How about a vegan dessert?
- Men and women's attitudes towards vegan desserts, and how the appearance of vegan desserts affects the experience.

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**Title**
How about a vegan dessert? - Men and women's attitudes towards vegan desserts, and how the appearance of vegan desserts affects the experience.

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**Abstract**
**Background:** Women prefer to eat plant-based food more frequently than men. Previous studies show that there is a difference in what we eat depending on which gender we belong to. The experience of food can be influenced by various aspects such as colour, shape, serving, and food information.

**Objectives:** The purpose of the study was to investigate if there were any differences between men and women's attitudes towards vegan desserts. Moreover, four vegan desserts were developed using creative design and molecular gastronomy, to investigate how the colour and shape of vegan desserts affects the experience of taste, flavour and texture.

**Material and methods:**
To answer the research question, two focus group interviews were conducted. Moreover, a creative design containing an online cross-sectional survey was performed to develop four vegan desserts using molecular gastronomy. The desserts had the same ingredients in equal quantities, but they differed in colour and shape. These desserts were subsequently tested in a sensory evaluation.

**Results** The results show that there is a difference between men and women regarding attitudes towards a vegan dessert. Women are more positive and curious, while men are more sceptical whether a vegan dessert tastes good. There was sometimes a significant difference in taste, but never in flavour and texture.

**Conclusions:** There are differences in men and women's attitudes towards vegan desserts, where women are more positive than men. Shape may affect the experience of taste, but not of flavour and texture in this study.

**Keywords**
Vegan, dessert, attitudes, food experience, mixed method, creative design, molecular gastronomy
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**Introduction**

A diet based on large quantities of fruit and vegetables has a positive impact on our health (World Health Organization [WHO], 2015; The Public Health Agency of Sweden, 2009; Dyett, Sabaté, Haddad, Rajaram, & Shavlik, 2013). It has been shown that women eat more fruit and vegetables and have more pronounced belief that food choices have an impact on our health (Wardle, Haase, Steptoe, Nillapun, Jonwutiwes, & Bellises, 2004). A vegan diet is based on plants and has increased in popularity over the recent years (Craig, 2009). People choose a vegan diet for various reasons, such as health, environment and ethics. Health is the most central reason for choosing a vegan diet (Dyett et al., 2013; Serdar & Phillips, 2011). Women choose a plant-based diet more often than men, and younger people eat less meat than older people (Beardsworth & Bryman, 1999; Wardle et al., 2004). The type of food consumed divides gender into different food categories where women are categorized into light products such as salads and fruits and men into heavier products like red meat (McPhail, Beagan, & Champman, 2012). There are various aspects that can affect the experience of food. Among other things, studies have shown that, the colour and shape of the food can affect how people experience taste, flavour and texture (Alley & Alley, 1998; Strugnell, 1997). How the food is served or the information given to the consumer, may play an important role in how the food is experienced (Stewart & Goss, 2013; Siegrist & Cousin, 2009).

The purpose of the study is to investigate if there are any differences between men and women's attitudes to vegan desserts, and how the colour and shape of vegan desserts affects the experience of taste, flavour and texture.

**Background**

**Different factors that may affect food choice**

Food is of great importance to our health (WHO, 2015; The Public Health Agency of Sweden, 2009). A diet with large portions of fruits, vegetables, legumes and whole grain products contains antioxidants which reduce the risk of diseases such as cardiovascular diseases and cancer (The Public Health Agency of Sweden, 2009). In recent years, a vegan diet has increased in the world (Craig, 2009). Researchers believe this may be linked to the fact that a vegan diet can be associated with many health benefits (Dyett et al., 2013; Craig, 2009). A
vegan diet tends to contribute to less saturated fat, meaning less bad cholesterol compared to a diet containing animal products. At the same time, a vegan diet usually gives more fiber, folate, vitamin C and phytochemicals from higher consumption of legumes, nuts, fruits, vegetables and whole grains, which helps to keep the body healthy (Dyett et al., 2013; Craig, 2009). Cookbooks with raw, vegan recipes have also increased in recent years (Farrow 2016; Voltaire 2015). These cookbooks show a healthy view of vegan food.

BMI (body mass index) is a measuring instrument for measuring body fat (WHO, 2018). Vegans often have a low BMI, due to the fact that the diet consists of a large amount of low-energy fruits and vegetables (Craig, 2009). People who have a high BMI run the risk of diseases such as cardiovascular diseases, osteoarthritis and high blood pressure. However, for some individuals it can be difficult to obtain credible results from BMI, because the measuring instrument does not take into account for example age, physical activity levels and gender (WHO, 2018). Although a vegan diet has many health-promoting aspects, studies also show that there is a health risk coupled to a vegan diet. From a vegan diet, vitamins and minerals such as vitamin B12, calcium, zinc, omega-3 fatty acids and vitamin D can be difficult to get (Dyett et al., 2013; Craig, 2009). Vitamin B12 is mainly found in animal products. A lack of the vitamin can lead to anemia and neurological symptoms (National Food agency, Sweden, 2017a). Calcium is an essential element that we often receive from animal products (National Food agency, Sweden, 2017b). Researchers believe that with a vegan diet these nutrients might need to be monitored and dietary supplements may be necessary (Dyett et al., 2013; Craig, 2009). Also, a study using an questionnaire where the aim was to investigate health belief and lifestyle behaviors of 100 vegans in the United States, found that vegans had excessive sodium use (Dyett et al., 2013). However, if a vegan diet is well planned, it may prevent certain diseases (Dyett et al., 2013; Craig, 2009).

People who are vegans, choose this diet for a variety of reasons such as health, ethical considerations and environment. Health has been found to be the main reason why people chose such a diet (Dyett et al., 2013; Serdar et al., 2011). Dyett et al. (2013) show that 47 percent of the participants chose a vegan diet because of health aspects (Dyett et al., 2013). In Serda et al.’s (2011) study, 40 percent of the participants chose a vegan diet due to health considerations (Serdar et al., 2011). Those who eat a vegan diet are often young and educated individuals (Serdar et al., 2011; Beardsworth & Bryman, 1999). Researchers explain that less educated and older people in society may be less likely to change their meat consumption due
to traditions (Serdar et al., 2011). Another study conducted by Beardsworth & Bryman (1999), also showed that age can have bearing on meat consumption; older people tended to have a higher meat consumption that younger ones. In this study, the results also showed a clear difference between men and women in vegetarianism and meat reduction. Women were the ones who more often chose to eat a plant-based diet (Beardsworth & Bryman, 1999). The researchers believe that this has to do with cultural associations between the consumption of meat and masculinity, in the way that masculinity and male dominance is connected to red meat (Beardsworth & Bryman, 1999). Ruby and Heine (2011) found that other people's attitudes can have an impact on what people choose to eat. The study shows that people value other people based on their eating habits. The researchers conducted two interdisciplinary studies that investigated people's perceptions of omnivores and vegetarians. In the first study the participants received brief descriptions and information about people's eating habits and lifestyles. Based on that information, the participants would then value the person's personality. In the second study the participants had the same structure as in the first study, but the people to be rated were much older. Both studies show that vegetarian diets are perceived as more ethical and less masculine than omnivore diets (Ruby & Heine, 2011).

