



Research Article

Food Design as a University-Industry Collaboration Project: An Experience Design on Controlling Chocolate Consumption and Long-Term Eating Behavior

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(First received October 05, 2022 and in final form December 26 2022)

2nd International Conference on Design, Research and Development
December 14 - 17, 2022

Reference: Durmaz, B., Curaoğlu, F. Food Design as a University-Industry Collaboration Project: An Experience Design on Controlling Chocolate Consumption and Long-Term Eating Behavior. Orclever Proceedings of Research and Development,1(1), 271-282.

Abstract

The history and consumption of chocolate, which is a favorite snack of people, dates back to 3000 years ago. Chocolate, or cocoa beans, used to be known as the food of the gods. At that time, cocoa beans were consumed in a drinkable form, that is, a liquid beverage prepared with special spice mixtures. With the advent of the industrial revolution and the development of technology, the form of chocolate has become solid. Today, it is still in an edible, chewable solid form. This project was aimed as an experience design on controlling chocolate consumption and long-term eating behavior. Our lifestyle and habits in today's modern world led us to be fast in every aspect. Eating fast because of these habits causes many different health problems. As a result, a product and product packaging design was made that supports the active role of the senses such as sight, smell and hearing, where consumption begins, in order to consume chocolate by melting and to secrete the most important stimulant salivary glands actively in order to provide a healthy and long-term pleasure-based consumption.

Keywords: Chocolate, Eating habits, Pleasure, Saturation/Toughness, Taste (Sense of taste)



1. Introduction

When the historical adventure of chocolate is examined, it differs from its present form in terms of shape and meaning. Excavations and researches show that the creation of chocolate as a processed substance goes back thousands of years. Due to the fact that cocoa beans are very troublesome, chocolate has been considered valuable and sacred throughout history and has been accepted as a rich cut food (drink) (Kaya Terme, 2019). Over time, with the development of technology, changes in chocolate production and consumption; perceptions and tastes have been shaped. Chocolate is a widely popular, customary and generally popular food integrated with daily life (Kaya Terme, 2019). This food, which had been consumed as a beverage in the past, became a solid form when we came to the present day.

Due to the fact that "modern man" competes with time, the need for fast and practical eating has emerged and fast food has emerged. The food system has been included in daily life in response to this need (Arslan 1997). The concept of "fast food", which has existed for a long time in Turkish food culture, has an important place in eating habits. Just like in food, fast food means eating foods that are easy to prepare in a short time, quickly (Cetin, Sen, 2021). Fast food, which is called food that is prepared and consumed quickly has been increasing rapidly around the world in recent years. According to research in this area, fast the number of food restaurants also tends to increase depending on demand (Cieurzyńska, Cieśluk, Barwińska, Marczak, Ordyniak, Lenart, Janowicz, 2019). Fast food for university students by Önder & Önder (2019) As a result of the analysis of the research carried out to determine the habits of food consumption, most of the students due to convenience and time constraints. They prefer to consume food products and fast food at least once a week. It has been determined that he consumes food (Gök, Isakova, Ince, 2020). While the fast and hasty consumption of food causes a consumption in more than necessary; it causes negative feelings such as neither being able to enjoy what one eats, nor being able to taste it, and regret in some people. We can observe many negative effects of fast eating on our health, such as heartburn, stomach pain, bloating, diabetes, preventing the feeling of fullness, and obesity. Globally, overweight and obesity are a major public health concern, with more overweight or obese adults than lean adults. In 2016, 39% of men and 40% of women aged 18 years and older, corresponding to approximately 2 billion adults worldwide, were overweight, and more than half a billion men and 15% of women worldwide were obese. Both overweight and obesity have increased markedly over the past four decades (WHO, 2020, 24).

It is thought that the most important reason for this global increase in obesity and overweight is the changes in lifestyle and environmental factors (Pazarbası, Akbıyık, Akyol Mutlu, 2016). The consumers of the new century, who are in an uncontrolled time



intensity, receive support from small snacks as a source of happiness and pleasure in a little time intervals they can spare.

