function was checking the models' suitability for the data attained in the experiment. The R^2 -value measures the proportion of the variance in the dependent variable that is predictable from the independent variables. The R^2 values for the two different models were the following:

The model 2 (which contained variables attitude, threshold, hunger, title type and title length effects) Multiple R-squared: 0.4716, Adjusted R-squared: 0.3395, F-statistic: 3.57 on 6 and 24 degrees of freedom with significance of the model being in the 95% confidence level as having p-value of 0.01137 (with residual standard error in the model 0.6204 on 24 degrees of freedom). When we look at the Table 3, the fit of the model and the Anova-test we see that there are only 3 possible significant variables and we test another model for with those variables to see more accurate model to find out the more precise effects from these variables. In this step we can already see that our hypothesis H_0 is valid for certain variables because the attitude and threshold seem not to be significant. Although, we see that there are other significant variables.

The model 1 (which includes only hunger, title type and title length effects) seems to be better in this case, even that it has a slightly less explanatory power after dropping out couple of variables resulting as having the Multiple R-squared: 0.4149, Adjusted R-squared: 0.3249, F-statistic: 4.609 on 4 and 26 DF with the p-value of 0.006024 (RSE in the model being 0.6273). Even that the explanatory power of the model is slightly weaker compared to the model 2, we can result more precise estimates for significant variables (significance is better for those variables which we attach in this model and also the Anova (see the appendix) shows them to be significant in an earlier model that we tested). The tests (Q-Q plot) for these models shows in Figure 5 and in Figure 6. The Q-Q plot compares the observations to estimated regression equation.

Variable	Coefficient (individual effect)	CI 95%	significance p-value	Adjusted coefficient	CI 95%	significance p-value	Tested in model
attitude	-0.01131222	-0.1380441 0.1154197	No (0,8564)	-0.003781	-0.11521914 0.10765756	No (0.945)	2
threshold (nofcho1)	-0.08030838	-0.2806817 0.120065	No (0,423)	-0.136613	-0.31616276 0.04293707	No (0.129)	2
hunger	0.09791731	-0.005850892 0.2016855	No (0,0635) yes, with 90% CI	0.078157	-0.01865419 0.17496781	No (0.1087)	1, 2
t.type1N (negative)							1, 2
t.type10 (neutral)	-0.6428571	-1.18158902 -0.1041253	Yes (0,0206)	-0.412568	-0.98271268 0.15757599	No (0.148)	1, 2
t.type1P (positive)	0.6349206	0.04179636 1.2280449	Yes (0,0365)	0.717622	-0.05173704 1.48698159	No (0.0661)	1, 2
title_eff1	0.06043777	0.004891086 0.1159844	Yes (0,0337)	0.027203	-0.04110311 0 .09550989	No (0.419)	1, 2

Table 3 Individual effects (gray background) and adjusted effects

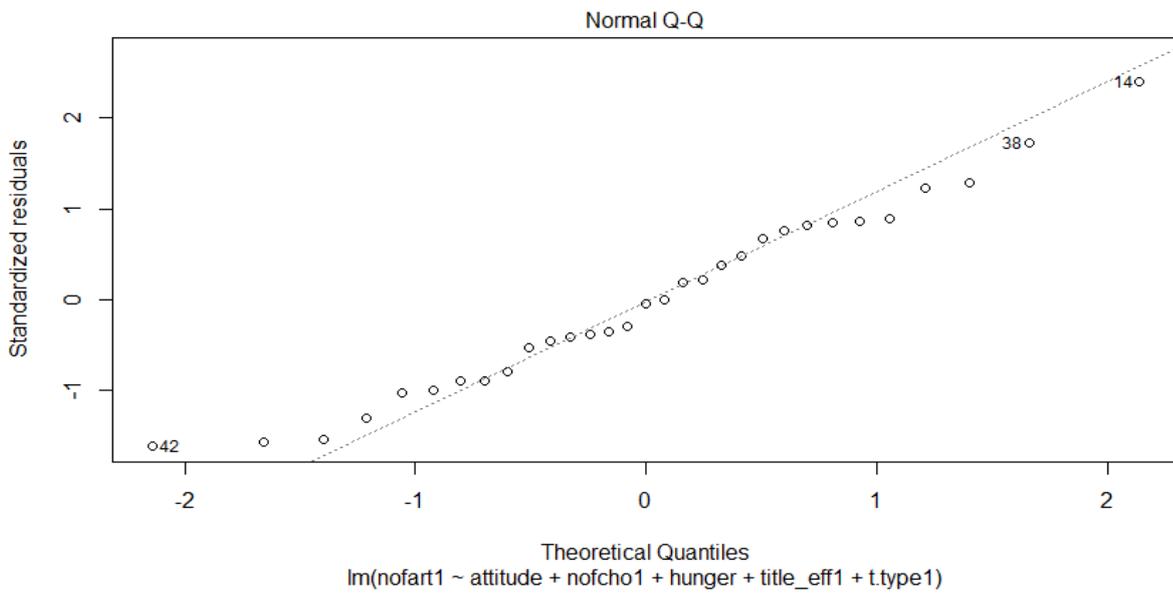


Figure 5 Distribution of residuals in model2

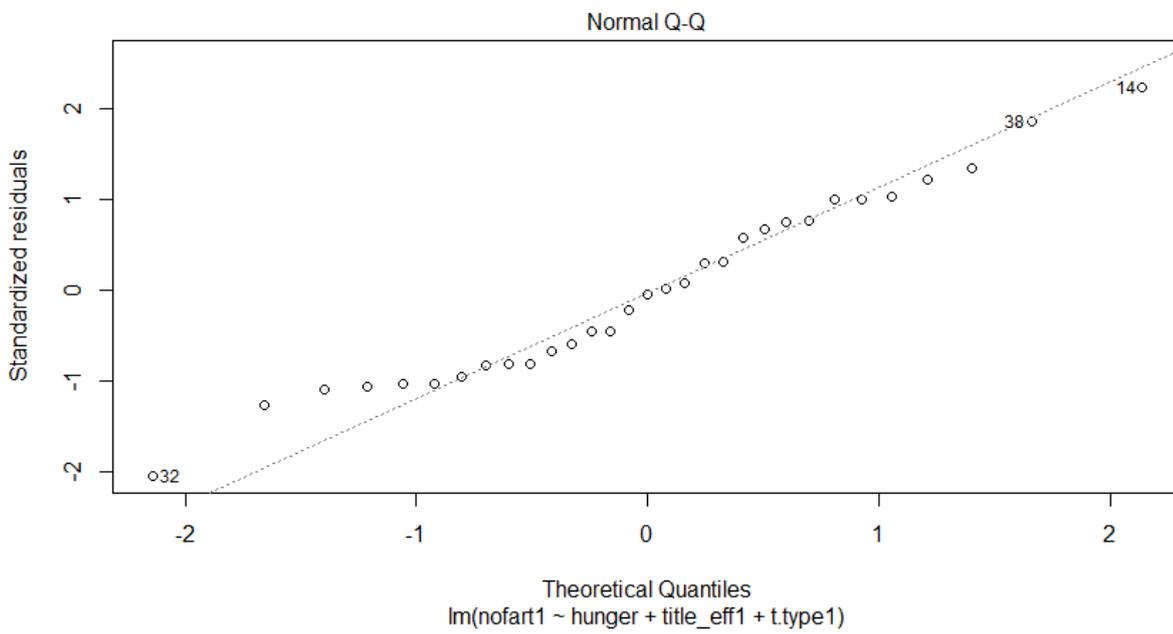


Figure 6 Distribution of residuals in model1

Response: nofart1~
hunger+title_eff1+t.type1

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
hunger	1	1.9899	1.98993	5.0574	0.03322 *
title_eff1	1	1.4386	1.43856	3.6561	0.06694 .
t.type1	2	3.8253	1.91263	4.8610	0.01609 *
Residuals	26	10.2301	0.39347		

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Response: nofart1~
attitude+nofcho1+hunger+title_eff1+t.type1

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
attitude	1	0.0201	0.02007	0.0521	0.82131
nofcho1	1	0.0806	0.08064	0.2095	0.65127
hunger	1	2.0417	2.04166	5.3041	0.03025 *
title_eff1	1	1.9773	1.97728	5.1368	0.03272 *
t.type1	2	4.1261	2.06303	5.3596	0.01190 *
Residuals	24	9.2382	0.38492		

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Figure 7 Analysis of Variance Table

In the first model there seem to be an outlier (observation 42), which is deviating more than other observations from the estimated regression line. Outliers (which deviate much from the regressed model) should be checked and the observation can be taken away from the data (for attaining more precise estimation of the model especially in small samples and if there are lot of deviations from the regression line because of certain outliers). In this case we are not taking out the outlier because we already conducted another model, resulted couple of variables being insignificant and tested the estimation against the regressed line (see the QQ-plot for model1 and figure 7) and see that there are no largely deviating outliers anymore in the more precise model followed by the model which included more variables.