People generally believe that they are aware of the impact food has on health (Wardle et al., 2004). The result of a self-report, questionnaire-based study where the purpose was to investigate food choices in 23 countries on a total of 19,298 university students showed that both men and women had a belief that food choices are important to our health. This belief was shown to be significantly higher for women than for men. Women are more likely to avoid fat and salt and eat more of fruit and fiber than men (Wardle et al., 2004). This can be linked to the study of McPhail et al., (2012) that showed that what we choose to eat may have to do with what gender we belong to, as women more often choose to eat healthier foods than men (McPhail et al., 2012). Researchers also argue that it is less important for men to eat healthy foods. Men care more about the taste of the food than to be healthy (Wardle et al., 2004). Men and women are associated with different food categories (McPhail et al., 2012) and whereas women are associated with lighter products such as salad and fruit, men are associated with heavier products such as red meat. Although people are very aware of gender categories for food, participants do not claim to themselves use these categories (McPhail et al., 2012).
Aspects that can affect the experience of food

How food is experienced has been shown to be influenced by various factors. In an American study, the purpose was to investigate the influence of physical state and colour on perceived sweetness. The researchers of this study had a hypothesis that liquid foods would be perceived as sweeter than solid foods. The result showed that viscosity (solid or liquid) and the colour of the food do affect the taste experience of sweetness. There was a significant difference between liquid and solid, where the liquid samples were perceived as sweeter than the solid. This supports the researchers' hypothesis. The result also showed that there was no significant difference supporting that food colour would affect the sweetness (Alley & Alley, 1998). Although the colour did not show any significant effect in this study, there are other studies showing that the colour of the food can indeed affect the taste experience. In one study, assessors ranked sweetness of different beverages. There was a significant difference (p≤0.001) in the concentration of colourless sucrose and fructose solutions. When the test was repeated for red coloured solutions in different concentrations, the result was not significant. This means that colour did affect the participant’s perceptions of sweetness (Strugnell, 1997). This can be linked to a research that investigated the effect of fruit acids on people’s opinions of the identity and the intensity of different fruit-flavoured solutions (Zampini, Wantling, Phillips & Spence, 2008). People find it easier to perceive flavours if they are coloured in a corresponding way compared to if they are coloured in a non-corresponding manner. For example, when orange juice is coloured orange, it is easier to perceive the flavour of oranges (Zampini et al., 2008).

It is not just colour and shape of food that affects how food is experienced. How the food is served can also have an influence (Stewart & Goss, 2013). In Stewart & Goss (2013) study, the colour and shape of the plate influenced the experience of sweetness, flavour intensity and quality. The results showed that the food eaten on a white and round plate resulted in the participants perceiving sweetness and taste intensity with an increased effect. When the food was served on a black and square plate, the food was presumed to have a good quality, but the sweetness and flavour intensity was perceived as low. The researchers explain that less sweet foods can be served on a plate that is round and white to increase the perceived sweetness and flavour intensity. In contrast, a dish that is very sweet and has a sharp taste can be served on a plate that is square and black to suppress the flavour (Stewart & Goss, 2013).
Food and beverages can also be perceived differently depending on which information the consumer receives (Siegrist & Cousin, 2009). Siegrist & Cousin (2009) investigated how participants experienced wine by variating the information provided about that particular wine. The information given was none (no information at all), negative or positive information about the quality of the wine. The result showed that if the participants got information before the wine tasting, this had an influence on the participants' assessment of the wine. The group who had received positive quality information about the wine before the tasting gave positive sensory assessments about the wine, while the group that received negative quality information before the tasting, rated the wine negatively. The researchers believe that the participants were looking for a taste experience in relation to the information they had received (Siegrist & Cousin, 2009).

Product development

There are various scientific methods that can be used to develop new food products for the market. Creative design is one such method, and this is the method that was used in the present study.

Creative design

Creative design is performed with the aim of developing the most optimal food products for the market. This design is structured as a three-step process (Naes & Nyvold, 2004). The first step includes finding out what product to develop depending on the different customer attributes. This part is important for creating the best possible product, where the developer uses experiences and creativity in the best possible way.

In the second step, the product developer works to produce prototypes. It is important that the developer takes into account the attributes that emerged in the first step. When prototypes have been developed, the product development proceeds into the third step, where the prototypes are tested. The third step also includes an analysis of these tests and the choice made based on the tests will determine if the products can be used or not (Naes & Nyvold, 2004).

In a study, the researchers examined the effects that sauces have on different levels and combinations of the basic tastes (Paulsen, Uelan, Nilsen, Öström, & Hersleth, 2012). Creative design was used as a method to develop culinary sauces for salmon. Creative design was shown to be a systematic and appropriate approach to developing culinary creations (Paulsen
et al., 2012). Creative design was also used as a method in another study, where the researchers were interested in consumers’ overall perception of preference for different combinations of soups and beer (Paulsen, Rognså, & Hersleth, 2015). The soups were developed through a creative design with the basic flavors as a factor. The result showed that creative design was an effective and flexible method for both exploring and developing food and beverage combinations. (Paulsen et al., 2015).

Molecular gastronomy

Another way of developing food products through scientific methods is molecular gastronomy (MG). Caporaso & Formisano (2016) have critically reviewed the latest development of MG. They explain that MG is a science-based food preparation that is part of food science and technology, where the purpose is to apply knowledge in order to improve food products (Caporaso & Formisano, 2016). Chefs and scientists collaborate to create high-quality foods with specific sensory characteristics in order to satisfy the consumer. MG can be designed in various ways to develop creative meals and food products, but has a common underlying aim where the scientists and chefs together create new dishes with new ingredients, new equipment, cooking methods and processes (Caporaso & Formisano, 2016; McCormick & Prokes, 2009). Often, MG is based on knowledge of the chemical, physical and biological processes that occur when cooking food. Through different combinations of ingredients and different cooking methods, the original shape and consistency of the food can change which can create new experiences. MG can be done by combining ingredients in new and different ways to create new taste experiences, since the taste changes through different combinations of ingredients (Caporaso & Formisano, 2016; McCormick & Prokes, 2009). The current study uses molecular gastronomy for creative development of vegan desserts. Through different combinations of the same ingredients, and the same amount of those ingredients, it was possible to create different and new products to investigate the experiences of the developed products.

Researchers themselves are usually more interested in the science behind the culinary phenomenon, while the chefs are more interested in the creative cooking. MG also has the purpose to entertain consumers through social, artistic and technical components of cooking (Caporaso & Formisano, 2016). Often, MG is used to understand the chemical and physical mechanisms of cooking processes (Wang & Wang, 2016). This is needed to help people understand cooking. Innovations in culinary processes are developed, and then presented as new methods, ingredients or tools. This means that scientific research is needed to discover
the intellectual applications of cooking that provide an understanding of the cooking (This, 2002).

Sensory evaluation

During the development of new food products, the products are often evaluated by sensory evaluation (Albinsson, Wendin, & Åström). In sensory methodology, individuals are used as measuring instruments for assessing the product's perceived properties. Sensory evolution is used among other methods in product development, quality control and research (Sensorisk studiegruppe, 1997; Lawless & Heymann, 2010). In sensory science, there are two main types of tests. The first type involves analytical methods, which means that the panel is a trained panel which has good sensory abilities and is selected due to standard e.g. ISO- standards (ISO3972:2011; ISO 8586-2:2008). The other type is consumer methods, where consumers are involved in the panel that tests the products. The participants in a consumer test are often selected specifically for the product that is being evaluated with regarded to e.g. age and gender. As the participants in an analytical panel are trained they can evaluated more samples than a consumer panel. A recommendation is between five to six samples for a trained panel at each assessment (Albinsson, et al., 2013; Lawless & Heymann, 2010; Sensorisk studiegruppe, 1997).