In this context, especially energy content is intense, sugar and fat (saturated and trans fatty acids) content is high; It has been shown in many studies that excessive consumption of foods with low vitamin, mineral and fiber content is associated with overweight and disease risk (Pazarbası, Akbiyık, Akyol Mutlu, 2016). The daily consumption and energy density of junk food, which has the above-mentioned features in terms of nutritional value and is usually a snack between main meals, is increasing day by day worldwide (Pazarbası, Akbiyık, Akyol Mutlu, 2016). For this reason, opportunities should be provided in which people can meet their energy needs in their environment and that they can get sufficient portion amounts. Hess and al. They developed a table in which they included the need for certain nutrients important for health in different countries. They state that the development of beneficial snacks for the human body will be an increasingly important area of cooperation between food manufacturers and dietitians (Ciużyńska, Cieśluk, Barwińska, Marczak, Ordyniak, Lenart, Janowicz, 2019). In this context, especially in the last ten years, in the field of industrial design, food manufacturers for healthy living and consumption have been collaborating with industrial designers on food design.

When we examine the results of a survey conducted on university students in 2019: Participants in the 25th question of the YFAS (Yale Eating Addiction Scale); answered the types of food that made them want to overeat and that they could not stop eating. According to this; the first choice food for women and men was chocolate with %45.33, ice cream with the second %36.67, cake-cake with the third %32.67, and confectionery with the fourth %26 (Akten, Noyan, 2019). Although the Turkish chocolate market has a significant potential, annual consumption per capita remains at 1 kilogram. This amount can reach up to 2.4 kg in Russia, 5.9 kg in the USA, 7.5 kg in France, 9.9 kg in the UK, and 11.5 kg in Switzerland. Turkish consumers mostly prefer milk chocolate with a rate of %33 as tablet chocolate. Milk chocolate is followed by pistachio with %21, hazelnut with %16, caramel with %15, dark chocolate with %12 and white chocolate with %2 (Özdoğan, 2008). Although the preference of chocolate varies from country to country, the interest and consumption of dark chocolate has increased in the world as a result of researches made in recent years.

Chocolate has been considered an unhealthy food for many years, but studies in recent years show that consumption of chocolate, especially dark chocolate, which has a higher cocoa content than milk chocolate, is associated with lower blood pressure,



cardiovascular disease, type 2 diabetes and mortality rate (Pazarbası, Akbiyik, Akyol Mutlu, 2016). The data obtained from studies on the subject draw attention to the fact that dark chocolate causes changes on glucose metabolism. A limited number of studies point out that dark chocolate may also have an effect on satiety factors. In a study by Sorensen and Astrup, it was shown that dark chocolate provides a higher sense of satiety compared to milk chocolate, suppresses food consumption and energy intake in the next meal, and reduces the desire for sugary food consumption (Pazarbası, Akbiyik, Akyol Mutlu, 2016).

Table 1 shows the nutrient composition of 80 g dark chocolate containing %70-85 cocoa according to the United States Department of Agriculture database (Pazarbası, 2015).

Table 1: Macro and micronutrient contents of dark chocolate and percentage of coverage

Food Items	Value	Amount to be taken daily	Daily intake percentage of coverage (%)
Macro nutrients			
Energy (kcal)	478	2180	21.9
Protein (g)	6.2	55	11.3
Total fat (g)	34.1	654	5.2
Total saturated fat (g)	19.6	174.4	11.2
Total monounsaturated fat (g)	10.2	327	3.1
Total polyunsaturated fat (g)	1	218	0.5
Cholesterol (mg)	2	250	0.8
Carbs (g)	36.7	1199	3.1
Fiber (g)	8.7	25	34.8
Sugar (g)	19.2		
Mineral			
Calcium (mg)	58	1000	5.8
Iron (mg)	9.5	18	52.8
Magnesium (mg)	182	310	58.7
Phosphorus (mg)	246	700	35.1
Zinc (mg)	2.6	10	26.0
Vitamins			
Thiamine (mg)	0.027	1.1	2.5
Riboflavin (mg)	0.062	1.1	5.6
Niacin (mg)	0.843	14	6.0
B ₆ vitamin (mg)	0.03	1.3	2.3
B ₁₂ vitamin (mg)	0.22	2.4	9.2
A vitamin (mg)	31	700	4.4
E vitamin (mg)	0.47	15	3.1
K vitamin (mg)	5.8	90	6.4