When looking at the variables and their impacts on the information acquisition we can say that in this data (small sample size) with the confidence level of 95% or even with 90% level, *the attitude did not seem to be significant variable, although it was estimated of having slightly negative impact on the information acquisition. The same interpretation goes with the threshold parameter as estimated of having negative impact on the information acquisition but somewhat bigger than the attitude* (see the Table 3 Individual effects (gray background) and adjusted effects). Although, the interpretation is that *if the attitude and threshold were significant variables they would have an estimated negative impact on information acquisition*. The negative estimates here are 0.0038 (when attitude level

increases by one) and a negative impact of 0.14 (when one more chocolate is being eaten). This would mean that the use of chocolate and positive beliefs decreases the willingness to acquire information of the indulgent substance that you are using (possibly by overconfidence or by ignorance). On the other hand, there can be seen more *significant impact from the hunger* (which is surprising) *as having a small positive impact on information acquisition* (when the level of hunger increases by one, the desire for more information increases by 0.08 articles). *The title type* (as people having more desire for either positive or negative titles and less (negative impact) on neutral ones) *seems to have the most powerful as well as the most significant effect on information acquisition*, although still not significant in the 95% confidence interval when adjusted with other variables (see the Table 3) This is quite intuitive and not surprising result. Instead, what is important to see here is the difference in effect directions. The negative and positive types seem to create more attention than the neutral type. The comparison level here is the negative article, so for the interpretation, the *neutral information type has a negative impact of 0.412* compared to negative article, and *a positive article has a 0.718 positive impact* compared to negative one. *This means that people are stimulated to attain information by negative information or even more stimulated by positive information of chocolate but less stimulated by neutral information.*

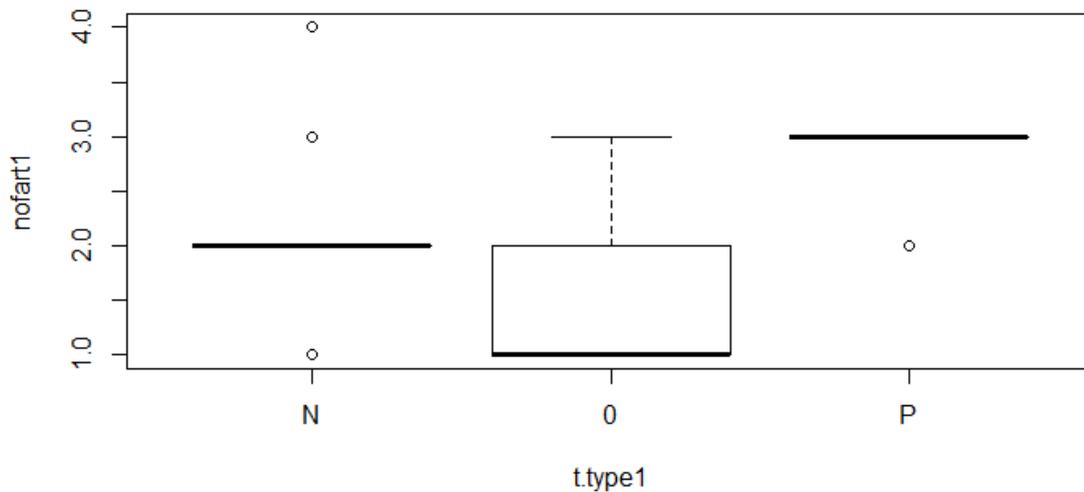


Figure 8 Boxplot for title types (N=negative, 0=neutral, P=positive)

Further, when looking at the title length effect, it seems that *the title length has no powerful effect as being only 0.027* (one extra word in a title has an increasing effect on acquiring information and of course this depends on the informative value of the word).

The effects could be stated perhaps with more defined/clarified manner if the scale of the dependent variable had been modified and the sample were bigger. Unfortunately, now the interpretation seems quite weak. According to ANOVA tests the three variables seems to be significant, but the significance fades in adjusted model because of the small sample size. These previously stated impacts were due to adjusted model where the variables stated were adjusted with each other's effects. Although, when looking at the more precise model with only title length, title type and hunger effects, the model itself seems to be more significant, although having slightly smaller explanatory power. In the end the model 1 (see the appendix for estimated values and confidence intervals) shows the following estimated regression equation to be in the case if we wanted to estimate the impact of these significant variables toward information acquisition:

number of articles read= $1,42 + 0.090 \cdot \text{hunger level} + 0.0067 \cdot \text{title length} - 0.27 \cdot \text{neutral title} + 0.826 \cdot \text{positive title}$

The model 1 compares the title types as having negative title as being the “threshold one”. In this case we can put the values in our model according to our available information and estimate how much people pay attention/are willing to read the information. For example, if we knew that there is a negative title which has 20 words and the situation is that the person is very hungry (level 10), the outcome would be $y = 1,42 + 0.09 \cdot 10 + 0.0067 \cdot 20$, the number of articles is estimated to be 2,45 articles. If in turn the title was positive the number of read articles would be estimated as being 3,28. Nevertheless, attitude toward the issue and situation always matter and we might find better explanation power as well as the significance if our sample were bigger. The reason why our final model (model 1) is not taking account those variables is because they weren't significant. Although, the attitude and threshold in our case did not create much impact on information acquisition.

4.2.2 Logistic regression model for testing the “Ostrich-Effect”

For our analysis purposes in estimating the odds for the type of the article, the best method seems to be logistic regression. Logistic regression is used for identifying a model which predicts the probability or likelihood that an individual will have the wanted phenomena. The logistic regression analysis was chosen here because it is a statistical method suitable for the study of a binomial variable outcome where either outcome is true or false. In our case the outcome is either 1 (neutral and positive article) or 0 (negative article).

The econometric equation for the (multiple) logistic regression model is the following (Verbeek, 2006):

$$Pr(Y = 1 | X_1, X_2, \dots, X_k) = \frac{e^{a+b_1X_1+\dots+b_kX_k}}{1 + e^{a+b_1X_1+b_2X_2+\dots+b_kX_k}}$$

$$\ln\left(\frac{P}{1-P}\right) = a + b_1X_1 + b_2X_2 + \dots + b_kX_k$$

, where Y = dependent variable (binary), X_k = independent single variables and

($b_1 = \ln(\text{OR})$ for X_1 , adjusted for $X_2, X_3 \dots X_k$)

P = proportion of information with the characteristic, and

$1-P$ = proportion of information without the characteristic

OR = odds ratio (probability)

When briefly again checking the variables, we see that there are 42 observations in the data and approximately 35% of the participants chose positive or neutral information in the first round of reading articles. This finding is interesting when comparing the distribution of chosen information type and the slightly positively skewed attitude. One might intuitively expect that a bigger portion of

neutral and positive articles are being chosen. The experiment setting (university students only) might explain the interest being more toward negative articles because of the possible clarity of the information is being lower and people want to receive both views after knowing already some information about the issue.

In other words, university students might already contain some specific information about chocolate, but the entropy can still be high (the information “unorganized”), so they rather attain the view which is unfamiliar to them (perhaps being more rational) for gaining better understanding and organize the overall information in a proper order by lowering the entropy after this process. (this is being just speculation) So, we can already expect that there is not so significant “Ostrich-effect” present among university students. Nevertheless, we will have a deeper look at the data to conclude this to be true.

In generalized linear model (logistic regression) the following results were obtained:

The attitude seems not to be a significant variable in the confidence interval level of 95% according to anova-test results (see the R results in the appendix). When interpreting the results, we can conclude that the title length plays a significant role in terms of attaining positive or neutral information in all of the tested models (type of the information as dependent variable and attitude, threshold, hunger, title length effect as independent variables). The models that were also tested were the second step models in which the outcome variable was the type of the information in second step in the experiment and the explanatory variables as attitude, threshold, added chocolate during the reading, and the first step title type.

Justification for testing these models is to find an impact from previous article titles and previous attitude and threshold which participants hold before moving on to the next step for acquiring more information. The Akaike information criterion (AIC) in these tests shows the relative quality of statistical models for a given set of data. In other words, the quality of each model is estimated by this AIC value. Thus, AIC provides a means for model selection but do not give any information about whether the model explains well the link between the outcome and independent variables. The model that is chosen has the smallest AIC as providing the best model quality compared to other tested models. In this case the model which is chosen is with the independent variables such as the attitude, hunger, threshold (number of chocolate eaten before reading) and the title length. Only the title lengths seem to be significant in 95% confidence interval as having the p-value of 0.0117.

The AIC in this model is 24.431. (see the appendix for R results) This means that *if the title length is increasing it boosts the positive or neutral information attaining by 2.7 times compared to negative information* (odds ratio being as 2.7). *Attitude, threshold and the hunger seem to have decreasing effect on positive or neutral information because the odds ratios are all below 1, nevertheless they all are insignificant variables according to our model's estimations.* When comparing this result to the earlier one where the outcome variable was the amount of information, this seem to be interesting finding because the amount of information was not defined by the title length as powerful (ANOVA showed significance, but the impact was weak) as is the link for the positive and neutral information and the title length. In turn, here where the type of the information is set as a (binary) dependent variable, we see the title length having a rather important impact on positive or neutral information occurrence. Still, we should not forget the most important thing which the importance or the salience of the additional word provides to the title length.

When testing the previous action (e.g. chocolates eaten before the reading), the title types of first read articles, the attitude, the added chocolate while reading the information and the title length effect on the second reading we can conclude the following:

the model that has a lower AIC (40.191) is the one with attitude, number of added chocolate during reading, title type of the first articles and the title length. Again, the title length is significant (p-value of 0.0083) and other variables seem to be insignificant in the 95% confidence interval. We can interpret this result as, *if the title length is increasing it gives a 1.29 multiplied effect on the positive or neutral information acquisition compared to negative information*, when the earlier action as the attitude and the title type of earlier articles and the number of chocolate consumed during reading are adjusted in a model. The higher attitude (increasing by one) seems to have negative impact for the positive or neutral information, the number of added chocolates a positive one and the title type from the first readings, so that positive or neutral article tend to follow the earlier neutral or negative rather than the positive article. Although, we must keep in mind that *these variables were not significant except the title length.*

In further studies, it would be nice to see whether the share of attaining certain type of information is similar with other people (distinct types and levels of education and different ages). With this sample it was rather difficult to test between distinct types or levels of education because the sample was attained from university students only, the sample size was relatively small, and the sample was

slightly skewed (right-tailed) (see the distribution in the following Figure 9 Distribution for years of education). As a disclosure we can see the Ostrich-effect being not shown in this study and data, which was obtained by organizing experiment for university students. The only thing that seemed to be significant according to our model and analysis is the positive effect of title length toward the positive and neutral information. The more precise effects could be attained if the multinomial logistic regression had been utilized when building an econometric model.