A variance analysis, ANOVA (Analysis of Variance), is often used to statistically evaluate if there are significant differences between the samples. ANOVA is often used in both consumer and analytical tests (Albinsson, et al., 2013; Lawless & Heymann, 2010; Sensorisk studiegruppe, 1997).

Mixed method

A mixed method can be used to execute a broad survey (Creswell, 2015; Morse, 2003; Johnson, Onwuegbuzie, & Turner, 2007). This approach includes both a quantitative and qualitative methodology and is commonly used in social, behavioural and health sciences to gain a better and deeper understanding of what is being investigated (Creswell, 2015; Morse, 2003). A mixed method study requires more resources compared to using only one method, meaning the investigation needs to be carefully planned so as not to waste resources (Morse, 2003). Combining two different methods usually gives a more reliable result (Morse, 2003; Johnson et al., 2007), which generally gives more powerful, informative, complete and
balanced results. This in turn means that there is an increase in confidence of handling a problem/research question (Johnson et al., 2007).

A quantitative method is performed by data collection based on numbers (Bryman, 2011). For example, it may be data collection from protocols, registries or surveys. Usually, a survey is conducted which is then generalized to a population (Patel & Davidson, 2011). The analysis is usually assessed statistically (Ejlertsson, 2012) and then presented in the form of tables or diagrams (Patel & Davidson, 2011).

A qualitative method aims at gaining a deeper understanding of what is being investigated, in terms of perceptions, attitudes and thoughts about the investigative subject. Usually, there are few respondents in the survey. A qualitative survey can be conducted through, for example, observations or interviews. During interviews, a standardized interview is conducted and this is also called a semi-structured interview, where the questions in the interview are based on a template (Patel & Davidson, 2011). For example, a content analysis can be used to analyse the material from the interviews meaning that the material is read, analysed several times and notes are made during the process. During this, themes and categories are created that underlie the result (Patel & Davidson, 2011).

Focus groups have been proved to be useful when people discuss health problems in everyday life, as this can give good discussions and lead to solutions. These can provide good results both when the participants know each other or are strangers to one another. Focus groups can be challenging in relation to management, data recording, and analysis (Saks & Allsop, 2007). Focus groups usually consist of six to ten participants and it is recommended to include at least three of these groups in a study, to get a credible analysis. During analysis, the researcher finds different themes in the groups that are compared to the other groups (Connelly, 2015).
Theoretical framework

The study is based on assumptions that women and men have different attitudes towards vegan desserts. These theories are based on previous studies that have shown that women are more positive to plant-based food (Beardsworth & Bryman, 1999; Wardle et al., 2004) compared to men.

The current study is also based on an assumption of using creative design in combination with molecular gastronomy to develop appropriate products, this in order to investigate whether and how colour and shape of the developed products affect the experience. The fact that colour and shape affect the experience has been shown in several studies (Alley & Alley, 1998; Strugnell, 1997; Zampini et al., 2008; Stewart & Goss, 2013).

Objective

The purpose of the study was to investigate if there were any differences between men and women's attitudes towards vegan desserts. Moreover, four vegan desserts were developed using creative design and molecular gastronomy, to investigate how the colour and shape of vegan desserts affects the experience of taste, flavour and texture.

Research questions

1. Are there differences between men's and women's attitudes towards vegan desserts?
2. How does colour and shape affect the experience of taste, flavour and texture of the developed products?

Material and method

The starting point of this study was creative design (Naes & Nyvold, 2004), which involves two quantitative studies and a practical design development step; a survey, recipe development and sensory evaluation. An additional step was added in this study. This step is a qualitative focus group interview. The step was performed in conjunction and just before the sensory evaluation, with the same participants. See figure 1, where all four steps are illustrated.
Literature search strategies

The literature in this study is mainly based on peer-reviewed articles. These articles have been found from various databases such as Summon and ScienceDirect. The articles were based on information about vegan aspects that influence the experience of food and methodology. Examples of key words are vegan, vegan attitude, food colour and shape, creative design and molecular gastronomy. Information about, among other things, the mixed method (qualitative and quantitative methods), and sensory analysis was also found on Libris (Library Information System). In addition, information for this study has been sought from various authorities, such as the World Health Organization and The Public Health Agency of Sweden.

Online cross-sectional survey

The first step in this survey was an online cross-sectional survey (see figure 1). Google forms was used to design the survey to find attributes for a vegan dessert. The survey was publicly distributed on the social network platform, Facebook and Linkedin, where the public could choose to participate. The survey did not take into account the gender, ethnicity or socio-economic status of the participants. The requirement to participate in the survey was that the participant was 18 years of age or older. Snowball sampling was used as a method for recruiting people to the survey, as those who had participated invited others to participate (Bryman, 2011). The survey was conducted in Swedish and then translated into English, (see Appendices 1 and 2). The questions were multiple-choice, with mandatory answers. The survey's first two questions involved the participant’s gender and age group. There were five questions about which attributes of a vegan dessert that the participants preferred most. These
attributes were taste, flavour shape, texture and colour. Taste is defined as sour, bitter, sweet or salt whereas flavour is defined as, for example, chocolate, strawberry or apple. Participants were informed to choose two attributes in each category and in the case of shape, images were also used to make the question more understandable.

Recipe development

The second step was to develop the desserts (see figure 1). Based on the results from the online cross-sectional survey, four different desserts were developed and two attributes of shape were selected as follows; the one that the participants liked the most and the one they liked the least. Two colours were chosen based on what the participants liked the most, and liked the second most. The selected attributes were combined in four different ways (see figure 2). Taste, flavour and texture were chosen based on what the participants preferred the most. The development of the desserts was based on a creative design influenced by molecular gastronomy. When referring to molecular gastronomy in this study it is used in the way that the desserts had the same ingredients and quantity of ingredients (see table 1), but the ingredients are combined in different ways to get four different appearances that are unequal in colour and shape (see figure 2). In the two desserts that have brown colour, the ingredients were combined in the same way but they differed in shapes. For the two orange desserts, the ingredients have been combined in the same way but the desserts differ in shapes.

Figure 2. Colour and shape combination for the desserts.
Method for cube/brown and hemisphere/brown.
Blend 1g cacao, all walnuts, dates and turmeric until a cohesive dough has formed, and press the dough into moulds. Then mix the rest of the ingredients and add them into the same mould on the top. Put them in the freezer for a few hours. Remove the desserts from the freezer about an hour before serving, and add flowers on the top as decoration.

Method for cub/orange and hemisphere/orange.
Mix all the ingredients except the turmeric. And pour it into moulds. Put in the freezer for a few hours. Remove the moulds from the freezer about an hour before serving, powder the turmeric on the top and add flowers as decoration.