Eating function is controlled by neuronal and hormonal signals that regulate appetite and satiety. The signals that occur in the digestive and absorption system are transmitted to the brain and the hunger-satiety cycle is maintained (Büyükuslu, 2019). Hunger has two definitions. One of them is the amount of glucose in the blood. When the amount of glucose in the blood drops, people feel hungry. Another definition is the stimulation of stretch receptors in the stomach. Stretch receptors are not stimulated when our stomach is empty. The longer we keep a food in the mouth and tongue, the more serous (water - based secretion) increases. This event provides a better taste by decoding the taste molecules better. While it tastes better with this aspect, another important task is to increase the amount of glucose that passes into the blood. The increase in glucose in the blood creates a sense of satiety in the person. In other words, it is important to ensure that the salivary glands are activated before the food is taken into the mouth in order to ensure the formation of satiety awareness in a short time. At this stage, we come across different concepts such as perception, taste, taste, senses, neurogastronomy.

The concept of perception is closely related to positive (liking) or negative (disgust) appreciation. Perception is the image that the brain creates using signals from all the relevant senses (mainly the senses of taste, smell, feeling, as well as hearing and sight). On the other hand, tasting is a person's capacity to record the flavor, and people have to use all their senses to do this (Yücel Güngör, Yıldız, Uca, Ekincek, Tüzünkan, 2020, 5). Taste is defined as the sum of the perceptions created by a food or beverage in the mouth, primarily with the senses of taste and smell, as well as other senses such as pain, touch, and temperature in addition to these senses (Cemeroglu & Acar, 1986; Miisoglu & Hayoglu, 2005). The brain is where all sensory information is brought together; where information is processed, conclusions are drawn and action is initiated. By its very nature, the flavor system is an extremely complex system. Taste, smell, touch, sight and hearing represent the five basic senses. When we evaluate food and beverage, the first three senses give information about the internal elements of food and beverage, while the senses of sight and hearing provide information about both internal elements and external qualities. Stimulation of the five senses has a direct impact on both our physical and mental health. The senses affect three important body systems: the autonomic nervous system, the immune system and the hormonal system (Yücel Güngör, Yıldız, Uca, Ekincek, Tüzünkan, 2020, 6). Neurogastronomy promises a food and beverage experience that appeals to all senses of people. All the senses cumulatively make up the dining experience. The famous French chef Paul Bocuse defined the interaction of multiple senses in food as follows: The ideal wine satisfies all five senses perfectly. To see with color; smell with bouquet (bouke); texture with freshness; taste with aroma and hear with "glou glou".

The multi-sensory interaction that affects food consumption can be a source of happiness and pleasure, as well as satisfying the person. The Greek philosopher Epicurus, the



founder of hedonism (Hedonism), suggested “to use pleasures in moderation for the happiness of people, and to avoid natural and non-essential pleasures” (Aytekin, Ay, 2015). Especially chocolate has been a source of happiness for its consumers for hundreds of years, both as a source of happiness and pleasure. In an experimental study of chocolate consumption and positive mood by Macht and Dettmer (2006), the effect of mindful chocolate consumption on mood was examined. As a result, it seems that food liking is a mediator between mindful chocolate consumption and positive mood. Such results have proven to be compatible with mindful eating paradigms aimed at influencing people's overall pleasure in eating (Meier, Noll, Molokwu, 2017).