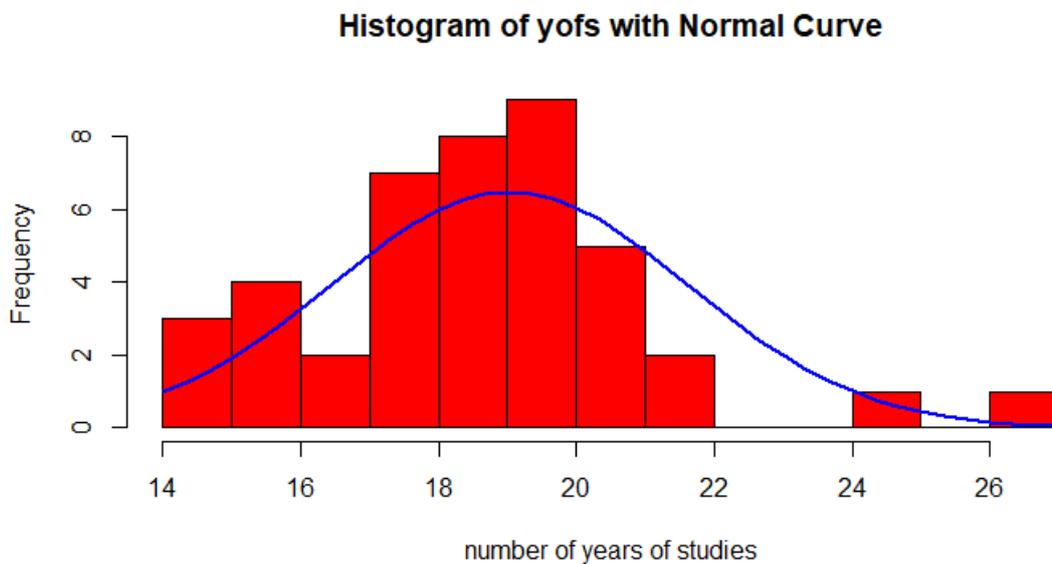


Figure 9 Distribution for years of education

4.3 Discussion

As already discussed in previous chapters decision-making is rather complex issue having its features grounding from subjective probabilities of cognition, from motivated attention toward action and their values both intrinsic ones and the extrinsic valuations. As described in the theory part, individual utility can be seen containing these features where the main aspects rely on probabilities and certain weights for motivated action (Golman & Loewenstein, 2014). The results define some part of the motivated action when the information acquisition process is on.

The main aim for this paper was to examine the factors affecting to information acquisition and fortunately we can conclude some which give their impact on the issue. According to the findings from the experiment, the attitude and threshold were not significant variables but if they were they would have an estimated negative impact on information acquisition. This would mean that the use of chocolate and positive beliefs decreases the willingness to acquire information of the indulgent substance that you are using (possibly by overconfidence or by ignorance). This on the other hand, could mean that people do not want to attain the information that might supply a surprise for them. In terms of Ostrich effect this means that we have a weak result of the effect but cannot say much about it because we only know the direction but not the magnitude. As referring to conclusion chapter, the impact was insignificant when testing the attitude and threshold toward information acquisition.

The conclusion follows the theory of utility of wisdom, where the prediction shows that the desire to attain more information increases as the valence of anticipated outcomes is rising. In other words, this means that the person is more willing to acquire information when the valence (the value of definitive answer and the instrumental value, in other words the total of intrinsic plus extrinsic attractiveness) increases.

In our case where the possible overconfidence or ignorance could be valid, the valence decreases and therefore people do not want to attain information because they see it might decrease their situational utility.

In this study, we can see more significant impact from other variables such as hunger on information acquisition. The estimated model gives the result as hunger of having a small positive impact on information acquisition. This research also concludes the title type as having an impact on information acquisition. According to estimated model for the data obtained from the experiment, people are stimulated to attain information by negative information or even more stimulated by positive information of chocolate but less stimulated by neutral information. In terms of providing information about health issues, we should think about the attention in a way that the information is designed to

be the most “indulging” in a way that people have the most desire for knowledge. If we supply the information that does not raise emotions, then our goal is not met if we want to increase the motivated attention.

As been stated earlier in this paper, the desire for information can be seen from many perspectives: situational (pragmatism and timing), motivational (within different type of valuations) or attitudinal (belief and emotional system). The information acquisition and the knowledge constructing from the pieces of acquisition situations cannot always be straightforward and rational in terms of choice and decision-making. There are several impacting factors that may lead decision-making to a wrong direction. The cognition and motivated actions play a leading role when we are making decisions. As Godman & Loewenstein formulated in their theory, the subjective probability is impacting in many ways, which means the cognition in our mind is making strategical decisions based on the probability of “win” or added value for doing certain things or not doing them. Another parameter that is interesting is the weight coming from motivated action. As stated in theory part, the motivated action is also defined partly from the subjective probability in one’s mind.

Furthermore, as stated by Caplin and Leahy (2001), “a benevolent agent must decide about information transmission to a principal who on the other hand exhibits non-linear preference over lotteries which are temporal”. The conclusion in their research was that “the classical revealed preference approach to the theory of choice is insufficient to answer a potential important class of policy questions in which the policy maker must decide the amount of the information to share with private agents”. If the decision-maker confronts the problem whether to supply the information or not, it means that the information will always be unopenly shared mainly because of incentive gain factors... there will always be self-interest to hold the information and do some bargaining with it. Although, luckily discussion nowadays encourage people to acquire and gather information, but still it is not openly shared and makes therefore suboptimalities in the economic decisions, because people cannot openly share the information in many cases (consider also liabilities and restriction).

In the future one might hope for at least the health-related information being openly shared for a bigger social gain in terms of cost savings in health care expenditures and for overall public interests. Unfortunately, money is still a powerful incentive in this game and determines lot of information sharing issues as well as in terms of lobbying certain interests over the public ones. The attitudes, even that were not confirmed to be significant in this study, have a powerful impact on decision making in other issues depending on situations and circumstances, and create norms on their way to become powerful.

As referring to Meadows (1999), the system that has powerful norms, attitudes and paradigms is difficult to change. However, a tiny shift in a well targeted place can produce powerful changes in system whether the system is a society, firm, a town or an ecosystem. By following Meadows' arguments, that the higher the level of a leverage point system which can be influenced on, the more powerful the meaning and the impact is on every level underneath these points. When putting this in other words, the more we can influence on attitudes and belief system in our cognition and creating trust among society, the more impact for openness we might have in the society.

This in turn, relates to motivation and information acquisition greatly. If we want society to save in terms of costs which the welfare society is having, the one solution is to motivate people to acquire information about their own level of health, their nutrition, harmful and useful products, spread both pros and cons openly of different medical treatments and mainly have discussion where as many as possible approaches about the issues are represented. According to the theory of utility of wisdom, there are powerful neglections that show us the meaning of surprise toward the motivated action. Even that the controversial information is first changing our "unorganized information in our mind" (perhaps increasing the entropy in the beginning of the process), we should still think that in terms of information acquisition, if monotonically increasing the better wisdom we will receive.

In health research, there is already lot of research which shows that patients who are being activated to monitor their health be proactive, have better health outcomes and better healthcare experiences. Although, there is still not enough evidence about the impact of these gains on overall costs and especially when having a long-term approach. (Hibbard & Greene, 2013) The more individual is activated to one's own health we might expect better outcomes in overall health and quality of life, but how do we estimate the efficiency and costs related to these matters because we all have our different preferences and opportunity costs?

An obvious answer for the problem measuring preferences and keeping people to trust on revealing their preferences is to provide reliable information, acting fair and overall having good will. The more the society goes toward competing internally and not sharing the information, the more attitudes are skewed and points to interfere in a system become both unnoticeable and unreachable. Again as referring the theory of *utility of wisdom*, the more aware people are about things the more they would pay attention which in turn would lead toward better knowledge and awareness.

In this discussion the society's norms and values play with big bets on how people are constructing their beliefs. If the norms and values do not allow to think and do differently, what innovative ideas can be established and proven as being as good as the old ones, or even better?

As a disclosure of this discussion, we can say that a lot is in concern when we are discussing about information acquisition and the use of it in manipulating people's actions by supplying certain type of information or changing policies toward proactive from the citizen side. Another type of concern is not to supply information openly. In a good sense and understanding we can expect institutions and governance to implement the information from the studies but what will happen if the information is applied to profit maximization for a private and not so ethical use and in a later stage against the majority utilities and kept hidden?

Despite of all the limitations and errors made in the experiment design as well as not conducting the multinomial logistic regression model for more detailed analyses for distinct types of information, this study provides the multidisciplinary information gathered from different research areas in literature review part and highlights the cognition's importance in decision-making and further in information acquisition. A link to a wider perspective of decision-making and policy setting is also shortly discussed.

The possible further research as adding value to the subject would be studying myopiness and emotion impacts on information acquisition. The type of the information as a categorial multilevel variable as a dependent variable would also serve the interest among public choice or behavioral economics literature for further results, as giving answers to questions, such as, what kind of information is boosting the motivated action the most. The stated further research could provide valuable information for governance use and public institutions purposes.

5 Conclusions

In this paper, the aim was to provide the reader a wider perspective to decision-making in terms of information acquisition. The context used in the study was mainly based on behavioral economics approach of social sciences.

In the traditional expected utility theory, people try to maximize their objective utility function which is defined by their own personal preferences. Those preferences are valued as material outcomes. In this study, the approach for the utility is slightly different. The study uses the specific utility theory, 'utility of wisdom', as its theoretical background. According to the theory, utility depends not only on the preferences valued as material outcomes but also on the intrinsic cognitive valuations. In this specific utility theory, the main factors determining the utility are subjective probability and motivated attention weight vector.

The study also includes experimental part, which tests the information acquisition in a laboratory setting. The aim was to examine experimentally, whether the beliefs define the information acquisition and do people expose themselves to positive or negative information based on their beliefs (attitude) and actions (threshold).

In the experiment, the setting was created so that it follows a minimum-effort game describing the daily situation which people often facing, the lack of time for putting the maximal effort on information acquisition. This study tested the information acquisition of a certain information, the attitude and the threshold related to the subject of the information and other variables that had impact toward desire for information. The attitude and the threshold were tested as subjective valuation by participants. In this study the subject was chocolate which in turn relates to health decisions and is considered being as indulgement substance.

The analysis for the experiment data was conducted by using quantitative methods, by utilizing statistical analysis tool, the R. The analysis of the data was separated into two different parts:

The first part consisted of creating the best fitting linear regression models and testing them for estimating the most accurate results defining the information acquisition as an outcome variable. The number of articles was set as a dependent variable defining the information acquisition.

The second part consisted of a binary dependent variable (the information type) and the logistic regression model.

The statistical analysis of the experiment data showed that the attitude and the threshold were not significant variables with the confidence level of 95%. Although, both were estimated of having slightly negative impact on the information acquisition. This could be interpreted so, that the use of chocolate and positive beliefs decreases the willingness to acquire information of the indulgent substance which is used (possibly by overconfidence or by ignorance). This could mean that people do not want to attain the information that might supply a surprise for them. The conclusion follows the theory of utility of wisdom, where the prediction shows the desire for information to be increasing as the valence of anticipated outcomes increases. In other words, the person is more willing to acquire information when the valence (the combined value of definitive answer and the instrumental value) increases. In our case where the possible overconfidence or ignorance could be valid, the valence decreases and therefore people do not want to attain information because they see it might decrease their situational utility.