Focus groups
The third step involved two focus group interviews, both were performed in Swedish. One of the groups consisted of only males, and the second one of only females. This in order to be able to compare the groups, to answer the research question if there are differences between men and women’s attitudes towards vegan desserts. The participants were in the age category, ranging from 21 – 70 years old, (see table 2).

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocoa</td>
<td>1 grams</td>
</tr>
<tr>
<td>Walnuts</td>
<td>5 grams</td>
</tr>
<tr>
<td>Dry dates</td>
<td>10 grams</td>
</tr>
<tr>
<td>Turmeric</td>
<td>0.5 grams</td>
</tr>
<tr>
<td>Hazelnuts</td>
<td>5 grams</td>
</tr>
<tr>
<td>Coconut Cream</td>
<td>15 grams</td>
</tr>
<tr>
<td>Edible flowers</td>
<td>3 flowers</td>
</tr>
</tbody>
</table>

Table 1. Ingredients for one dessert.
Focus group interviews were performed just before the consumer panel of the sensory evaluation, with the same participants. The recruitment of the focus groups and the sensory evaluations was made by friends of friends. The researcher had no relation to the participants before. The interview was conducted with the support of an interview guide and semi-structured character together with follow-up questions about thoughts and perception of vegan desserts (see, appendices 3 and 4). Focus group interviews were conducted in a kitchen area around a large table. The area was bright and open, there was no noise interference in the background. Both interviews were about 20-30 minutes long, were recorded and transcribed verbatim after the interview. After the interviews had been transcribed, the analysis process was commenced. The analysis was made following a content analysis that is based on Patel’s and Davidssons (2011) method, (Patel & Davidsson, 2011). The material was first read through once, and thoughts were noted on a paper. Then the material was read again and new notes were added. The material was read again several times and was coded with words. The code words that were noted were things that were repeated. The code words were then sorted with different colour markers and categories were developed. These categories were interpreted and created different themes that are the headlines in the result section of the focus groups.

**Sensory evaluation**

In the fourth step in this study, the new products that had been developed were evaluated with the same participants from the focus groups in a small consumer panel using a profile method based on taste, flavour and texture. Also, preference was measured. In the sensory evaluations, a nine-degree hedonic category scale was used. The evaluations with a small consumer panel were performed on two occasions with six participants on each occasion, one panel with men and one with women. Paper and pen were used during the assessments. The questions about taste, flavour and texture had a scale ranging from "nothing / not strong at all" to "very strong". For the issue of preference, the scale ranged from "extremely dislike" to " extremely like". The test was designed in Swedish but was translated into English, (see appendices 5 and 6). For the desserts that have two different layers, two different questions were made for the texture of each layer. The four products were coded with three-digit codes.

<table>
<thead>
<tr>
<th>Age-category</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>21–30</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>31–40</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>41–50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>51–60</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>61–70</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 2. Participants' age for both men and women.
The desserts were served on a white round paperboard plate and the test began with the participants testing one dessert at a time. Participants could also give a personal comment about the desserts and had access to water and crackers. Sensory evaluation was performed in the same room in connection with the group interviews. Participants were informed about the tests and invited to drink water and eat crackers between the samples. The responses were coded into Excel and analysed and interpreted by mean values and 2-way ANOVA (1 rep) – Sample means & Bonferroni LSD, in the statistical program Panel Check V1.4.2.

**Ethical considerations**

This study follows the four main requirements set by the Swedish Research Council (Swedish Research Council, 2002). These main requirements should be followed in humanities and social sciences research (Patel & Davidson, 2011). The material for this study was kept confidential and it is not possible to identify the participants. Participants in the online cross-sectional survey that were the same participants as in the sensory evaluation, were informed about the study, its purpose and that participation was voluntary with all their information being handled anonymously. All participants in the sensory evaluation and focus group interviews had consented to participate in the study. The material for the study was only to be used for this research and the material will be destroyed after the research is completed (Bryman, 2011).
Results

Online cross-sectional survey

It was 141 persons that participated in the online cross-sectional survey, where 77% were women and 23% were men, (see figure 3). The results also show that the majority of the participants were in the age group of 20-29 years old (55%), (See figure 4).

Figure 3. Gender of participants in the online cross-sectional survey.

Figure 4. Age of participants in the online cross-sectional survey.
Chocolate was the most popular flavour with a number (N) of 91 and apple was the flavour that the participants preferred the least N=8, (See figure 5).

Figure 5. Results from the online cross-sectional survey, flavour attributes for a vegan dessert.

The answer of which taste the participants prefer for a vegan dessert was that sweet was chosen most times N=133, and bitter was being the least chosen N=1, (See figure 6).

Figure 6. Results from the online cross-sectional survey, taste attributes for a vegan dessert.
The answer of which shape of vegan dessert the participants preferred, the hemispherical shape was chosen most times N=96. The cube shape was the form that was chosen least times N=18, *(See figure 7).*

![Figure 7. Results from the online cross-sectional survey, shape attributes for a vegan dessert.](image)

Which texture the participants prefer for a vegan dessert, the soft texture was chosen most times N=90, and dry was selected least times N=2, *(See figure 8).*

![Figure 8. Results from the online cross-sectional survey, texture attributes for a vegan dessert.](image)
The answer about which colour the participants preferred, brown was the colour that was chosen most times N=67, and black selected least times N=8, (See figure 9).

**Figure 9.** Results from the online cross-sectional survey, colour attributes for a vegan dessert.
Recipe development

Figure 10, contains photos of the used samples. All desserts contain the same ingredients and the same quantity of ingredients, but differ in colour and shape.

Focus groups

Different themes emerged from the analysis of the conducted interviews with men and women, which are the headings below.

Focus group with men

The interview was divided into themes that emerged in the analysis of men’s attitude towards vegan desserts.
Unaccustomed

For many of the participants a vegan dessert was something new. Some had not been in contact with it before and did not know how a vegan dessert was prepared. This was seen especially in the age category of 41-70. Several were sceptical if it would be good. It was noticed that the participants lacked knowledge, but they understood that a vegan dessert was without animal products. Below some comments are cited.

“It sounds strange that it would be completely vegan. It must contain cream or butter if it is going to be a dessert?” (Male, 68 years old).

“My friend served me a dessert that I think was vegan. It looked like a regular dessert. I think it was really tasty.” (Male 28 years old).

Age differences

It was mainly the older age category of 41-70 who had less knowledge of vegan desserts. The younger age group of 21-40 had eaten and had more knowledge of a vegan dessert. The older age group also had thoughts that a vegan dessert was a bit boring and would not taste good. The younger age category was more positive to vegan desserts and that it would taste good. Below a comment is cited.

“A vegan dessert feels a bit boring and not particularly tasty.” (Male 55 years old).

Taste

For the men, the taste was important. A dessert should taste good and it should be creamy and sweet. Many of the men were sceptical if it was possible to make a vegan dessert as good as one with animal products, but they were all open to trying a vegan dessert. Below a comment is cited.

“If it is possible to make them as sweet, creamy, tasty, and that it looks tasty, I would like to eat vegan desserts.” (Male 66 years old)
Health promoting

An underlying theme throughout the interview was that a vegan dessert was healthy. They agreed with each other that a vegan dessert was healthy. Some would like to live healthier, and therefore they thought that a vegan dessert would be a good option for a dessert. Below some comments are cited.

