Title: Sensory Attributes of Reduced Egg Cake Using Soya Flour and Hydrocolloid as an Egg Replacer

Student Number: xxxxxx

2017

Supervisor: Anita Setarehnejad

Attention of: Dr Ruth Fairchild

Student Declarations In Respect of Individual Work

Statement 1
Dissertation submitted in partial fulfilment of the requirements of Cardiff Metropolitan University for the Degree of Bachelor of Science with Honours. This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed:...xxxxx......................

Date:........28.03.17......................

Statement 2
I declare that the whole of this work is the result of my individual effort and that all quotations from other authors have been acknowledged. Where corrections services have been used the extent and the nature of the correction is clearly marked in a footnote.

Signed:...xxxxx......................

Date:........28.03.17......................
Statement 3

I hereby give consent for my research project, if accepted, to be available in the open source repository D-space for use inside and outside the University.

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Date:.........28.03.17..........................

Statement 4

I hereby give consent for my research data and/or portions of my report to be used by my supervisor in the creation of academic articles for publishing, provided that I have appropriate authorship on these papers.

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Date:......28.03.17............................
Sensory Attributes of Reduced Egg Cake Using Soya Flour and Hydrocolloid as an Egg Replacer
Britton, C and Setarehnejad, A

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Background
Eggs are an important ingredient in cake, they add to the texture, aroma, colour and moistness of cake. They are also one of the most expensive ingredients in baking and contribute to up to 50% of the total cost thereof the production of a good egg replacer would be advantageous in industry (Ratnayake et al, 2012). Previously there has been research into either the full or partial replacement of eggs with replacers such as whey protein and emulsifiers with varying results. Hydrocolloids such as xanthan gum have been shown to increase cake volume and increase shelf life (Gomez et al, 2007). Soya flour has proteins with similar emulsifying properties to egg so this project aimed to evaluate the effect of using a combination of soya flour and xanthan gum to partially replace the egg in cake.

Methods
Sixteen cakes were produced with 75%, 50% and 25% of egg replacer consisting of soya flour and xanthan gum, along with control samples made with 100% egg. The weights, volume and firmness of the samples were measured and a sensory panel using a triangle test was used to compare the products made. The samples for the sensory panel were made in a separate practical. The volumes were measured using a VolScan and the texture analysed using TA-XT2 texture analysis with a 25mm diameter cylindrical probe to measure the firmness. The programme SPSS 23.0 for Windows, IBM Corporation, New York, was used to analyse the results to see if there was a statistical difference between samples.

Results
The majority of the samples had a good rise and volume apart from the sample with 75% egg replacer which had a slightly smaller volume and uneven rise. A Friedman’s Anova test was done on the volume results which gave a P value of 0.157 which is more than 0.05 meaning there was no significant difference between the volumes of the control samples and the samples with egg replacer. The results from the sensory analysis showed that the samples generally decreased in firmness but the range was small. After a week the samples all increased in firmness with the samples with less egg increasing slightly more in firmness.

![Graph showing average specific volume of samples](image)

Figure 1 – A Graph to show the average specific volume of samples

Results Continued
For the sensory analysis a triangle test with two control samples and one with 50% egg replacer were used and participants were invited to leave comments on the reasons for the choice or on the characteristics of the samples. Out of 24 participants 9 selected the correct odd sample which gave a probability of 0.406 which is more than the critical P value of 0.05 suggesting there was no detectable difference between the samples.

![Scanning photographs of samples](image)

Figure 2 – Scanning photographs of samples

Discussion and Conclusion
The cakes all had a good rise and volume apart from the sample with 75% egg replacer which had an uneven rise and a smaller volume. As the volumes of the samples with reduced egg were found to not be significantly different from the control samples it suggests that the soya flour and xanthan gum worked well to replace the egg in the cake. The results from the sensory panel show that the cakes with half the amount of egg replaced had a very similar, taste, appearance and texture to the control cakes with just egg which means it could possibly be used in industry as the general public could not tell the difference. To improve the egg replacer further the amount of soya flour and xanthan gum could be adjusted or the an emulsifier could be added as research has shown the addition of emulsifier can give gas bubble stability and give a softer crumb (Rahmati and Tehrani, 2014).