As estimation from the model addresses, that there can be seen more significant impact from other variables such as hunger having a small positive impact on information acquisition, although not being either significant variable in the 95% confidence level when adjusted with other variables such as attitude and threshold. The research also concludes the title type as having an impact on information acquisition which was estimate as being the most significant variable among the tested ones.

People seem to be stimulated to attain information by negative information or even more stimulated by positive information of chocolate but less stimulated by neutral information, although the type of the information was not significant in the 95% confidence level when adjusted with other variables. Unfortunately, the experiment did not attain enough participants and the sample size ended up being rather small why the significance does not appear easily in 95% confidence level.

In terms of providing information about health issues, we should think about the attention in a way that the information is designed to be the most “indulging” way for people having the most desire for knowledge. If we supply the information that does not raise emotions, then our goal is not met if we want to increase the motivated attention.

According to the *utility of wisdom-theory*, the more aware people are about things the more they would pay attention and the more clarity of the information pieces they would gain, the better they will understand the meaning of wisdom and go towards it. In this discussion, the society’s norms and values play a major role how people are constructing their beliefs and the motivated attention bending on those beliefs. When taking this thought further, we can next find out ways which information

stimulate people's attention the most and guides them to be proactive in their actions parallel reducing the costs of welfare state.

6 References

- Ainslie, G. (1999). The Dangers of Willpower. *In a book of J. Elster; O.-J. Skog, Getting Hooked*. Cambridge: Cambridge University Press.
- Ainslie, G. (2001). *Breakdown of Will*. Cambridge: Cambridge University Press.
- Akerlof, G.;& Dickens, W. (1982). The economic consequences of cognitive dissonance. *American Economic Review*, 72, 307-319.
- Andreou, C. (2006). Environmental Damage and the Puzzle of the Self-Torturer. *Philosophy & Public Affairs*, 95-108.
- Asch, D.;Baron, J.;Hershey, J.;Kunreuther, H.;Meszaros, J.;Ritov, I.;& Spranca, M. (1994). Omission bias and pertussis vaccination. *Medical Decision Making*. 14 (2) , 118-123.
- Baumeister, R. F. (2003). The Psychology of Irrationality. Teoksessa I. Brocas;& J. D. Carrillo, *The Psychology of Economic Decisions: Rationality and well-being* (ss. 1-15).
- Baumeister, R. F.;Loewenstein, G.;& Read, D. (2003). *Time and Decision: Economic and Psychological Perspectives on Intertemporal Choice*. Russell Sage Foundation Publications.
- Baumeister, R.;Campbell, J.;Krueger, J.;& Vohs, K. (2003). Does high self-esteem cause better performance, interpersonal success, happiness, or healthier lifestyle? *PSYCHOLOGICAL SCIENCE IN THE PUBLIC INTEREST vol.4 (1)*.
- Benabou, R.;& Tirole, J. (2013). Self-confidence and Personal Motivation. *Quarterly Journal of Economics*, 117, 871-915.
- Camerer, C. (2003). *Behavioral game theory: experiments in strategic interaction*. New York: Russell Sage Foundation Princeton University Press. .
- Caplin, A.;& Leahy, J. (2001). Psychological Expected Utility Model an Anticipatory Feelings. *Quarterly Journal of Economics* 116, 55-80.
- Chernev, A. (30. Sep 2003). When more is less and less is more: the role of ideal point availability and assortment in consumer choice. *J. Consumer Res.*, ss. 170-183.
- Chernev, A.;Böckenholt, U.;& Goodman, J. (2015). Choice overload: A conceptual review and meta-analysis. *Journal of Consumer Psychology*. 25, 333-358.
- Costa-Gomes, M. A.;& Weizsäcker, G. .. (2008). Stated beliefs and play in normal-form games. . *The Review of Economic Studies*, 75(3), 729-762.
- Dahlgren, G.;& Whitehead, M. (1991). *Policies and Strategies to Promote Social Equity in Health*. Stockholm: Institute for Futures Studies. .
- Danzinger, S.;Levav, J.;& Avnaim-Pesso, L. (2011). Extraneous factors in judicial decisions. *Proc Natl Acad Sci U S A*. 108(17), 6889-92.

- Elster, J. (1998). A plea for mechanism. *In a book from P. Hedström et al. (. Swedberg, Elster, Jon (1998), A plea for mechanisms, ch. 3 (pp. 45-73) in Peter Hedström and R Social Mechanisms: An Analytical Approach to Social Theory. Cambridge: Cambridge University Press. (ss. 45-73). Cambridge: Cambridge University Press.*
- Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, IL: Row, Peterson.
- Frederick, S.;Loewenstein, G.;& O'Donoghue, T. (2002). Time Discounting and Time Preference: A Critical Review. *Journal of Economic Literature* , 351-401.
- Galai, D.;& Sade, O. (2003). The "Ostrich effect" and the relationship between liquidity and the yields of financial assets. *SSRN working paper*.
- Geanakoplos, J.;& al., e. (1989). Psychological games and sequential rationality. *Games and Economic Behavior* 1, 60-79.
- Gintis, H. (2009). *The bounds of reason: Game theory and the unification of the behavioral sciences*. Princeton University Press.
- Gneezy, U. (2005). Deception: The role of consequences. *American Economic Review*, 384-394.
- Goeree, J. K.;& Holt, C. A. (2001). Ten Little Treasures of Game Theory and Ten Intuitive Contradictions. *The American Economic Review*, Vol. 91, No. 5, 1402-1422.
- Golman, R.;& Loewenstein, G. (2014). Curiosity, Information Gaps, and the Utility of Knowledge.
- Gourville, J. D.;& Soman, D. (2005). Overchoice and Assortment Type: When and Why Variety Backfires. *Marketing Science*, Vol.24(3), 382-395.
- Health&Behavior, I. o. (15. Nov 2001). *Research, Practice, and Policy. Health and Behavior: The Interplay of Biological, Behavioral, and Societal Influences*. Retrieved from, Behavioral Risk Factors: <https://www.ncbi.nlm.nih.gov/books/NBK43744/>
- Hibbard, J.;& Greene, J. (2013). What The Evidence Shows About Patient Activation: Better Health Outcomes And Care Experiences; Fewer Data On Costs. *Health Affairs* 32, no.2 , 207-214.
- Holt, C. A. (2007). *Market, Games & Strategic Behavior*. Boston: Pearson Education.
- Janis, I. L. (1958). *Psychological Stress: Psychoanalytic and behavioral studies of surgical patients*. New York: John Wiley & Sons.
- Jevons, W. J. (1871). *Theory of Political Economy*. London: Maxmillan and co.
- Kahneman, D. (2011). *Thinking fast and slow*. Farrar, Straus and Giroux.
- Kahneman, D.;& Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, vol.47, 263-291.
- Kang, M.;Hsu, M.;Krajbich, I.;Loewenstein, G.;McClure, S.;Wang, J.;& Camerer, C. (2009). The wick in the candle of learning:Epistemic curiosity activates reward circuitry and enchances memory. *Psychological Science* 20(8), 963-973.

- Karlsson, N.;Loewenstein, G.;& McCafferty, J. (2004). The Economics of Meaning. *Nordic Journal of Political Economy*. 30., 61-75.
- Karlsson, N.;Loewenstein, G.;& Seppi, D. (2009). The Ostrich effect: Selective attention to information. *J Risk Uncertain* 38, 95-115.
- Kelman, H. (1938). Compliance, identification, and internalization: Three processes of attitude change. *Journal of Conflict Resolution*, 51-60.
- Kotler, P. (1991). *Marketing Management: Analysis, Planning, Implementation and Control 7th ed.* New Jersey: Prentice Hall, Englewood Cliffs.
- Kreps, D.;& Porteus, E. (1978). Temporal Resolution of Uncertainty and Dynamic Choice Theory. *Econometrica*, XLVI, 185-200.
- Köszegi, B. (2006). Ego Utility, overconfidence, and task choice. *Journal of the European Economic Association* 4(4), 673-707.
- Laffont, J.;& Mortimort, D. (2002). *The Theory of Incentives- Principal-Agent Model.* Princeton: Princeton University Press.
- Laibson, D. I. (2015). *In a book from M. Altman, Real World Decision-Making: An Encyclopedia of Behavioral Economics.* Santa Barbara: Greenwood.
- Linder, J.;Doctor, J.;& Friedberg, M. e. (2014). Time of Day and the Decision to Prescribe Antibiotics. *JAMA Intern Med.* 174(12), 2029-2031.
- Loewenstein, G. (1987). Anticipation and the Valuation of Delayed Consumption. *The Economic Journal*, 666-684.
- Loewenstein, G. (1994). The Psychology of Curiosity: A Review and Reinterpretation. *Psychological Bulletin*, 75-98.
- Loewenstein, G.;& Prelec, D. (1992). Anomalies in Intertemporal Choice: Evidence and an Interpretation. *The Quarterly Journal of Economics*, 573-597.
- Loewenstein, G.;Asch, D. A.;Friedman, J. Y.;Melichar, L. A.;& Volpp, K. G. (2012). Can behavioural economics make us healthier? *British Medical Journal* 344.
- Meadows, D. (1999). Leverage Points. Places to intervene in a system. https://web.archive.org/web/20131008160618/http://www.sustainabilityinstitute.org/pubs/Leverage_Points.pdf. Hartland: The sustainability Institute.
- Meadows, D. H. (2008). *Thinking in Systems - A primer.* Chelsea Green Publishing.
- Nash, J. F. (1950). "Equilibrium Points in N-person Games" . *Proceedings of the National Academy of Sciences.* 36 (1), 48-49.
- Rabin, M. (1993). Incooperating fairness into game theory and economics. *Amer. Econ. Rev.* 83, 1281-1302.
- Samuelson, P. (1937). A Note on Measurement of Utility. *The Review of Economic Studies*, 155-161.

Stanford Encyclopedia of Philosophy. (12. March 2018). Retrieved from, Inductive logic:
<https://plato.stanford.edu/entries/logic-inductive/>

Stigler, G. J. (1961). The Economics of Information. *The Journal of Political Economy*, Volume 69, Issue 3, 213-225.

Teixeira Rodrigues, A.;Roque, F.;Falcão, A.;Figueiras, A.;& Herdeiro, M. (2013). Teixeira Rodrigues A, Roque F, Falcão Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies. *Int J Antimicrob Agents* 41(3), 203-212.

Tversky, A. (1972). Elimination by aspects: a theory of choice. *Psych. Rev.* 79, 281-299.