“We certainly need a healthier population. But I think it's hard to make people eat healthy desserts.” (Male 40 years old).

“Yes, that's probably good for our health. My doctor says that I need to eat less sweet things.” (Male 55 years old).

Focus group with women:

The interview was divided into themes that emerged in the analysis of women's attitude towards vegan desserts.

Health promoting

According to women a vegan dessert does not contain animal products, and an important aspect is that the dessert is healthy, and that it contains natural ingredients which benefits the body health. A vegan dessert should not contain sugar. All women agreed with each other that a vegan dessert would result in a healthier population, if we ate vegan desserts instead of traditional desserts. This is because they thought that it is better for the body when one eats more plant-based ingredients. But they were worried that people did not have a good view of vegan desserts. The health discussions returned during the whole interview. Below some comments are cited.

“Helpful, fresh, and healthy.. yes, but a fresh dessert simply.” (Female, 22 years old).

“I think there are people who are sceptical, people think vegan is boring and tasteless. But it's good for society that we go to vegan diet because it contains natural healthy ingredients.” (Female, 26 years old).

Age differences

The women were relatively positive to a vegan dessert. But it was noticeable nonetheless, that there were differences between the different age categories. In the age category of 41-70,
there were thoughts that a vegan dessert was boring and that it may not taste so good, but they were still more open to try the vegan dessert. The age category of 41-70, was more unfamiliar with a vegan dessert, while in the age group of 21-40, participants had eaten vegan desserts and they had more knowledge of it. They also had more positive attitude towards vegan desserts. The older age category also had thoughts that it would not be good for the farmers, since they have many products that are animal. Below some comments are cited.

“My first thought is that it may not be so funny, it does not sound so funny with a vegan dessert. But maybe it is.” (Female, 64 years old).
“I made a vegan dessert to my guests once, it was appreciated.” (Female, 26 years old).

Curiosity
The women were curious about a vegan dessert. Some of the participants talked about the desserts as they ate and were positive about the taste. Some had never eaten a vegan dessert before but would like to taste. Throughout the interview, all participants seemed open and curious about vegan desserts. Below a comment is cited.

“I think it's interesting to taste it. I have probably never tasted that.” (Female, 61 years old).

Larger range
The women agreed that a larger range of vegan desserts would bring themselves and others to eat more vegan desserts. They believed that a larger range would make people pay more attention to vegan desserts. Below some comments are cited.

“It would be good if cafes had a greater range of vegan desserts.” (Female 26 years old).
“Yes, there must probably be more options. And you need to do more advertising for it.” (Female 48 years old).
Sensory evaluation

The results of both men and women show a significant difference in the sweet taste p<0.05 between O/H and O/C, where O/H was perceived as sweeter. A significant difference of both men and women was also seen for the taste bitter p<0.05 between O/C and B/C. Where O/C was perceived as more bitter. There was no significant difference to the flavour or texture experience.

⭐ = Significant difference

**Figure 11.** Results of both men's and women's experiences of various attributes for vegan desserts in a Spider web plot.

The results of only men show a significant difference in the bitter taste p<0,01 between O/C and sample B/H, where O/C was perceived as more bitter. There was also a significant difference for preference P<0,001 between B/H and O/C in the result for only men, where B/H was liked the most. The dessert that the participants liked the least, O/C, was experienced the bitterest and the least sweet. The dessert that the participants liked the most, B/H, was the least bitter and the sweetest. There was never any significant difference to the flavour or texture experience.
Figure 12. Results of only men's experiences of various attributes for vegan desserts in a Spider web plot.
Women often had similar experiences of the attributes of the different desserts. There was no significant difference in the results for only women.

![Figure 13. Results of only women's experiences of various attributes for vegan desserts in a Spider web plot.](image)

**Discussion and analysis**

**Study design**

A creative design method was used to determine the products needed for this study, and to have a good structure of the development of the vegan desserts. Creative design has been shown to be useful in other studies (Paulsen et al. 2012; Paulsen et al. 2015). The current study is built in different steps, and this structure has been helpful and has led to the successful completion of the research and development process.

This study does not aim to develop products that will be launched on the market but the creative design method has been useful for developing desserts which were consequently tested, in order to find out if and how colour and shape of vegan desserts affect the experience of taste, flavour and texture experience. In this study the desserts were developed by MG theory to maintain a scientific level. The author of this study is both the scientist and the chef who created the vegan desserts. This study does not use MG to investigate chemical
processes, which MG often used for (Caporaso & Formisano, 2016; McCormick & Prokes, 2009; Wang & Wang, 2016). The current study makes use of MG by combining the same ingredients and the same amount of ingredients in different ways, resulting in different products. The theory of MG was used to develop creative desserts that involve new culinary combinations of ingredients with the same starting point. MG proved to be a useful method to develop creative and science-based desserts in this study. It has also been shown in other studies that MG is a suitable method for gaining new knowledge to improve food products. (This, 2002; Caporaso & Formisano, 2016; McCormick & Prokes, 2009; Wang & Wang, 2016).

A qualitative step in this study was added to answer the question if there was a difference between men and women's attitudes towards a vegan dessert. Since this study contains both qualitative and quantitative surveys, this study is a mixed method study. Through the creative design, it has been possible to plan the study carefully in line with previous studies (Naes & Nyvold, 2004; Paulsen et al. 2012; Paulsen et al. 2015). This resulted in a good approach to the mixed method, which makes this study provide powerful, informative, complete and balanced results, which has also been proven in other studies (Morse, 2003; Johnson et al., 2007).

**Study result**

**Step 1. Online cross-sectional survey**

The participants preferred desserts that have a circular shape. Hemispheres and cylinders were the shapes that the participants preferred the most. The cube and cuboid have edges and were the shapes that were liked the least. The participants in this study like desserts that are soft and juicy while they dislike hard and dry ones. The result showed a link between favourite flavour (chocolate) and the favourite colour (brown), as chocolate usually has a brown colour which is conveyed in several chocolate books (Khodorowsky, & Loisy, 2005; Presilla, 2009). Sweet was the favourite taste of the attributes and it was also shown that it is important that a dessert is sweet from the focus groups from this study. Sweet is the most popular attribute and seen as something important for a dessert. This may have to do with the fact that desserts are often served sweet (Krondl, 2011; Lebovitz, 2011). After eating a meal, people often have a desire for sweet and tasteful food (Gendall, Joyce & Abbott, 1999). In a study, nine women tested three different meals that had different protein and carbohydrate content, but which were similar in energy and fat content. One of the three meals had high protein content,
another had high carbohydrate content and the third had equal content of protein and carbohydrates. The result showed that the women had a desire for sweet and tasteful products after the meals. The desire was greater after the meal that had a high protein composition (Gendall, et al., 1999). This may be the reason why desserts are often served sweet (Krondl, 2011; Lebovitz, 2011), and that the participants from this current study preferred a sweet dessert, as was shown both in the online cross-sectional survey and from the focus groups. The participants were mainly women. In order to get a more equal result between the men and women, a questionnaire could have been done in the field, where the number of men and women could be controlled in the survey (Bryman, 2011; Saks & Allsop, 2007). The fact that most participants were women was not considered to be a problem since the result would be used as a basis for developing products to investigate how colour and shapes affect various food experiences. The largest group of participants were in the age group of 20-29 years old. This was most likely due to the fact that the author, who shared the survey on social media, is in this same age category. This may affect the result, as the desserts have been developed according to the attributes most preferred by the age group of 20-29 years old.