To conclude the soya flour and xanthan gum work reasonably well to replace up to 75% of the egg to produce a cake that still retained the properties expected of a good cake but more work could be done to alter the formula and improve it further.

References
Rahmati, N and Tehrani, M (2014) Influence of different emulsifiers on characteristics of eggless cake containing soy milk: Modelling of physical and sensory properties by mixture experimental design Journal of Food Science and Technology, Volume 51, Issue 9, pp.1697-1710 (accessed online 25.03.17 from https://www.ncbi-nlm-nih.gov.ezproxy.cardiffmet.ac.uk/pmc/articles/PMC4152492/)
Abstract

The purpose of this research was to evaluate the properties of an egg reduced cake using soya flour and xanthan gum as an egg replacer. Samples were made with 25%, 50% and 75% as well as a control sample with 100% egg. The weights and volumes of the samples were measured. The volumes were measured using a VolScan and analysed using the Friedmans Anova test on SPSS 23.0 which showed there was no significant difference between the samples with egg replacer and the samples with just egg. The firmness of the cakes was analysed using a texture analyser for both fresh samples and week old samples to see how an egg replacer affected the shelf life of the product. A sensory panel using a triangle test was conducted with 25 panellists. Each participant was given 3 coded samples, two samples with 100% egg and one with 50% egg and 50% egg replacer, and asked to pick the odd sample. 9 of the participants picked the correct sample which indicated a probability of 0.406 which is more than 0.05 suggesting there was no detectable difference between the samples. The soya flour and xanthan gum worked well to replace up to 75% of the egg to produce an acceptable cake that had a good volume that was not significantly different from the control and that had no detectable difference in a sensory trial meaning it could potentially be used in cake manufacturing.

Keywords

Egg, Soya Flour, Xanthan Gum, Volume, Sensory, Texture

Paper Category – Technical Paper
Introduction

Eggs play an important role in baking and in the production of cake, they add to the texture, aroma, colour and moistness of a cake. Eggs have emulsifying, foaming and gelation properties that entrap large air bubbles within the mixture producing a smooth batter to give the desired light and airy texture of cake (Paraskevopoulou et al, 2015). In cake mix a protein network is formed when intramolecular disulphide bonds form between the protein in the egg and the proteins in the wheat flour. These bonds can form as both the egg and wheat proteins have free sulfhydryl bonds (Deleu et al, 2016). Proteins in the egg unfold and move to the surface of the air bubbles produced in the mix forming a film network that is strong and flexible stopping the bubbles from collapsing and increasing the final volume of the cake. Eggs are also involved in the prevention of staling in cake and extending the products shelf life. The fats, emulsifiers and proteins found in the egg interfere with the process of starch retrogradation which causes staling, therefor increasing the shelf life of the cake (Figoni, 2007). Eggs can be one of the most expensive ingredients in baking contributing to as much as 50% of the total cost of the ingredients for a product therefor the production of a good egg replacer would be advantageous in industry (Ratnayake et al, 2012). Currently industry is working to produce an egg replacer using a mixture of proteins and additives that are able to achieve the same effect as using eggs without making changes to the sensory aspects of the cake in order to the lower cost of cake production or to create allergen free or vegan products.

Online there are many suggestions for ingredients that can be used to replace eggs in baking such as yogurt or pureed fruit which are suitable for home baking but may not be suitable in industry as they could be costly and not as easy to store as they would need to be chilled and would have a short shelf life. There is an egg replacer available to buy called Ener-G Egg
Replacer that contains potato and tapioca starch. It advises that for it to work best extra oil and lecithin should be added to the mix meaning although it is sold as an egg replacer it does not work well enough on its own to replace egg completely (Ener-G, 2017).