Tversky, A.;& Shafir, E. (1992). Choice under conflict: the dynamics of deferred decision. *Psych. Sci.* 3(6), 358-361.

Tversky, A.;& Shafir, E. (1992). Choice under conflict: the dynamics of deferred decision. *Psych. Sci.* 3(6), 358-361.

Vega-Redondo, F. (2003). *Economics and the Theory of Games*. Cambridge University Press.

Verbeek, M. (2006). *A Guide to Modern Econometrics*. John Wiley & sons.

Witte, K. (1992). "Putting the fear back into fear appeals: The extended parallel process model".

Witte, K. (1994). FEAR CONTROL AND DANGER CONTROL: A TEST OF THE EXTENDED PARALLEL PROCESS MODEL (EPPM). *Communication Monographs*. Vol. 61 Issue 2, p113., 113-135.

7 Appendix

Results from R:

summary(data) descriptive:

```

myop1      myop2      nationality  study  sec      yofs      gender      attitude      hunger
Min.   :0.0   Min.   :0.0000  FIN   :19  a:16  3 :10  Min.   :14.00  0:22  Min.   : 1.000  Min.   :1.000
1st Qu.:0.0   1st Qu.:0.0000  ETH   : 5  b: 7  4 :10  1st Qu.:18.00  1:20  1st Qu.: 6.000  1st Qu.:1.000
Median :0.5   Median :1.0000  BAN   : 2  c: 8  5 : 7  Median :19.00  Median : 7.000  Median :3.000
Mean   :0.5   Mean   :0.5238  GER   : 2  d:11  8 : 4  Mean   :19.02  Mean   : 6.806  Mean   :3.581
3rd Qu.:1.0   3rd Qu.:1.0000  JAP   : 2      2 : 3  3rd Qu.:20.00  3rd Qu.: 8.500  3rd Qu.:5.500
Max.   :1.0   Max.   :1.0000  RUS   : 2      6 : 3  Max.   :27.00  Max.   :10.000  Max.   :9.000
              (Other):10      (Other): 5      NA's   :11      NA's   :11

nofcho1      nofart1      t.type1      conc.type1      tot.type1      nofchoadd      t.type2      conc.type2      nofart2      tot.type2
Min.   :0.0000  1:11  0:12  0:8  0 :27  0:22  0:23  0:11  0: 1  (neg)0 :23
1st Qu.:0.0000  2:18  N:21  N:24  1 :12  1: 9  N:14  N:21  1:11  (pos)1 :11
Median :0.0000  3:11  P: 9  P:10  neutral:3  2: 5  P: 5  P:10  2:18  neutral: 8
Mean   :0.7381  4: 2  Mean :12.21  Mean :31.4
3rd Qu.:1.0000  3: 9  3rd Qu.:18.00  3rd Qu.:34.0
Max.   :4.0000  5: 2  Max.   :28.00  Max.   :54.0

title_eff1      title_eff2      age
Min.   : 4.00  Min.   : 0.00  Min.   :21.0
1st Qu.: 8.00  1st Qu.: 8.00  1st Qu.:25.0
Median :11.50  Median :10.50  Median :28.5
Mean   :11.29  Mean   :12.21  Mean   :31.4
3rd Qu.:15.00  3rd Qu.:18.00  3rd Qu.:34.0
Max.   :21.00  Max.   :28.00  Max.   :54.0

```

Call:
 glm(formula = **tot.type1 ~ attitude + hunger + nofcho1 + title_eff1**,
 family = "binomial", data = thesis2)

Analysis of Deviance Table

Model: binomial, link: logit

Response: tot.type1

Deviance Residuals:

```

Min      1Q  Median      3Q      Max
-1.70731 -0.29486 -0.02973  0.24268  1.70555

```

Terms added sequentially (first to last)

Coefficients:

```

              Estimate Std. Error z value Pr(>|z|)
(Intercept) -8.0150    4.4012  -1.821  0.0686 .
attitude    -0.3902    0.3287  -1.187  0.2353
hunger      -0.3906    0.2824  -1.383  0.1666
nofcho1     -0.6453    0.6149  -1.049  0.2940
title_eff1   0.9949    0.3947   2.521  0.0117 *

```

Df Deviance Resid. Df Resid. Dev Pr(>Chi)

```

NULL          30  41.381
attitude     1  2.5493   29  38.831  0.1103
hunger        1  0.2004   28  38.631  0.6544
nofcho1       1  0.5568   27  38.074  0.4555
title_eff1    1 23.6429   26  14.431 1.16e-06 ***

```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

 Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

OR 2.5 % 97.5 %

Null deviance: 41.381 on 30 degrees of freedom
 Residual deviance: 14.431 on 26 degrees of freedom
 (11 observations deleted due to missingness)

```

(Intercept) 0.00033047 4.368321e-09 0.2110356
attitude    0.67695262 2.986287e-01 1.2373331
hunger       0.67663947 3.331923e-01 1.1027647
nofcho1      0.52448457 1.130817e-01 1.4711249
title_eff1   2.70448635 1.538734e+00 7.8827852

```

AIC: 24.431

Number of Fisher Scoring iterations: 7

Call:
 glm(formula = **tot.type1 ~ attitude + nofcho1 + title_eff1**, family = "binomial", data = thesis2)

Analysis of Deviance Table

Model: binomial, link: logit

Deviance Residuals:
 Min 1Q Median 3Q Max
 -2.25923 -0.30017 -0.06299 0.40811 1.67351

Response: tot.type1

Terms added sequentially (first to last)

Coefficients:
 Estimate Std. Error z value Pr(>|z|)
 (Intercept) -6.5083 3.6615 -1.777 0.07549 .
 attitude -0.4380 0.3543 -1.236 0.21635
 nofcho1 -0.5219 0.5542 -0.942 0.34636
 title_eff1 0.7581 0.2796 2.712 0.00669 **

Df Deviance Resid. Df Resid. Dev Pr(>Chi)
 NULL 30 41.381
 attitude 1 2.5493 29 38.831 0.1103
 nofcho1 1 0.5634 28 38.268 0.4529
 title_eff1 1 21.4510 27 16.817 3.63e-06 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 41.381 on 30 degrees of freedom
 Residual deviance: 16.817 on 27 degrees of freedom
 (11 observations deleted due to missingness)
AIC: 24.817

OR 2.5 % 97.5 %
 (Intercept) 0.001491032 1.588924e-07 0.3529064
 attitude 0.645342603 2.783837e-01 1.2334036
 nofcho1 0.593393345 1.574241e-01 1.5578527
 title_eff1 2.134195848 1.405816e+00 4.5059446

Testing for the second step:

Call:
 glm(formula = **tot.type2_ ~ attitude + nofchoadd + t.type1 + title_eff2**, family = "binomial", data = thesis2)

2.5 % 97.5 %
 (Intercept) -8.21382461 2.1133066
 attitude -0.67822040 0.2158713
 nofchoadd -0.35563090 1.1567344
 t.type10 -1.75043827 3.4070332
 t.type1P -4.04406120 1.8456611
 title_eff2 0.09447209 0.4962799

Deviance Residuals:
 Min 1Q Median 3Q Max
 -1.9841 -0.6415 -0.2551 0.6810 1.7638

Analysis of Deviance Table
 Model: binomial, link: logit

Coefficients:
 Estimate Std. Error z value Pr(>|z|)
 (Intercept) -2.73069 2.51551 -1.086 0.27768
 attitude -0.19913 0.21810 -0.913 0.36123
 nofchoadd 0.32951 0.37032 0.890 0.37357
 t.type10 0.70215 1.25755 0.558 0.57661
 t.type1P -0.95066 1.44626 -0.657 0.51097
 title_eff2 0.25590 0.09772 2.619 0.00883 **

Response: tot.type2

Terms added sequentially (first to last)

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Df Deviance Resid. Df Resid. Dev Pr(>Chi)
 NULL 30 42.684
 attitude 1 1.8036 29 40.881 0.1792837
 nofchoadd 1 0.6587 28 40.222 0.4170212
 t.type1 2 0.6084 26 39.614 0.7377250
 title_eff2 1 11.4227 25 28.191 0.0007255 ***

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 42.684 on 30 degrees of freedom
 Residual deviance: 28.191 on 25 degrees of freedom
 (11 observations deleted due to missingness)
AIC: 40.191

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Number of Fisher Scoring iterations: 5

	OR	2.5 %	97.5 %
(Intercept)	0.06517404	0.0002708827	8.275560
attitude	0.81944149	0.5075193695	1.240943
nofchoadd	1.39029133	0.7007312129	3.179533
t.type10	2.01808785	0.1736978006	30.175585
t.type1P	0.38648545	0.0175261505	6.332285
title_eff2	1.29162306	1.0990784907	1.642599

Call:
 glm(formula = tot.type2 ~ attitude + nofcho1 + nofchoadd + t.type1 + title_eff2, family = "binomial", data = thesis2)

Deviance Residuals:
 Min 1Q Median 3Q Max
 -1.9842 -0.6416 -0.2550 0.6810 1.7638

Coefficients:
 Estimate Std. Error z value Pr(>|z|)
 (Intercept) -2.7315045 2.6578291 -1.028 0.3041
 attitude -0.1990662 0.2290428 -0.869 0.3848
 nofcho1 -0.0004298 0.4549182 -0.001 0.9992
 nofchoadd 0.3298320 0.5009191 0.658 0.5102
 t.type10 0.7023760 1.2800527 0.549 0.5832
 t.type1P -0.9497928 1.7134815 -0.554 0.5794
 title_eff2 0.2559180 0.0996312 2.569 0.0102 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 42.684 on 30 degrees of freedom
 Residual deviance: 28.191 on 24 degrees of freedom
 (11 observations deleted due to missingness)

AIC: 42.191

Number of Fisher Scoring iterations: 5

	2.5 %	97.5 %
(Intercept)	-8.49509902	2.3433022
attitude	-0.70242607	0.2389166
nofcho1	-0.90854262	0.9250607
nofchoadd	-0.64918879	1.3799113
t.type10	-1.77556051	3.4850519
t.type1P	-4.75201116	2.2125277
title_eff2	0.09194713	0.4980864

Analysis of Deviance Table

Model: binomial, link: logit

Response: tot.type2

Terms added sequentially (first to last)