Since chocolate is a high-calorie and energizing food that many people consume with pleasure, it should be consumed in the right way with healthy portions and choices. But Food Science According to food experts working at Galaxy, we are consuming this food incorrectly. The According to Sun's report, the mistake most people make is chewing chocolate instead of melting it in the mouth. If chocolate is **consumed by melting and absorbing in the mouth, it allows the taste to spread more in the mouth by melting the cocoa butter**. Also, because it takes more time to consume chocolate this way, it can help reduce the desire to consume more chocolate (Cumhuriyet, "According to food experts, most people eat chocolate wrong" 2022). According to the news here, experts state that consuming chocolate in small quantities is important in order not to overwhelm the palate. In this way, we can enjoy every piece consumed to the fullest. In order to prolong this process, to be able to enjoy the taste that remains on the palate after eating the chocolate. The flavor of some chocolates can stay in the mouth for up to 45 minutes, but most often it is around 15 minutes. (Cumhuriyet, "According to food experts, most people eat chocolate wrong" 2022).

2. Materials and Methods

This study covers the process and results of a chocolate design based on user experience of a university-industry cooperation project carried out within the scope of Eskişehir Technical University graduation projects. The aim of the project is to design a creative product that will enable the user to experience chocolate consumption with a healthy eating approach. For this, while concepts such as pleasure, satiety, taste are discussed; A survey of 151 people and semi-structured face-to-face interviews with 7 people during the experience design process within the scope of user-oriented design approach, mainly literature review, within the scope of main topics such as mouth anatomy, tongue structure, taste, the functioning of the eating act in the brain, hormones and chocolate , video A case study based on the research Qualitative Research paradigm was structured within the scope of different research processes such as analysis and project diaries. As a result of the research, it has been reached that the melting in the mouth is preferred



experience of the users in order to spread the experience of eating chocolate for a long time based on pleasure while eating chocolate with healthy portions. This study includes in researches about the production of sketches, mocks-ups and prototypes of the product.

2.1. Literature Searches

Literature review period of the study has not been examined in detail until now. In addition, in a field study conducted in 2007, annual per capita chocolate consumption in Turkey was 1 kg, in Russia 2.4 kg, in the USA 5.9 kg, in France 7.5 kg, in England 9.9 kg, in Switzerland 11, 5 kg. It is predicted that this number will increase in the future due to the increase in the young population (Özdoğan, 2008). While the consumption of chocolate varies according to the seasons, its consumption increases on special days such as holidays. Turkish consumers mostly prefer milk chocolate with a rate of %33 as tablet chocolate (Özdoğan, 2008). Chocolate preferences vary from country to another country. However, studies conducted in recent years and doctors' saying that dark chocolate is more beneficial for health so it has increased the interest for dark chocolate in the world.

With the increasing urban life and developing technology, our food consumption patterns are also changing in line with the changing nutritional needs day by day. With the habit of eating fast and hastily, it causes not only the feeling of not understanding the taste of the food eaten, but also not being able to postpone the feeling of satiety and therefore many health problems. Fast eating behavior, which is a bad eating habit, harms the digestive system the most. When eating fast, the feeling of satiety does not reach the brain or reaches the brain late, as the nutrients cannot be absorbed sufficiently. As a result, the person continues to consume more food without realizing that he is full. People who make a habit of eating fast food decrease the feeling of satiety. Enjoying while eating increases the enjoyment of the food 10 times. When fast food is eaten, it is not possible to enjoy the food.

The rapid increase in the world population in the last century has brought with it consumption that has never been seen before. By 2050, the world population will reach 9.1 billion, 34 percent more than today (MANKAN, Esra, 2017). To feed this larger, more urban and wealthier population, food production (excluding food used for biofuels) needs to increase by 70 percent (MANKAN, Esra, 2017). This population growth in the world will cause changes in our eating habits. There is no way to do this, but it is driving innovative ideas that can change the way we eat. What is foreseen for this is to ensure that people acquire sustainable eating habits.