Previously there have been studies into either full or partial egg replacement with different egg replacers such as whey protein, spray dried bovine plasma and emulsifiers with varying results. Studies have shown that the addition of hydrocolloids can improve the characteristics of partially egg replaced cakes. Hydrocolloids are a substance that forms a gel when in contact with water which gives them emulsifying and gelling properties similar to egg. They are often used in baked goods to increase the water retention, shelf life, and to improve the crumb structure and volume. Miller and Hoseney found that cakes made with xanthan gum added had a higher maximum height than control cakes made with egg (Miller and Hoseney, 1993). Gomez et al found that the cakes with xanthan gum added had a 12.3% volume increase after baking as well as an increased shelf life as the samples texture remained unchanged after 2 days whereas other samples with different hydrocolloids added had an increase in hardness after 2 days (Gomez et al, 2007). Another study found that samples made with emulsifiers still do not score as highly in sensory tests as samples with 100% egg so more research could be done in this area to improve egg replacement. The same study found that the cakes with reduced egg had slower staling rates which could be beneficial in industry as it could increase shelf life and reduce waste. The cakes made with just egg had an increase in crumb hardness over 4 days of 167% whereas the cakes made with 50% whey protein based egg replacer had an increase of 132% crumb hardness (Paraskevopoulou et al, 2015). One study in 2001 by Arozarena et al found that using a combination of white lupine protein, emulsifiers and xanthan gum produced a usable egg replacer. However, there was no sensory or consumer
acceptance tests so although it scored well in analysis of properties such as the volume it may have given the cake an unacceptable taste or mouthfeel so it would not be able to be used in industry to replace the egg meaning more research is needed to evaluate the sensory properties.

Soya flour is a flour made from soy beans that has a high protein content. Soya flour could potentially be used to replace egg as it has proteins with emulsifying and gelling properties that are similar to egg. There have been various studies into the addition of soya flour into baking for nutritional reasons or as a substitute for wheat flour but there have been few that test the use of soya flour specifically to replace egg. In a study by Ratnayake et al on the effect of egg and egg replacers on product quality they found that using a soya flour and wheat gluten based egg replacer to completely replace egg gave the cakes an unpleasant aftertaste and off flavour but partially replacing the egg produced an acceptable cake product (Ratnayake et al, 2012). Using a small amount of soya flour in combination with a hydrocolloid to mimic the properties of egg in cake may work together to produce a good egg replacement.

**Aim**

The aim of the project was to evaluate the properties of an egg reduced cake using soya flour and xanthan gum as an egg replacer to replace 25%, 50% and 75% of the egg. Measurements of the rise, volume and texture were taken as well as conducting a sensory panel to test the consumer acceptability of an egg reduced cake.
Materials and Method

Study Design
The study was designed to quantitatively analyse properties of cake that may be effected by reducing the amount of egg. Sixteen cakes were produced with 75%, 50% and 25% egg replacer along with control samples made with 100% egg. The weights, volume and firmness of the samples were measured and a sensory panel using a triangle test was used to compare the products made. The programme SPSS 23.0 for Windows, IBM Corporation, New York, was used to analyse the results to see if there was a statistical difference between samples. The method used is similar to methods used in other research into the replacement of eggs in cake. Volume and firmness are often measured to analyse the effect of reducing and replacing cake as they are elements that are likely to be affected by the properties of egg.

Materials
Cake flour (Bako Wales), Liquid whole egg (Bako Wales), Castor sugar (Bako Wales), Shortening (Bako Wales), Margarine (Bako Wales), Baking powder (Bako Wales), Water, Soya Flour (Amazon), Xanthan gum (Tesco)

Cake Preparation
Before data collection was commenced ethical approval was sort from the Cardiff Metropolitan University Ethics Panel and approved in November 2016 (Appendix 1). A risk assessment was completed for all the practical’s and can be seen in Appendix 2. In the first practical four samples of cakes were produced with different amounts of egg and egg replacer made from soya flour, xanthan gum and water as shown in tables 1 and 2 below. Four 200g
cakes were produced from each batch sample so sixteen cakes were produced in total. A basic Madeira cake recipe was used.