	Df	Deviance	Resid. Df	Resid. Dev	Pr(>Chi)
NULL			30	42.684	
attitude	1	1.8036	29	40.881	0.1792837
nofcho1	1	0.5391	28	40.342	0.4628059
nofchoadd	1	0.2176	27	40.124	0.6408820
t.type1	2	0.8550	25	39.269	0.6521224
title_eff2	1	11.0780	24	28.191	0.0008736 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

	OR	2.5 %	97.5 %
(Intercept)	0.06512124	0.000204468	10.415574
attitude	0.81949564	0.495382013	1.269873
nofcho1	0.99957034	0.403111282	2.522021
nofchoadd	1.39073443	0.522469438	3.974549
t.type10	2.01854304	0.169388478	32.624122
t.type1P	0.38682117	0.008634313	9.138787
title_eff2	1.29164675	1.096306860	1.645569

<u>Variable name</u>	<u>Description</u>	<u>codes/values</u>	<u>Type of a variable</u>
nofart1	the number of articles read at time t_0	amount	Continuous
nofart2	the number of articles read at time t_1	amount	Continuous
tot.type1	total type/quality of information (summary of the type of a title and the conclusion) at time t_0	0=negative, 1=neutral or positive	Binary
tot.type2	total type/quality of information (summary of the type of a title and the conclusion) at time t_1	0=negative, 1=neutral or positive	Binary
age	Age	years	Continuous
gender	Gender	0=Male, 1=Female	Binary
nationality	Nationality of the participant	0=FIN, 1= Other	Categorical
study	field of studies	a=social sciences, b=health/(medical sciences, c=economics, d=others	Categorical
nofs	number of years studied	years	Continuous
sec	socioeconomic class/income decile	1= the lowest decile, ... , 10= the highest decile	Categorical
myop1	testing myopiness (a preference choice between $E(v)=1000\text{€}$ at time t_0 or $E(v)=1200\text{€}$ at time t_1 , annual interest rate of 20%)	0=No, 1= Yes	Binary
myop2	testing myopiness (a preference choice between $E(v)=1000\text{€}$ at time t_0 or $E(v)=1400\text{€}$ at time t_1 , annual interest rate of 40%)	0=No, 1= Yes	Binary
hunger	the state of hungriness	1=not at all, ... , 10= extremely	Scale
attitude	the attitude towards chocolate	1=hate it, ... , 10= love it	Scale
nofcho1	the threshold (number of chocolate eaten before reading)	amount	Continuous
nofchoadd	the number of chocolate eaten during reading	amount	Continuous
title_eff.1	the effect of length of the article's title at the first period t_0	0=neutral, P=positive, N=negative	Categorical
title_eff.2	the effect of length of the article's title at the second period t_1	0=neutral, P=positive, N=negative	Categorical
t.type1	the type of the article's title at the first period	0=neutral, P=positive, N=negative	Categorical
t.type2	the type of the article's title at the second period	0=neutral, P=positive, N=negative	Categorical
conc.type1	the type of the article's conclusion at the first period	0=neutral, P=positive, N=negative	Categorical
conc.type2	the type of the article's conclusion at the second period	0=neutral, P=positive, N=negative	Categorical

Table 4 Variables

7.1 Consent form and questionnaire form

Instructions and consent form for the experiment

The purpose of this experiment is to test information acquisition and decision-making. The objective is to test the hypothesis of the study, not ability or intelligence.

The following data will be recorded: gender, age, nationality, field of studies, number of years studied, socioeconomic status, attitude towards chocolate, preference choice of readings and preference choice in lottery wins. The experiment answers will be coded so that participants are kept anonymous.

The experiment is divided into three parts.

1. In the first task you are going to fill in your demographic details and proceed until the first questionnaire blanket is answered. This is going to take approximately 3minutes.
2. The second part is to read some information related to experiment. You can choose any of the 10 different articles. When you have chosen and read the article(s), please mark the number of the article which you chose (and read completely) in a questionnaire. PLEASE MARK ONLY THOSE WHICH YOU READ COMPLETELY!

The experiment is not testing your intelligence, reading skills or speed, so read as you normally do when reading articles or news. The time provided for the second part is 5minutes, so there is reasonable time for more than 1 article. The instructor will tell you when the time for the second part starts and ends.

3. The third part consists of similar type of a task as the second part. Again, the instructor will tell you when to start and when to stop the task.

The total amount of time for the experiment is ~15minutes.

Please note that talking and walking are not allowed during the experiment! The instructor will announce when the procedure is over. If you have any questions, please contact the instructor only!

Record of Consent

Your signature below indicates that you have understood the current experiment and consent to your participation. This experiment participation is voluntary, and you may refuse to answer some questions on the questionnaire and withdraw from the experiment at any time. If you have further questions related to this research, please contact the researcher/instructor.

participant

date

Questionnaire

Please, choose one of the option below:

1. Gender: female male
2. Age: _____ years
3. Nationality: _____
4. Field of studies: economics social sciences
 health/medicine IT/techs
 other, what? _____
5. In which socioeconomic class (or income decile) would you place yourself
1. 2. 3. 4. 5. 6. 7. 8. 9. 10.
6. If you win surely in a lottery, would you prefer 1000€ in hand right away or
 1200€ after a one year?
7. If you win surely in a lottery, would you prefer 1000€ right away or
 1500€ with a chance of 80% and 1000€ with a chance of 20% after 1 year
8. How hungry are you now?
1. 2. 3. 4. 5. 6. 7. 8. 9. 10.
not hungry at all very hungry
9. What is your attitude towards chocolate?
1. 2. 3. 4. 5. 6. 7. 8. 9. 10.
hate it love it
10. How many candies/chocolates have you eaten now? _____

11. Now you should choose 2-5 articles for your readings and read them thru, which numbers did you choose? (mark only those which you read completely!!!)

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

Why did you choose those articles?

12. How many chocolates have you eaten now? _____

13. Now you should choose again 2-5 articles for your readings and read them thru, which numbers did you choose? (mark only those which you read completely!!!)

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

Why did you choose those articles?

If you have any feedback, you can submit it here:

Thank you for your participation!

7.2 Articles in the experiment

1 Effects of chocolate, cocoa, and flavan-3-ols on cardiovascular health: a systematic review and meta-analysis of randomized trials

[Lee Hooper](#), [Colin Kay](#), [Asmaa Abdelhamid](#), [Paul A Kroon](#), [Jeffrey S Cohn](#), [Eric B Rimm](#), [Aedín Cassidy](#)

The American Journal of Clinical Nutrition, Volume 95, Issue 3, 1 March 2012, Pages 740-751,

<https://doi.org/10.3945/ajcn.111.023457>

Abstract

Background: There is substantial interest in chocolate and flavan-3-ols for the prevention of cardiovascular disease (CVD).

Objective: The objective was to systematically review the effects of chocolate, cocoa, and flavan-3-ols on major CVD risk factors.

Design: We searched Medline, EMBASE, and Cochrane databases for randomized controlled trials (RCTs) of chocolate, cocoa, or flavan-3-ols. We contacted authors for additional data and conducted duplicate assessment of study inclusion, data extraction, validity, and random-effects meta-analyses.

Results: We included 42 acute or short-term chronic (≤ 18 wk) RCTs that comprised 1297 participants. Insulin resistance (HOMA-IR: -0.67 ; 95% CI: -0.98 , -0.36) was improved by chocolate or cocoa due to significant reductions in serum insulin. Flow-mediated dilatation (FMD) improved after chronic (1.34%; 95% CI: 1.00%, 1.68%) and acute (3.19%; 95% CI: 2.04%, 4.33%) intakes. Effects on HOMA-IR and FMD remained stable to sensitivity analyses. We observed reductions in diastolic blood pressure (BP; -1.60 mm Hg; 95% CI: -2.77 , -0.43 mm Hg) and mean arterial pressure (-1.64 mm Hg; 95% CI: -3.27 , -0.01 mm Hg) and marginally significant effects on LDL (-0.07 mmol/L; 95% CI: -0.13 , 0.00 mmol/L) and HDL (0.03 mmol/L; 95% CI: 0.00 , 0.06 mmol/L) cholesterol. Chocolate or cocoa improved FMD regardless of the dose consumed, whereas doses >50 mg epicatechin/d resulted in greater effects on systolic and diastolic BP. GRADE (Grading of Recommendations, Assessment, Development and Evaluation, a tool to assess quality of evidence and strength of recommendations) suggested low- to moderate-quality evidence of beneficial effects, with no suggestion of negative effects. The strength of evidence was lowered due to unclear reporting for allocation concealment, dropouts, missing data on outcomes, and heterogeneity in biomarker results in some studies.

Conclusions: We found consistent acute and chronic benefits of chocolate or cocoa on FMD and previously unreported promising effects on insulin and HOMA-IR. Larger, longer-duration, and independently funded trials are required to confirm the potential cardiovascular benefits of cocoa flavan-3-ols.

2 Habitual Chocolate Consumption May Increase Body Weight in a Dose-Response Manner

James A. Greenberg, Brian Buijsse

Source: [PLoS ONE](#). Aug2013, Vol. 8 Issue 8, p1-7. 7p.

Abstract

Objective: Habitual chocolate intake was recently found to be associated with lower body weight in three cross-sectional epidemiological studies. Our objective was to assess whether these cross-sectional results hold up in a more rigorous prospective analysis.

Methods: We used data from the Atherosclerosis Risk in Communities cohort. Usual dietary intake was assessed by questionnaire at baseline (1987–98), and after six years. Participants reported usual chocolate intake as the frequency of eating a 1-oz (28 g) serving. Body weight and height were measured at the two visits. Missing data were replaced by multiple imputation. Linear mixed-effects models were used to evaluate cross-sectional and prospective associations between chocolate intake and adiposity.

Results: Data were from 15,732 and 12,830 participants at the first and second visit, respectively. More frequent chocolate consumption was associated with a significantly greater prospective weight gain over time, in a dose-response manner. For instance, compared to participants who ate a chocolate serving less often than monthly, those who ate it 1–4 times a month and at least weekly experienced an increase in Body Mass Index (kg/m²) of 0.26 (95% CI 0.08, 0.44) and 0.39 (0.23, 0.55), respectively, during the six-year study period. In cross-sectional analyses the frequency of chocolate consumption was inversely associated with body weight. This inverse association was attenuated after excluding participants with preexisting obesity-related illness. Compared to participants without such illness, those with it had higher BMI and reported less frequent chocolate intake, lower caloric intake, and diets richer in fruits and vegetables. They tended to make these dietary changes after becoming ill.