2.2. Interviews

Giving the Chocolate Making Techniques course at Anadolu University Gastronomy department, Dr. Instructor During the meeting with its member, Mehtap Yücel Güngör, the process of chocolate from past to present was discussed. The biggest point where it was designed in an industrial sense; the fact that chocolate, which has been consumed as a liquid for thousands of years, has become a solid product and we are still consuming its edible, chewable form. In addition, the consumption of chocolate creates such an urge in people that it may be difficult to slow down the consumption and not exceed the healthy portion with the pleasure it reaches. So, in order to construct the way the chocolate created in the project correctly is melted and consumed (the action of sucking), Prof. from Osmangazi University, Department of Anatomy. Dr. Yüksel Aydar was interviewed about the anatomy of the mouth and the relationship between the act of eating and the brain. Mouth-watering is an important factor for long-term consumption. Taste cells are located in the papillae on our tongue. Enzymes necessary for the dissolution of the food in the mouth are secreted by the activation of the salivary glands. The more this secretion is, the more the mouth is watered, the better the taste is perceived as a result of the dissolution of the foods. In the activation of the salivary glands, the senses such as sight, smell and hearing, where consumption begins, take an active role. Therefore, it is beneficial to start consumption (activation of salivary glands) without contact with food. In addition, the excess of secreted enzymes will increase the amount of glucose passing into the blood, which will make the person feel full.

2.3. Questionnaire

A total of 151 people participated in the survey, 108 women, 42 men, and 1 third gender identity. The survey questions were prepared on the consumption of chocolate. As a result of the survey, 141 people say that they consume chocolate, while 10 people do not consume chocolate. Those who do not consume chocolate do not prefer because they find it sugary and unhealthy, have allergies, are not suitable for diet, do not suit their palate and do not consume packaged products. On the other hand, chocolate consumers say that the first choice is mostly tablet chocolates, but they finish them in a few days, instead of at once. When asked about their consumption patterns, they say that they consume it by melting in the mouth with a rate of %59.1, and that they chew and swallow several times with a rate of %24. It concluded that their expectations from chocolate are taste, quality and happiness.



2.4. Video Shoots

In the video shoots made with 20 people, 8 people are between the ages of 18-25, 8 people are between the ages of 12-14, 2 people are between the ages of 30-35, 1 person is 59 years old and 1 person is 4 years old. Six different form of chocolate were presented to the participants. As shown in Figure 1, and they were asked to make two choices between them. The first choice of the majority was chocolate in spherical form and the second choice was chocolate in round form. They said that among the reasons for choosing these, they were curious about a filling and they chose it because they thought it was bigger. While those in the 12-14 age group threw the chocolate into their mouths as a whole during their consumption, the other people who made the choice took a small bite of the chocolate and then looked inside the piece in their hands. This project aims that if people consume the chocolate with a big pleasure and with enough eating time, it will increase their consciousness of satiety and they will feel it by the help of healthy porsions.



Figure 1: Chocolates forms.

3. Results

As a result of this project, a product and product packaging design was made that supports the active role of the senses such as sight, smell and hearing, where consumption begins, in order to consume chocolate by melting and to secrete the most important stimulant salivary glands in order to provide a healthy and long-term pleasure-based consumption actively.



4. Discussion and Conclusion

By 2050, the world population will reach 9.1 billion, 34 percent more than today (MANKAN, Esra, 2017). The United Nations (UN) predicts that food production must be increased by 70% by 2050 to feed the world's population (BASF). There is no one way to do this, but it is driving innovative ideas that can change the way we eat.

This study deals with our eating habits, which negatively affect our health, together with fast consumption, which is the return of the modern world. While increasing urban life and technology-oriented developments change our perceptions of time and speed, they also force our food consumption patterns such as getting pleasure from what we eat and eating slowly. The habit of eating quickly and in a hurry it causes consumption in more than necessary amounts, while it causes negative feelings such as neither being able to enjoy what one eats, nor being able to taste it, and regret in some people. As a result, negative effects are seen on our health.

A few people who chose the square form of chocolate thought that round form of it look liked a candy. For this reason, when they feel like chocolate, they really taste the chocolate. Some people preferred to eat a kind of chocolate which was an old taste and form for them in the past. Because it reminded them an old taste possibly from their childhood.

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