<table>
<thead>
<tr>
<th></th>
<th>Sample 1 100% egg</th>
<th>Sample 2 75% egg</th>
<th>Sample 3 50% egg</th>
<th>Sample 4 25% egg</th>
</tr>
</thead>
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<td>100g</td>
<td>100g</td>
<td>100g</td>
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<tr>
<td>Margarine</td>
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<tr>
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<tr>
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<td>0g</td>
<td>7.5g</td>
<td>15g</td>
<td>22.5g</td>
</tr>
<tr>
<td>Water</td>
<td>0g</td>
<td>37.5g</td>
<td>75g</td>
<td>112.5g</td>
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</table>

Table 1

<table>
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<th>Egg Replacer</th>
<th></th>
</tr>
</thead>
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<tr>
<td>Soya flour</td>
<td>50g</td>
</tr>
<tr>
<td>Xanthan gum</td>
<td>10g</td>
</tr>
<tr>
<td>Water</td>
<td>300g</td>
</tr>
</tbody>
</table>

Table 2

A soya flour and xanthan gum egg replacer mix was made. The xanthan gum weight was 2% the weight of the flour. 25%, 50% and 75% of the egg replacer were added to the samples to partially replace the egg. Water was added to the samples with reduced egg at the same time the egg was added to replace the natural moisture content of the egg.

For each batch the flour, baking powder and egg replacer were sieved together twice to thoroughly mix, incorporate air and get rid of any lumps. The shortening, margarine and castor sugar were mixed together for 10 minutes before gradually adding the water and egg. The flour, baking powder and egg replacer mix were then added and mixed for 1 minute. 200g of batter was added to four lined tins and baked for 35 minutes. The cakes were then taken out of the tins and left to cool on a cooling rack.
In the second practical, the weights of all the samples were taken and the measurements of two samples from each of the batches were taken using the VolScan and texture analyser. Scanning photographs were taken of each of the samples. Two samples of each batch were left in ambient storage for a further week and had their texture analysed to see the effect of the egg replacer on the products shelf life.

A separate practical was used to bake samples to be used in the sensory analysis. Two batches of cakes were made, one with 100% egg and one with a 50:50 ratio of egg to egg replacer. The cakes were kept in sealed plastic in ambient storage until they were used in the sensory panel.

**Data Collection Tools**

**Texture Analysis** – Texture analysis was carried out on 3 slices from the centre of each of the cake samples using TA-XT2 texture analysis with a 25mm diameter cylindrical probe. An average firmness was then calculated for each sample. The texture of each sample was analysed on the fresh product and a week later to see the effect of the egg replacer on the shelf life.

**VolScan Analysis** – A VolScan Profiler was used to measure the volume of the cake samples, two cakes for each sample were measured and an average was calculated. The results were used together with weight measurements to calculate the specific volumes of the samples.

**Sensory Analysis** – A triangle test was conducted with 25 untrained panellists that were a mix of students, staff and visitors to a University in South Wales. To make the results more reliable and accurate a larger group of participants could have partaken. The trail took place over 4 hours on one day, if the trial was set up over two sessions on different days there could have
been more participants. A triangle test was used to determine whether there was a detectable difference between the sample with 100% egg and the sample with 50% egg and 50% egg replacer (Poste et al, 1991). The poster in Appendix 3 was placed around the university campus as well as in an email sent to staff and students and posted on social media. The participants were each given a participant information sheet to explain the project and a questionnaire, both of which can be seen in Appendices 4 and 5. The samples were all a uniform size and were each given a random 3 digit code, placed in random orders and the participants were each given a cup of water and a cracker for palate cleansing. The participants were asked to state which was the odd sample and asked to add any comments on the reason for their choice or on the characteristics of the samples.

**Statistical Analysis** - The results from the VolScan were analysed on SPSS 23.0 using the Friedman’s Anova test to calculate if there was a significant difference between volumes of the samples as the volumes were likely to be affected when the amount of egg was reduced if the replacer did not have a positive effect on the cake.