Conclusions: Our prospective analysis found that a chocolate habit was associated with long-term weight gain, in a dose response manner. Our cross-sectional finding that chocolate intake was associated with lower body weight did not apply to participants without preexisting serious illness.

3 Sweet Dreams: Will Chocolate be the next "Health Food"?

Source: Tufts University Health & Nutrition Letter, 15260143, Feb2005, Vol. 22, Issue 12

COULD THE CANDY in that heart-shaped box of Valentine's chocolates actually be good for your heart?

Certainly, the nation's candy makers would love for you to think so. Mars Inc., the global food conglomerate that makes M&Ms, Snickers and Dove bars, among other products, has spent 15 years researching the purported health benefits of chocolate, according to The New York Times. In 2003, the company introduced the CocoaVia snack bar, which is packed with the flavanols that are credited with chocolate's heart-healthy qualities while being mostly free of cocoa butter; to date, Mars has sold CocoaVia only on the Internet. An American Heart Association meeting in November heard evidence that eating two CocoaVia snack bars daily could reduce cholesterol levels. In December, a "CBS Sunday Morning" segment touted Mars' patented Cocopro process that, according to a company news release, "retains much of the naturally occurring cocoa flavanols that provide potential health benefits."

This is not the first time health claims have been made for chocolate. The ancient Mayans used cocoa to treat skin diseases, fevers and seizures. Carl Linnaeus, the "father of taxonomy," advocated chocolate as a cure for lung disease, muscle disease and hemorrhoids. In the early 1990s, Mars backed research claiming chocolate is actually good for your teeth.

The current claims began in the late 1990s, with a Mars-financed study by Carl Keen, PhD, chairman of the nutrition department at the University of California-Davis. Keen found that cocoa seemed to have an aspirin-like beneficial effect on platelets in the blood, thanks to flavanols--part of a group of phytonutrients called flavonoids. Various flavonoids have been shown to prevent oxidation, stimulate the immune system, impede cancer cell growth, and protect against bacteria and viruses. These are the same substances that have led to recommendations to drink red wine (in moderation) and green tea. Most commercially available chocolates and cocoa powders don't contain significant levels of flavanols, which are stripped out in processing. Flavanols can make chocolate taste bitter and astringent--hardly the qualities most consumers look for in a candy bar. Mars' Cocopro system aims to boost flavanol levels in M&Ms, Dove bars and other products while still making them taste good.

Next, Norman K. Hollenberg, MD, PhD, a professor at Harvard Medical School, and colleague Naomi Fisher, MD, observed a group of Kuna Indians on an island off the coast of Panama who enjoyed an unusually low rate of hypertension--and who drank large quantities of lightly processed cocoa. That led to a study, published in 2003 in The Journal of Hypertension, showing the flavanols in cocoa stimulate nitric oxide production in blood vessels.

Another study, published in October in The British Journal of Cardiology by Dr. Hollenberg and Harold Schmitz, PhD, chief of research at Mars, made similar claims for a cardiovascular benefit from cocoa flavanols. And, according to The New York Times, Dr. Hollenberg recently concluded a pilot study that found subjects who drank a cup of high-flavanol cocoa had a 33 percent increase in blood flow to the brain.

Independently, researchers from Imperial College in London announced in November that an ingredient in cocoa--theobromine--could treat persistent coughs. The study--which tested only 10 subjects--found theobromine was nearly a third more effective than codeine against coughs.

Soon, Mars is expected to launch a line of cocoa products backed by studies suggesting benefits for high blood pressure and vascular disease.

So should health-conscious consumers add chocolate to their diet? Jeffrey Blumberg, PhD, FACN, CNS, chief of the Antioxidants Research Laboratory at the Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University, has a clear, one-word answer: "No."

Blumberg explains, "While consumption of some chocolate (principally the dark, less sweet, high proanthocyanidin chocolate more common in Europe--not the milk chocolate more common in the US) does show some bioactivity in quenching free radicals (i.e., as an antioxidant) and promoting vascular responsiveness (associated with reduced risk of heart disease), it cannot be considered a health food because of its significant negative attributes (high fat, sugar and calorie content)."

"Eat it because you like it," says Jeanne Goldberg, PhD, a professor in the Friedman School of Nutrition Science and Policy at Tufts University. "Choose carefully--buy what you really like and enjoy it."

"Chocolate is a delightful treat and should be enjoyed as such, not as a health food," Blumberg adds. "If knowing chocolate contains some beneficial nutrients makes you feel slightly less guilty about indulging (but not over-indulging!), that's fine."

Even Mars' chief scientist, Harold Schmitz, says he hasn't increased his chocolate consumption because of recent research findings. But, he told American Medical News, "I started feeling a lot better about eating it."

4 Protective Effect of Dark Chocolate on Cardiovascular Disease Factors and Body Composition in Type 2 Diabetes: A Parallel, Randomized, Clinical Trial.

[Ayoobi, Nina](#); [Jafarirad, Sima](#); [Haghighizadeh, Mohammad Hossein](#); [Jahanshahi, Alireza](#)

Source: [Iranian Red Crescent Medical Journal](#). Aug2017, Vol. 19 Issue 8, p1-7. 7p.

Abstract

Background: Diabetes leads to complications such as cardiovascular diseases. There are limited data about the effect of dark chocolate on cardiovascular function in patients with diabetes.

Objectives: The current study aimed at determining the effect of dark chocolate on cardiovascular health and body composition among people with diabetes.

Methods: The current parallel, randomized, clinical trial was conducted on 44 patients with diabetes (Ahvaz, Iran). They were randomly assigned into the intervention (n = 21, 30 g dark chocolate daily for 8 weeks) and the control groups (n = 23). At the beginning and end of the intervention period, fasting blood samples were collected to measure nitric oxide (NO) and angiotensin II. Also, anthropometric measurement, body composition analyses, and blood pressure were compared between the 2 groups before and after the intervention.

Results: A significant reduction in systolic (-6.9 ± 7.3 vs. 0.3 ± 1.9 ; $P = 0.001$) and diastolic blood pressure (-5.8 ± 6.7 vs. 0.5 ± 3.9 ; $P = 0.001$), waist circumference (WC) (-0.7 ± 1.0 vs. 0.1 ± 1.2 ; $P = 0.007$), and significant increase in soft lean mass ($P = 0.045$) was observed in the intervention group. There were no significant changes in NO levels, but a trend close to significance for angiotensin II ($P = 0.052$) at end of the intervention between the 2 groups.

Conclusions: The current study findings showed that dark chocolate consumption in patients with diabetes might improve their WC, body composition, and blood pressure, but had no effect on NO in this dosage.

5 A double-blind, placebo-controlled, randomized trial of the effects of dark chocolate and cocoa on variables associated with neuropsychological functioning and cardiovascular health: clinical findings from a sample of healthy, cognitively intact older adults

W David Crews, Jr, David W Harrison, James W Wright

The American Journal of Clinical Nutrition, Volume 87, Issue 4, 1 April 2008, Pages 872–880,
<https://doi.org/10.1093/ajcn/87.4.872>

Abstract

Background: In recent years, there has been increased interest in the potential health-related benefits of antioxidant- and phytochemical-rich dark chocolate and cocoa.

Objective: The objective of the study was to examine the short-term (6 wk) effects of dark chocolate and cocoa on variables associated with neuropsychological functioning and cardiovascular health in healthy older adults.

Design: A double-blind, placebo-controlled, fixed-dose, parallel-group clinical trial was used. Participants ($n = 101$) were randomly assigned to receive a 37-g dark chocolate bar and 8 ounces (237 mL) of an artificially sweetened cocoa beverage or similar placebo products each day for 6 wk.

Results: No significant group (dark chocolate and cocoa or placebo)-by-trial (baseline, midpoint, and end-of-treatment assessments) interactions were found for the neuropsychological, hematological, or blood pressure variables examined. In contrast, the midpoint and end-of-treatment mean pulse rate assessments in the dark chocolate and cocoa group were significantly higher than those at baseline and significantly higher than the midpoint and end-of-treatment rates in the control group. Results of a follow-up questionnaire item on the treatment products that participants believed they had consumed during the trial showed that more than half of the participants in both groups correctly identified the products that they had ingested during the experiment.

Conclusions: This investigation failed to support the predicted beneficial effects of short-term dark chocolate and cocoa consumption on any of the neuropsychological or cardiovascular health-related variables included in this research. Consumption of dark chocolate and cocoa was, however, associated with significantly higher pulse rates at 3- and 6-wk treatment assessments.

6 The devil in the dark chocolate

Source: The Lancet, Vol 370 December 22/29, 2007

A truffle treatment for atherosclerosis is the stuff, that chocolate manufacturers (and patients) dream of. But how close is such a scenario to reality? Last month, a study in *Circulation* showed that dark chocolate that is rich in flavanols induced coronary vasodilatation and improved coronary vascular function in 11 heart transplant recipients compared with patients taking a cocoa-free control chocolate. Other studies have also suggested that dark chocolate has cardiovascular benefits. A recent small randomized trial showed that people who were prehypertensive or had early-stage hypertension could lower their blood pressure by eating small amounts of dark chocolate as part of their usual diet. Great news if you happen to be a lover of dark chocolate.

However, if your passion is white or milk chocolate, bad luck. Research has shown that this type of chocolate, which is often devoid of flavanols, offers no health benefit. But there is a catch for dark-chocolate fans too. Dark chocolate can be deceptive. When chocolate manufacturers make confectionary, the natural cocoa solids can be darkened and the flavanols, which are bitter, removed, so even a dark-looking chocolate can have no flavanol. Consumers are also kept in the dark about the flavanol content of chocolate because manufacturers rarely label their products with this information. And, although flavanols, if they are present, seem to offer some health benefit, the devil in the dark chocolate is the fat, sugar, and calories it also contains. To gain any health benefit, those who eat a moderate amount of flavanol-rich dark chocolate will have to balance the calories by reducing their intake of other foods—a tricky job for even the most ardent calorie counter. So, with the holiday season upon us, it might be worth getting familiar with the calories in a bar of dark chocolate versus a mince pie and having a calculator at hand. Of course, some would say that, in terms of food intake, the best and simplest health message would be to stay away from the chocolate and eat a healthy, balanced diet, low in sugar, salt, and fat, and full of fresh fruit and vegetables. We say: “Bah, humbug to that. Pass the chocolates.” ■ The Lancet

7 Chocolate and Health-Related Quality of Life: A Prospective Study

Teresa Balboa-Castillo, Esther López-García, Luz M. León-Muñoz, Raúl F. Pérez Tasigchana, José Ramón Banegas, Fernando Rodríguez-Artalejo, Pilar Guallar Castellón

Source: PLOS ONE, April 22., 2015,

DOI:10.1371/journal.pone.0123161

Abstract

Background: Chocolate consumption has been associated with a short-term reduction in blood pressure and cholesterol, and improvement of insulin sensitivity; however, participants could not be aware of presenting hypertension or hypercholesterolemia. Moreover, the effect of chocolate on mental health is uncertain. This study assessed the association of regular chocolate consumption with the physical(PCS) and mental(MCS) components of health-related quality of life(HRQL).