Step 2. Recipe development
The desserts in this study were developed with a MG theory, in the way that the desserts had the same ingredients and quantity but the ingredients were combined in different ways. This was done in order to get a full design to develop the dessert. The ingredients for the brown desserts were combined equally but the desserts were made in different shapes, and for the orange desserts the ingredients were also combined equally but made into different shapes. By developing the desserts through MG and using the same ingredients at equal quantity, it was possible to develop similar desserts but with different shapes and colours. The fact that the desserts had different combinations for the different colours may affect the results, as the taste can change through different combinations of ingredients (Caporaso & Formisano, 2016; This, 2002; McCormick & Prokes, 2009). The weakness that different compositions of ingredients affect the taste was discovered only after performing the sensory evaluation. If the developed products had been beverage, it would have been easier to combine the same content of ingredients to develop differently coloured beverages, as has been done in other studies (Alley & Alley, 1998; Strugnell, 1997; Zampini et al., 2008).
Step 3. Focus groups

The result shows that women are more open to vegan desserts than men. This may be due to the fact that meals based on plants are seen as feminine (Ruby & Heine, 2011; McPhail et al., 2012). Men in this study, may not be as positive to plant-based foods, which might be because they do not want to be seen as less masculine (Ruby & Heine, 2011; Beardsworth & Bryman, 1999).

Both men and women mentioned health considerations throughout the interview. A vegan dessert was considered as something that was healthy. This may be because a diet that contains a large number of plants and nuts has a positive effect on one’s health (The Public Health Agency of Sweden, 2009; Dyett et al., 2013; Craig, 2009). This result may also explain why the women in the study were more positive towards a vegan dessert, since women more often choose healthier foods than men do, and because women have a stronger belief that food choices are important to health (Wardle et al., 2004). The participants' thoughts and beliefs that a vegan dessert is healthy, and the fact that women are more open to healthy food, can also be explained by the fact that women are more open and curious about a vegan dessert (Ruby & Heine, 2011; McPhail et al., 2012; Wardle et al., 2004). This would also explain why women talked more about a wider variety of vegan dishes than men did (Wardle et al., 2004). Both men and women can have preconceived ideas that a vegan dessert is healthy because people who are vegans often choose this for health aspects (Serdar et al., 2011; Dyett et al.). From the focus groups an impression was given that a vegan dessert should be healthy and the participants seemed to agree on this. Today there are vegan-dessert cookbooks that marketed as healthy (Farrow, 2016; Voltaire, 2015), this can result in people believing and thinking that a vegan dessert has to be healthy.

Since men do not prefer to eat as healthy as women prefer to do, (Wardle et al., 2004) this can explain the fact that the taste was an essential aspect for the men in this study. A vegan dessert was seen as something healthy, but men had difficulties in believing that a vegan dessert could taste good. This could mean that for men the taste is more important than how healthy the food is. An alternative way to interpret this is that men were more unfamiliar with vegan desserts and that the taste may be in focus at first stage when they would get used to eating a new type of product (Wardle et al., 2004; Beardsworth & Bryman, 1999).

In this study, there were differences in age, for both men and women, regarding attitudes to a vegan dessert and other studies support this outcome (Beardsworth & Bryman, 1999; Serdar et al., 2011. This might be interpreted that elderly people may want to preserve the traditions
while the younger ones may be more curious about new foods, as shown in Serdar's (2011) study, (Serdar et al., 2011).

Step 4. Sensory evaluations
There was a significant difference in the results with both men and women in perception of sweetness; O/C that was experienced as sweetest and O/H that was experienced as the least sweet. However, there was no significant difference in the outcome that focused on men or women separately. This can be explained by the fact that women and men perceive the sweetness differently in the desserts, where the women experience the desserts sweeter than men do since women are more open to plant-based foods (Beardsworth & Bryman, 1999). Women may experience the dessert sweeter because of pre-existing positive thoughts and attitudes towards a vegan dessert. A similar thing was also seen in Siegrist & Cousin’s (2009) study, where the participants’ anticipated expectations of the wine had an impact on the result (Siegrist & Cousin, 2009).

The cube-shaped desserts were perceived slightly sweeter than the hemisphere-shaped one, which thus can be interpreted as the shape having an effect on the sweet taste experience of the dessert. However, the results in Stewart & Goss (2013) showed the opposite. The food was perceived as sweeter on the round plate, which can be compared to the hemispheric desserts in this study, and the food was perceived as less sweet when served on a square plate, which is comparable to the cube-shaped dessert (Stewart & Goss, 2013). However, the small selection panel in this study makes it difficult to compare the studies with each other (Albinsson et al., 2013; Lawless & Heymann, 2010; Sensorisk studiegruppe, 1997).

The result showed a significant difference for the bitter taste between B/H and O/H for the whole group of men and women, but there was no significant difference for the bitter taste in the results that only concerned the women, while the men had a significant difference in the perceived bitter taste. This shows that the men experienced the desserts more bitter than the women did, and that the colour has an impact in this study on the bitter taste, where the orange colour is perceived bitterer than the brown colour. As shown in the online cross-survey and focus group discussions, men had a more sceptical attitude to vegan desserts, and bitter was the taste least preferred. This may be related to men having a preconceived negative attitude to vegan desserts and thus experiencing them as bitterer (Siegrist & Cousin, 2009). That the orange colour was perceived bitterer than the brown colour may mean that the
orange colour is not appreciated for a vegan dessert, since the bitter taste was the least attractive taste. The fact that an orange vegan dessert is not appreciated also supports the results of the online cross-survey.

The results for the whole group showed no significant difference in the participants' preference. On the other hand, a significant difference was observed for the men's preference of the dessert. As B/K was the most liked dessert and the O/H was the least liked dessert, this means that both colour and shape may be important for the preference of the desserts with men, which is supported by other studies (Stewart & Goss, 2013; Strugnell, 1997). The outcome shows that the men’s most desirable dessert, B/K, was also perceived the sweetest and the least bitter of the desserts. The dessert that was liked the least, O/H, was experienced as the least sweet and the most bitter. This also supports the results of the online cross-survey of this study of the taste's attributes for what the participants preferred the most and the least. That there was a significant difference in the preference of a vegan dessert with men but not with women, means that there were men who liked and those who less liked the vegan desserts that were served, which also supports the result that men are less open to plant-based food (Wardle et al., 2004; Beardsworth & Bryman, 1999).

There was no significant difference according to flavour and texture, which means that colour and shape do not affect the flavour and texture experiences of this study. Due to the low number of participants in the sensory evaluation and that the panel consisted of consumers, it is difficult to conclude that the colour and shape of the dessert affect the tastes, flavour and texture of the dessert. Since the ingredients of the desserts with different colours were combined differently this affects the taste, flavour and texture of the dessert. Due to this it makes difficult to see if the colour has an impact on the experience of taste, flavour and texture.