**Results**

**Specific Volume**

The average weight of the samples with 100% egg and 75% egg were very similar, the samples with 50% and 25% egg had an increased weight (Graph 1). This could be because the cakes with more egg could have had a higher moisture content that evaporated when heated in the oven therefor causing more weight loss whilst cooking. The volumes of the samples with 75% and 50% egg were slightly more than the sample with 100% egg and the sample with 25% had a slightly lower volume, the same trend was shown with the specific volumes of the cakes (Graph 2). The significant difference of the volumes was calculated using the programme SPSS.
23.0 with the Friedman’s Anova Test, the original printouts can be seen in Appendix 8. The 75%, 50% and 25% egg samples were compared to the 100% egg control sample and they all gave the same P value of 0.157 which is more than 0.05 meaning the samples were not significantly different from each other suggesting the soya flour and xanthan gum worked well as an egg replacer.

Graph 1 – A graph to show the average weight of the samples

Graph 2 – A graph to show the average specific volumes of the samples
Appearance

The appearance of a product plays an important part in whether a consumer will like or purchase a product so when substituting an ingredient in cake the appearance should still match the consumer’s perception of what a good cake looks like. At the mixing bowl stage the mixtures had similar textures and appearance but the samples with more egg had a more shiny appearance. After baking the surface of the samples with 100% and 75% egg had a golden brown colour and the 50% and 25% samples had a paler colour and a less even surface. The samples with 25% egg had an uneven rise compared to the other samples which had an even domed shape. The 25% egg sample had less height and rise than the other samples but a few small air bubbles can still be seen when the sample is sliced. The samples with 100% and 75% egg had a similar distribution of large and small air bubbles, the 50% egg samples had some large air bubbles but they were less evenly distributed.

![Figure 1 - Scanning photographs of samples](image)

Texture Analysis

Texture analysis was obtained from 3 even slices of each of the samples. The fresh cake samples had similar firmness. The 100% and 75% egg samples were slightly firmer than the 50% and 25% samples (Figure 2). The samples decreased in firmness as the amount of egg decreased but the 25% egg sample was firmer than the 50% egg sample. After being stored for a week the samples all increased in firmness (Figure 3). The samples with less egg had a slightly larger increase in firmness after storage.
Figure 2 – Texture analysis results of average values

Figure 3 – Texture analysis results of week old samples average values
**Sensory Analysis**

A sensory panel was conducted using a triangle test. There were 25 participants in the sample but one participant did not identify an odd sample stating they “Can’t tell the difference” so it was not included in the final analysis. Out of the remaining 24 participants, 9 selected the correct odd sample which had 50% egg replacer. Using a statistical chart the results indicated a probability of 0.406 which is more than the critical value of $P = 0.05$ suggesting there was no detectable difference between the sample with 100% and the sample with 50% egg replacer (Poste et al, 1991). Although some of the participants identified the odd sample correctly the reasons for their choice were that the sample was ‘more moist’ and had an ‘eggy taste’ even though it was the sample with less egg. This suggests that the soya flour and xanthan gum were a good substitute for the egg as there was not a detectable difference between the samples.

**Discussion**

The aim of the project was to evaluate the properties and acceptability of partially egg replaced cake. The majority of the results obtained from measuring the weights, volume and firmness of the cakes combined with the sensory analysis results showed the soya flour and xanthan gum to work well together when used to partially replace the egg up to a point.