Materials and methods: We analyzed data from a cohort of 4599 individuals recruited in 2008–2010 and followed-up once prospectively to January 2013 (follow-up mean: 3.5years). Regular chocolate consumption was assessed at baseline with a validated diet history. HRQL was assessed with the SF-12 v.2 at baseline and at follow-up. Analyses were performed with linear regression and adjusted for the main confounders, including HRQ Lat baseline.

Results: At baseline, 72%of the study participants did not consume chocolate, 11% consumed ≤ 10 g/day and 17% >10 g/day. Chocolate consumption at baseline did not show an association with PCS and MCS of the SF-12 measured three years later. Compared to those who did not consume chocolate, the PCS scores were similar in those who consumed ≤ 10 g/day (beta: -0.07; 95% confidence interval (95%CI): -0.94 to 0.80) and in those who consumed >10 g/day (beta: 0.02; 95%CI: -0.71 to 0.75); corresponding figures for the MCS were 0.29; 95%CI: -0.67 to 1.26, and -0.57; 95%CI: -1.37 to 0.23. Similar results were found for sex, regardless of obesity, hypertension, hypercholesterolemia, diabetes or depression.

Conclusions: No evidence was found of an association between chocolate intake and the physical or mental components of HRQL.

8 The cardiometabolic benefits of chocolate: can chocolate be the elusive elixir to optimum health?

Bradley J. McEwen

Source: *Advances in Integrative Medicine*

Available online 13 February 2018

<https://doi.org/10.1016/j.aimed.2017.12.008>

Method: Meta-analysis of fourteen cohort or nested case-control studies. Population-based cohort and case-control studies in Australia, Germany, Japan, Sweden, United Kingdom, and the United States, with the specific settings not stated.

Result: Six prospective studies reported the risk of coronary heart disease associated with chocolate consumption. The pooled risk ratio (RR) of coronary heart disease for the highest versus lowest intake of chocolate was 0.90 (95% confidence interval (CI), 0.82-0.97). Additionally, the risk ratio for myocardial infarction was 0.86 (95% CI, 0.77-0.96). Furthermore, for studies with a follow-up duration of fewer than 10 years, the risk ratio was 0.72 (95% CI, 0.57-0.92). Whereas, studies with a follow-up duration of ≥ 10 years, the risk ratio was 0.92 (95% CI, 0.86-0.99).

Eight reports from seven studies estimated the risk of stroke for the highest versus lowest level of chocolate consumption with a risk ratio of 0.84 (95% CI, 0.78-0.90). For cerebral infarction, the risk ratio was 0.87 (95% CI, 0.78-0.96) and for hemorrhagic stroke, the risk ratio was 0.83 (95% CI, 0.71-0.97). Furthermore, for studies with a follow-up duration of fewer than ten years, the risk ratio was 0.56 (95% CI, 0.37-0.85) and studies with follow-up duration of ≥ 10 years the risk ratio was 0.85 (95% CI, 0.79-0.91). By gender, the risk ratios of total stroke were 0.87 (95% CI, 0.79-0.97) for males and 0.84 (95% CI, 0.74-0.94) for females.

Six independent reports from five studies estimated the risk of diabetes for chocolate consumption. Compared with the lowest intake of chocolate, the highest intake of chocolate was associated with a reduced risk of developing diabetes (RR 0.82, 95% CI, 0.70-0.96). Additionally, the risk ratio for men was 0.79 (95% CI, 0.65-0.96) and for women was 0.92 (95% CI, 0.72-1.17).

For coronary heart disease, when compared with no intake of chocolate, the risk ratios of coronary heart disease across chocolate consumption levels were 0.94 (95% CI, 0.90-0.99) for 1 serving/week, 0.91 (95% CI, 0.85-0.97) for 3 servings per week, 0.89 (95% CI, 0.83-0.95) for 7 servings per week, and 0.88 (95% CI, 0.81-0.95) for 10 servings per week.

The risk ratios for chocolate consumption and stroke were 0.91 (95% CI, 0.86-0.97) for 1 serving/week, 0.87 (95% CI, 0.81-0.94) for 3 servings/week, 0.85 (95% CI, 0.76-0.93) for 7 servings per week, and 0.83 (95% CI, 0.72-0.94) for 10 servings per week.

The risk ratios for chocolate consumption and diabetes were 0.80 (95% CI, 0.71-0.91) for 1 serving/week, 0.76 (95% CI, 0.63-0.91) for 3 servings per week, 0.83 (95% CI, 0.67-1.03) for 7 servings per week, and 0.89 (95% CI, 0.69-1.16) for 10 servings of chocolate per week.

A meta-analysis was conducted to investigate the association between the consumption of chocolate and the risk of coronary heart disease, stroke, and type 2 diabetes. One serving of chocolate was assumed to approximate 30 g of chocolate.

Conclusion: Compared with the lowest intake of chocolate, the highest consumption of chocolate was associated with decreased risks of coronary heart disease, stroke, and type 2 diabetes.

9 Psychoactive effects of tasting chocolate and desire for more chocolate

Jennifer A.Nasser, Lauren E.Bradley, Jessica B.Leitzsch, Omar Chohan, Kristy Fasulo, Josie Haller, Kristin Jaeger, Benjamin Szulanczyk, Angelo Del Parigi

Source: Physiology & Behavior, Volume 104, Issue 1, 25 July 2011, Pages 117-121

Abstract

The purpose of this study was to characterize the psychoactive effects of tasting chocolate and to evaluate the contribution of the main chocolate components to the desire to consume more of it. A total of 280 participants, (F-155; M = 125) ranging in age from 18–65, completed the study. Participants were randomly assigned to taste 12.5 g of either white chocolate (“control”) or one of four chocolate (“cocoa”) samples varying in sugar, fat and percent cocoa content, then answered the question: “Do you want more of this chocolate?” and “If yes, how many more pieces of this chocolate would you like to eat?” They completed pre- and post-consumption surveys, consisting of 30 questions derived from the Addiction Research Center Inventory (ARCI) subscales, Morphine–Benzedrine Group (MBG), Morphine (M) and Excitement (E). Significant decreases in post–pre consumption changes in MBG subscale were observed between the control sample and the 70% cocoa ($p = 0.046$) or the 85% cocoa sample ($p = 0.0194$). Proportionally more men than women wanted more of the tasted chocolate ($p = 0.035$). Participants were more likely to want more of the tasted chocolate if they displayed a greater change in the MBG scale, and if their chocolate sample had high sugar and cocoa content, as assessed by multiple logistic regression. Our results suggest that multiple characteristics of chocolate, including sugar, cocoa and the drug–like effects experienced, play a role in the desire to consume chocolate.

Results: ARCI subscales were used to probe psychoactive effects from tasting chocolate. MBG subscale responses increased after tasting samples with 0–60% cocoa. The greater the change in MBG score, the greater the desire for more chocolate. High sugar and cocoa content and male gender increased desire for more cocoa.

Conclusions: We have demonstrated that tasting chocolate has measurable psychoactive effects and that sugar and cocoa contents of chocolate are primarily related to the desire to consume more of it. To our knowledge this is the first report of use of a validated “drug-effect” questionnaire to probe the psychoactive effects experienced from tasting a high sugar/high fat food. The data support our hypothesis that the psychoactive effects of chocolate are positively correlated with its sugar content. In addition, the data also support the hypothesis that cocoa content contributes to desirability of chocolate. Further studies assessing the time course of individual and interactive effects of fat, sugar and cocoa on psychoactive responses, activation of dopaminergic and opioidergic neurotransmitter circuits, and their contribution to overconsumption of high energy-dense food seem warranted.

10 Chocolate: Food or Drug?

Kristen Bruinsma Md, Douglas L. Taren PhD

Source: Journal of the American Dietetic Association, Volume 99, Issue 10, October 1999, Pages 1249-1256

[https://doi.org/10.1016/S0002-8223\(99\)00307-7](https://doi.org/10.1016/S0002-8223(99)00307-7)

Abstract

Although addictive behavior is generally associated with drug and alcohol abuse or compulsive sexual activity, chocolate may evoke similar psychopharmacologic and behavioral reactions in susceptible persons.

A review of the literature on chocolate cravings indicates that the hedonic appeal of chocolate (fat, sugar, texture, and aroma) is likely to be a predominant factor in such cravings. Other characteristics of chocolate, however, may be equally as important contributors to the phenomena of chocolate cravings. Chocolate may be used by some as a form of self-medication for dietary deficiencies (e.g., magnesium) or to balance low levels of neurotransmitters involved in the regulation of mood, food intake, and compulsive behaviors (e.g., serotonin and dopamine). Chocolate cravings are often episodic and fluctuate with hormonal changes just before and during the menses, which suggests a hormonal link and confirms the assumed gender-specific nature of chocolate cravings. Chocolate contains several biologically active constituents (methylxanthines, biogenic amines, and cannabinoid-like fatty acids), all of which potentially cause abnormal behaviors and psychological sensations that parallel those of other addictive substances. Most likely, a combination of chocolate's sensory characteristics, nutrient composition, and psychoactive ingredients, compounded with monthly hormonal fluctuations and mood swings among women, will ultimately form the model of chocolate cravings. Dietetics professionals must be aware that chocolate cravings are real. The psychopharmacologic and chemosensory effects of chocolate must be considered when formulating recommendations for overall healthful eating and for treatment of nutritionally related health issues.

7.3 Evaluation of the articles

Article number	1	2	3	4	5	6	7	8	9	10
Number of words in the title	18	12	9	20	35	6	10	14	10	4
Title type	0	N	0	P	0	N	0	P	N	0
Conclusion type	P	N	0	P	0	N	0	P	N	N

red color= negative, yellow color= neutral, green color=positive