**Method analysis**

**Step 1. Online cross-sectional survey**

This study consists of four different steps. As a first step, a survey was chosen to discover suitable products and to investigate the attributes of a vegan dessert. The survey provided results regarding the attributes in a less time-consuming way than other methods would have done (Bryman, 2011). In order to attract many participants to the survey, the survey was
chosen to be conducted online through social media which has been shown to be useful for attracting many participants (The Public Health Agency of Sweden, 2015). An online cross-sectional survey gives the participants anonymity, which can lead to more people participating and the answers can be more credible than when a researcher participates as an interviewer (Bryman, 2011; The Public Health Agency of Sweden, 2015). Since it is not possible to know who answered the questionnaire, no target audience for the survey was set. Since this survey concerned the attributes of a vegan dessert, it was not considered important to have a specific target group for this study. The participants shared the survey several times, which resulted in a snowball selection, which in turn resulted in a larger number of participants (Bryman, 2011). Tick-answers for the questions were chosen in order to read the results faster than if the participants would have answered through open questions (Bryman, 2011; Saks & Allsop, 2007). The response options were chosen based on what could be realistic to develop the desserts. The reason why the participants were asked to tick two answers in the multiple-choice options was to get more data. Anonymity means that the researcher cannot explain uncertainties for the participants, which could arise in tick-answers. There were some participants who ticked one answer and some ticked three answers. The participants who had responded with more or less answers were still chosen to take part in the result, since it did not seem to be detrimental to the results. The questions were chosen to be mandatory as these questions were not considered offensive since they were about desserts (Bryman, 2011).

Step 2. Recipe development

The reason for choosing to develop the desserts based on the attributes of colour and shape that were the most and the least liked respectively, was to easily see significant differences in the sensory evaluation. However, the results from the online cross-sectional survey showed that the black colour was the one that was liked the least and was seen to be too similar to the brown colour, which was the reason why orange was chosen instead. Raw preparation of desserts is often used as a cooking method for developing soft vegan desserts (Farrow, 2016; Voltaire, 2015). Developing raw desserts means that the raw materials cannot be heated more than 42 degrees. The reason why this method is often used is to preserve the nutrients in the raw ingredients. Through a raw method, soft desserts could be created which was the attribute that was liked the best according to the survey. Dates are often used in order to make raw vegan desserts sweet in a natural way (Farrow, 2016; Voltaire, 2015). Therefore, dates were
chosen as an ingredient for developing the desserts sweet. Cocoa was used to create a chocolate flavour for the desserts and at the same time make the desserts brown in colour. Turmeric was used as an ingredient to make orange desserts. The desserts were designed in a simple manner to make the appearance of colour and shape well-defined. Edible flowers were used as simple decorations to entertain the consumer (Caporaso & Formisano, 2016; McCormick & Prokes, 2009). The flowers were not considered as a disturbance in the perception of colour and shape of the desserts.

Step 3. Focus groups
A deeper understanding of the phenomenon was needed to answer the research question about attitudes towards a vegan dessert. The focus group interviews were conducted before the sensory analysis, so that the sensory evaluation would not affect the participants' thoughts about a vegan dessert. An individual deep interview could have been used to compare men's and women's attitude towards a vegan dessert, but it would be more time consuming and less dynamic (Bryman, 2011). Focus groups are used to understand people and to compare different groups (Saks & Allsop, 2007; Connelly, 2015). Focus groups were shown to be a good method of comparing men and women and responding to the research question, which Connelly, 2015 also advocates it to be when comparing groups (Connelly, 2015). To compare men and women's attitude to a vegan dessert, the groups were divided according to gender. The number of participants were six in each focus group and were chosen since it was a suitable number for such a group. It made a good prerequisite of dialogue, and it was not too many participants because everyone was able to speak enough and it provided for a good dialogue (Connelly, 2015). Additional focus groups would be necessary in order to gain a deeper understanding of the differences between men and women's attitudes toward vegan desserts. It is recommended to perform at least three focus groups, in order to get a sufficient result (Connelly, 2015). In this current study, three focus groups with women and three with men might be needed to achieve a sufficiently result. The result of this study should therefore be interpreted with caution.

Step 4. Sensory evaluations
A consumer panel was used for convenience choices, but a trained panel had given a stronger, since they have trained sensory skills. To have a total of 12 participants in the consumer panels gives an insufficient number for being a consumer panel (Albinsson et al., 2013;
Lawless & Heymann, 2010). However, a comprehensive basis for this study consisted of performing sensory evaluations with consumer panels combined with focused group interviews. A unipolar, nine-degree hedonic scale was chosen since it is often used in intensity tests and in consumer surveys. Concerning the questions about the textures, a unipolar scale was also chosen to avoid problems about the contradictions of the texture. Color, shape, serving and information about the food being tested can affect the experience of the food (Alley & Alley, 1998; Strugnell, 1997; Zampini et al., 2008; Stewart & Goss, 2013; Siegrist & Cousin, 2009). The results of this study could have been different if the study would also take into account other aspects that can affect the taste, such as the serving and information about the desserts (Siegrist, & Cousin, 2009; Stewart, & Goss, 2013). However, in order to make this survey less complex, only the aspects of colour and shape of the desserts were examined as aspects that can affect food experiences. The author chose to investigate how a product’s colour and shape affect food experience because research has been done regarding this subject for a long period of time, but there is yet no clear answer if colour and shape do affect various food experiences (Alley & Alley, 1998; Strugnell, 1997; Zampini et al., 2008).

It was considered appropriate to test intensity of the newly developed desserts because sensory evaluation is often conducted for new developed products (Albinsson et al., 2013; Lawless & Heymann, 2010; Sensorisk studiegruppe, 1997). Sensory evaluation is also included in the final step of creative design (Naes & Nyvold, 2004). In this study, the intensity of the experience of desserts was examined in order to answer the research question about how the colour and shape affect the taste, flavour and texture of vegan desserts. The statistical analysis was made by the use of ANOVA, which was chosen because it is often used in consumer tests in order to see if there are any significant differences in the experiences (Albinsson et al., 2013; Lawless & Heymann, 2010; Sensorisk studiegruppe, 1997).

**Ethical aspects**

As this study investigates people, it was considered important to follow the four main requirements set by the Swedish Research Council (Swedish Research Council, 2002). In order to make the participants comfortable to participate in the study, the researcher was careful to report about the four main requirements with detailed information of the study and its purpose before the survey began. It may be inconvenient for participants to share their own
opinions about different subjects, due to the risk of it being sensitive when sharing their personal experiences. Therefore, it was particularly important that the participants were treated confidentially in this study, and that their names were not mentioned (Bryman, 2011). Having a focus group also allows the participants to choose if they do not want to enter into a discussion and if they do not want to share their personal opinions.

Relevance for the subject food and meal Science
The three building blocks that are based on food and meal science are the following;

- Nutrition and health
- Food science
- Food culture and communication

Through a mixed method, this study includes these three blocks that are parts of food and meal science. The use of mixed method also shows the greatness of what food and meal science involves. The study concerns Nutrition and Health by examining plant-based foods, where a lifestyle that includes a lot of fruit and vegetables is good for health (The Public Health Agency of Sweden, 2009; WHO, 2015; Dyett et al., 2013). By performing a creative design to develop new vegan desserts, the researcher developed new products and thus demonstrates knowledge in a practical way for the food science area of the three blocks. Using a molecular gastronomy design in the development of these products shows cooking skills at a scientific level (Caporaso & Formisano, 2016; McCormick & Prokes, 2009; Wang & Wang, 2016). Using a focus group interview to communicate and analyse people's thoughts, opinions, attitudes and culture for a vegan dessert, concerns Food Culture and Communication in the subject of Food and Meal Science.