**Volume**

The cakes all had a good rise and volume apart from the sample with 75% egg replacer which had an uneven rise and a smaller volume. The volumes of the partially egg replaced samples were found to not be significantly different from the control samples with 100% egg as the Friedman’s Anova test gave a $P$ value of 0.157 which is higher than 0.05. This suggests the egg
replacer works as well as the egg at incorporating air into the cake mix, allowing the mix to rise and then be able to hold the structure without collapsing by forming protein films around the air bubbles. The samples with 75% and 50% egg had a slightly larger volume than the control samples which could mean the addition of the soya flour and xanthan gum combined with the egg is able to give the cakes a better volume. The specific volume can be used to measure how light and airy or dense the crumb is, a lower specific volume indicates that the cake is more aerated and is therefore preferable. The samples had similar specific volumes meaning they had similar aeration. This supports other research that shows the addition of hydrocolloids such as xanthan gum to cake can increase the volume. A study found that out of a selection of hydrocolloids, the addition of xanthan gum to cake mix gave the largest volume increase of 12.3% (Gomez et al, 2007). The hydroxyl groups interact with the starch in the flour which affects the starch gelatinization temperature. An increase in the starch gelatinisation temperature leads to the change in the batter from a fluid to an aerated emulsion to a solid porous structure happening at a slower rate allowing the cake to have longer to increase in volume giving a larger final product (Gomez et al, 2007).

**Texture Analysis**

The cakes with the least amount of egg had a different texture to the other samples especially after a week in storage. The cakes with 25% egg had a dryer and crumbly texture meaning the although the egg replacer worked well at replacing a small amount of the egg, it did not work replacing the egg in larger proportions. The results from the texture analyser show the cakes with less egg were less firm than the samples with more egg as shown by the lower peak heights on the graph meaning less force was needed to compress the samples (Figure 2). This could be because the egg replacer does not form as strong a matrix as the proteins in the eggs.
do giving the cakes a crumblier texture that falls apart easily. Results from another study differed from this and found that the addition of hydrocolloids increased the firmness of the cakes, this may be due to the samples in this research using a hydrocolloid in combination with the soya flour to partially replace the egg whereas the other study only used a combination of hydrocolloid and emulsifier to completely replace the egg in the samples (Ashwini et al, 2009). The use of an egg replacer did not seem to greatly affect the shelf life, all the samples increased in firmness by about the same amount meaning the use of soya flour and xanthan gum as an egg replacer wouldn’t help to increase the shelf life of a product (Figure 3).

**Sensory Analysis**

The results from the sensory panel show that the cakes with half the amount of egg replaced had a very similar, taste, appearance and texture to the control cakes with just egg which means it could possibly be used in industry as the general public could not tell the difference and in some cases the participants preferred the cakes with egg replacer. This is contrary to sensory results obtained by other research which found there was a significant difference between samples using a soy flour based egg replacer or soy protein isolate as an egg replacer compared to control samples made with egg (Lin et al, 2017). They found that samples with soy were perceived to have a higher off flavour (Ratnayake et al, 2012). The difference in results in this project could be due to the egg not being completely replaced and therefor a smaller amount of soya flour being used along with the use of a hydrocolloid. The research in these studies focused on the complete replacement of egg in order for use in vegetarian, or allergen free bakes or to reduce the overall cost. Partially replacing the egg is still of use in the industry as it can possibly reduce the cost and increase profits.
Further Research

To improve this research further samples made with reduced egg and no egg replacer could have been made to use as controls with the 100% egg samples to better evaluate the benefits of using the egg replacer on the properties of the cakes as opposed to just reducing the amount of egg to reduce the cost of cake production which could have a negative effect on attributes of the cake such as the volume. More samples of each cake could have been made to improve the reliability of the results and improve the accuracy of the average means for the volume and texture values.

Given that the cakes with 75% egg replacer did not produce a good enough cake the egg replacer would be unsuitable to use to completely replace egg without further change to its formulation but it could possibly be used as a replacer for less than 75% of the egg. Further research could be done to improve the egg replacer further by changing the amount of soya flour and xanthan gum used or by the addition of an emulsifier. Emulsifiers have been shown to give gas bubble stability and to give eggless cake a softer texture (Rahmati and Tehrani, 2014). An alternative hydrocolloid instead of xanthan gum could be used such as HPMC which has been shown in other research to give cakes good aeration and volume (Gomez et al, 2007). Ashwini et al found that the addition of HPMC improved the crumb colour, mouthfeel and quality of eggless cakes (Ashwini et al, 2009).

A reason for replacing egg is that it is an allergen. Although soya flour works well as an egg replacer it is also an allergen so it would be replacing one allergen with another meaning in some cases it may not be the best option to use if trying to make an allergen free product. Instead of soya flour, chia seeds could be used to replace the egg. One study showed that the
use of chia seed gel to partially replace eggs by up to 75% produces cakes that were perceived as acceptable by taste panellists but they did not score as highly as the control cakes and the cakes also had reduced volume suggesting more research into using the chia seeds in combination with a hydrocolloid to improve its properties as an egg replacer could be done (Borneo, Aguirre and Leon, 2010). However, a disadvantage to using chia seeds is that they can give the cake a different appearance and texture that is grainy so some people may not like it.

Conclusion
To conclude the soya flour and xanthan gum work reasonably well to replace up to 75% of the egg to produce an acceptable cake but more work could be done to alter the formula and improve it further. The results from the volumes and sensory analysis of the cakes both show there was not a significant difference between the samples with the different amounts of egg and egg replacer. This suggests that the soya flour and xanthan gum worked well in combination to make a good replacement for the egg as the cakes still retained properties that produce a good cake but not good enough to completely replace the egg.

References


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Friday, 04 November 2016

Britton, Chloe
BSc (Hons) Food Science & Technology
Cardiff School of Health Sciences

Dear Applicant

Re: Application for Ethical Approval: Evaluating the sensory attributes of a commercial cake with reduced egg using soya flour, emulsifier, and hydrocolloid as an egg replacer.

Ethics Reference Number: [Redacted]

Your ethics application, as shown above, was considered by the Health Care and Food Ethics Panel on 11/2/2016

I am pleased to inform you that your application for ethical approval was APPROVED, subject to the conditions listed below – please read carefully.

Standard Conditions of Approval

- Your Ethics Application has been given a Project Reference number as above. This MUST be quoted on all documentation relating to the project (e.g. consent forms, information sheets), together with the full project title.
- All documents must also have the approved University Logo and the Version number in addition to the reference and project title as above.
- A full Risk Assessment must be undertaken for this proposal, as appropriate, and be made available to the Committee if requested.
- Any changes in connection to the proposal as approved must be referred to the Panel/Committee for consideration without delay quoting your Project Reference Number. Changes to the proposed project may have ethical implications and so must be approved.
- Any untoward incident which occurs in connection with this proposal must be reported back to the Panel/Committee without delay.
- If your project involves the use of human samples, your approval is given on the condition that you or your supervisor notify the HTA Designated Individual of your intention to work with such material by completing the form entitled “Notification of Intention to Work with Human Samples”. The form must be submitted to the PD (Sean Duggan). BEFORE any activity on this project is undertaken

This approval expires on 11/3/2017. Please set a reminder on your Outlook calendar or equivalent if you need to continue beyond this approval date. It is your responsibility to reapply / request extension if necessary.

Yours sincerely

Prof. Arthur Tatham
Chair of Department of Healthcare and Food Ethics Panel
Cardiff School of Health Sciences
Llandaf Campus
Western Avenue, Cardiff CF5 2YB
Tel : 029 2041 7125
E-mail : atatham@cardiffmet.ac.uk

Cc: Setarehnejad, Anita

PLEASE RETAIN THIS LETTER FOR REFERENCE
Appendix 2 - Risk Assessment

RISK ASSESSMENT FORM 1

1A

MEMBER OF STAFF: Anita Setarehnejad, Judith Hay
LOCATION OF WORK: Bakery/Sensory Suite
DURATION OF ACTIVITY: 1 month
ACTIVITY TITLE: Partial egg replacement in cake using soya flour and xanthan gum
NATURE OF WORK: Texture analyser, Volscan, sensory analysis
PEOPLE INVOLVED:

Will the work detailed above involve any of the following hazards?

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>

1B

STAFF MEMBER'S CERTIFICATION OF ASSESSMENT

If you have answered no to the seven questions above and are satisfied with the following statement, you should sign and date it, setting a date not more than 12 months hence for the work to be reassessed.