Future research suggestions
This study shows that there is an interest in vegan desserts. In view of this and with the support of other research, younger people are more positive to vegan foods than older (Beardsworth & Bryman, 1999; Serdar et al., 2011). This points to the fact that there will likely be more vegan foods in the future. It was found in this study that participants would like to have a wider range of vegan dishes. Therefore, an increase of vegan desserts and other vegan food alternatives would be interesting and a necessary development in order to satisfy
potential customers. This study does not involve those who already have a vegan diet, but it would be interesting to investigate vegan’s wishes regarding the development of products. Since this study found significant differences regarding the influence of the colour and shape of the dessert on taste experiences, more and larger future studies are needed to demonstrate that it is possible to influence the consumer's experiences for food. For future research, the ingredients in the combination should be more similar to each other for products that have different colours. This would provide a safer result of how and if the colour affects food experiences.

**Conclusion**

Both men and women in this study have positive attitudes towards vegan desserts. However, there were differences between men and women's attitudes towards vegan desserts, where the women, especially the younger ones, were more positive and curious than the men. The men, especially the elderly ones, were more sceptical if a vegan dessert would taste good. The colour and shape of the four vegan desserts based on creative design and molecular gastronomy had an effect on the taste experience. However, flavour and texture experiences were not affected by the colour and shape of the four desserts. More and larger studies are needed to draw conclusions of how the appearance of food can affect food experiences.
References


Appendices

Appendix 1: online cross-sectional survey (Swedish)

Genus:
Man
Kvinna

Ålder:
yngre än 20
20–29
30–39
40–41
50–59
60 +

Vilka två av följande aromer föredrar du helst för en dessert som endast innehåller ingredienser från växtriket- vegandessert?

Choklad
Karamell
Lakrits
Jordgubbe
Hallon
Blåbär
Äpple
Apelsin
Citron

Vilka två av följande smaker föredrar du helst för en dessert som endast innehåller ingredienser från växtriket- vegandessert?

Salt
Sött
Surt
Bittert
Vilka två av följande former föredrar du helst för en dessert som endast innehåller ingredienser från växtriket- vegandessert?

- Cylinderformad
- Kub
- Rätblock
- Hemisfär

Vilka två av följande texturer föredrar du helst för en dessert som endast innehåller ingredienser från växtriket- vegandessert?

- Hård
- Mjuk
- Torr
- Saftig
- Seg
- Knaprig
- Rinnig
- Fast

Vilka två färger föredrar du helst för en dessert endast som innehåller ingredienser från växtriket- vegandessert?

- Röd
- Rosa
- Gul
- Orange
- Grön
- Lila
- Brun
- Svart
Appendix 2: online cross-sectional survey (English)

Gender:
Male
Female

Age:
Younger than 20
20-29
30-39
40-41
50-59
60+

Which two of the following flavours do you prefer for a dessert that contains only ingredients from plants – vegan dessert?
Chocolate
Candy
Liquorice
strawberry
Raspberry
Blueberry
Apple
Orange
Lemon

Which two of the following tastes do you prefer for a dessert that contains only ingredients from plants – vegan dessert?
Salty
Sweet
Sour
Bitter
Which two of the following shapes do you prefer for a dessert that contains only ingredients from plants – vegan dessert?

- Cylindrical
- Cube
- Cuboid
- Hemisphere

4. Which two of the following textures do you prefer for a dessert that contains only ingredients from plants – vegan dessert?

- Hard
- Soft
- Dry
- Juicy
- Crisp
- Liquid
- Fixed

Which two colours do you prefer for a dessert that contains only ingredients from plants – vegan dessert?

- Red
- Pink
- Yellow
- Orange
- Green
- Purple
- Brown
- Black
Appendix 3: Focus groups (Swedish)

1. Vad innebär det för dig att en dessert är vegan?
2. Vad är er första tankar om en vegandessert?
3. Berätta vad du tänker och känner när du hör ordet vegandessert
4. Hur viktigt är det för dig att en dessert är vegan?
5. Vad tror ni att det innebär för samhällsperspektiv att äta vegandesserter?
6. Var placerar du en vegandessert på en skala 1–10 där 1 är vill aldrig äta och 10 vill alltid ha vegandessert
7. Vad skulle få er att äta mer vegandesserter?
8. Vad tror ni skulle få samhället att äta mer vegandesserter?
Appendix 4: Focus group (English)

1. What does it mean to you that a dessert is vegan?
2. What are your first thoughts about a vegan dessert?
3. Tell me what you think and feel when you hear the word vegan dessert.
4. How important is it that a dessert is vegan?
5. What do you think it means from a societal perspective to eat vegan desserts?
6. Where do you place a vegan dessert on a scale 1-10 where 1 is never wanting to eat it and 10 is always wanting vegan dessert
7. What would make you eat more vegan desserts?
8. What do you think would make society eat more vegan desserts?
Appendix 5: sensory analysis (Swedish)

Genus
Man
Kvinna

Sätt ett kryss (X) där du tycker det stämmer bäst med dina upplevelser.
Provnummer: ……

Sött
Ingen sötma Tydlig sötma

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Syra
Ingen syrlighet Tydlig syrlighet

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Sälta
Ingen sälta Tydlig sälta

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Bittert
Ingen beskhet Tydlig beskhet

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Choklad
Ingen Choklad Tydlig choklad

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Textur ljusa lagret
Inte hård                        Mycket hård

Textur ljusa lagret
Inte alls mjuk                        Mycket mjuk

Textur mörka lagret
Inte alls hård                        Mycket hård

Textur mörka lagret
Inte alls mjuk                        Mycket mjuk

Alternativt för textur i formuläret:
Textur
Inte alls hård                        Mycket hård

Textur
Inte alls mjuk                        Mycket mjuk

Totalt gillade av produkten
Gillar inte alls                        Gillar väldigt mycket
Om du har några andra synpunkter om produkten, kommentera nedan

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Appendix 6: sensory analysis (English)

Gender
Man
Woman

Mark a cross (X) where you think it best matches your experience.
Sample number: ......

Sweet
No sweetness at all                       Very sweet
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Acidity
No acidic at all                         Very acidic
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Saltiness
No salty at all                          Very salty
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Bitter
No bitterness at all                    Very bitter
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Chocolate
No chocolaty at all                     Very chocolaty
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
<table>
<thead>
<tr>
<th>Texture bright layer</th>
<th>Not hard</th>
<th>Very hard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Texture bright layer</th>
<th>Not soft at all</th>
<th>Very soft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Texture dark layer</th>
<th>Not hard at all</th>
<th>Very hard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Texture dark layer</th>
<th>Not soft at all</th>
<th>Very soft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Alternatively, for texture in the form:

<table>
<thead>
<tr>
<th>Texture</th>
<th>Not hard at all</th>
<th>Very hard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Texture</th>
<th>Not soft at all</th>
<th>Very soft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total liked of the product</th>
<th>Extremely dislike</th>
<th>extremely like</th>
</tr>
</thead>
</table>
If you have any other comments on the product, comment below
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