I have assessed/reassessed* the work outlined above with respect to the School's Health & Safety Policy.

I undertake to review this assessment if the nature of the work should change, or if any unforeseen hazards should be encountered.

*This assessment will be reviewed not later than

Signed: Anita Setarehnejad
Print name: Anita Setarehnejad
Date: 24/1/17  

* - delete or complete as necessary

E-mail: gatham@cardiffmet.ac.uk
Cc: Setarehnejad, Anita

PLEASE RETAIN THIS LETTER FOR REFERENCE
School / Unit and Area: CSHS CSK/LC/HC/Bakery
Assessment Number: 1

Risk Assessment undertaken by:
Student Name: xxxxxxx
Lecturer/Technician Name: Anita Setarehnejad, Judith Hay

Description of the work activity being assessed:
Food manufacturing, sensory analysis and testing.

Persons Affected:
Staff [x] Students [x] Others [x]

Details of Others:

<table>
<thead>
<tr>
<th>HAZARD IDENTIFICATION</th>
<th>RISK RATING - without Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please provide details of the hazards associated with the area or task.</td>
<td>The Risk Rating (RR) and Degree of Risk are determined by multiplying the Severity (S) of injury by the Likelihood (L) of occurrence. Please see for details</td>
</tr>
<tr>
<td><strong>EXAMPLES INCLUDE:</strong> Working at height, Manual Handling, Electricity, Fire, Noise, Contact with moving parts of machinery, Dust etc</td>
<td></td>
</tr>
<tr>
<td>1 Burns from hot appliances</td>
<td>S</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2 Fire hazard due to flammable materials</td>
<td>5</td>
</tr>
<tr>
<td>3 Food poisoning</td>
<td>5</td>
</tr>
<tr>
<td>4 Contact with moving parts</td>
<td>3</td>
</tr>
<tr>
<td>5 Electricity</td>
<td>3</td>
</tr>
<tr>
<td>6 Manual handling</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Once all potential hazards have been identified and a Risk Rating has been applied, please go to page 2 and provide details of the control measures required to reduce the risk to an acceptable level.
### CONTROLS TO BE APPLIED

**Examples Include:** Elimination, Substitution for something less hazardous, Barriers or fixed guards, standard operating procedures and personnel protective equipment

| 1 | *Give appropriate training*  
*Have the correct personal protective equipment* | 27.01.17 | 3 | 1 | 3 | Low |
|---|---|---|---|---|---|---|
| 2 | *Give appropriate training*  
*Have the correct personal protective equipment* | 27.01.17 | 5 | 1 | 5 | Moderate |
| 3 | *Ensure frequent and appropriate handwashing*  
*Clean all surfaces and equipment used*  
*Have the correct personal protective equipment* | 27.01.17 | 4 | 1 | 4 | Moderate |
| 4 | *Have appropriate training on how to use the machines*  
*Have the correct personal protective equipment* | 27.01.17 | 3 | 1 | 3 | Low |
| 5 | *Ensure electrical equipment is kept away from water sources*  
*Have appropriate training on how to use electrical equipment*  
*Have the correct personal protective equipment* | 27.01.17 | 3 | 1 | 3 | Low |
| 6 | *Give appropriate training*  
*Have the correct personal protective equipment* | 27.01.17 | 3 | 1 | 3 | Low |

---

**Date of first assessment:** 27.01.17

**Assessment review dates:**

---

---
# TASTE PANELLISTS REQUIRED

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>Reduced Egg Cake</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td>06/02/2017</td>
</tr>
<tr>
<td>TIME</td>
<td>10:00 to 14:00</td>
</tr>
<tr>
<td>LENGTH OF TEST</td>
<td>5 Minutes</td>
</tr>
<tr>
<td>PLACE</td>
<td>D122 – Food Industry Centre Sensory Suite</td>
</tr>
<tr>
<td>ALLERGENS</td>
<td>Wheat Flour (Gluten), Butter (Lactose), Soya Flour (Soya), Egg</td>
</tr>
</tbody>
</table>

**FURTHER DETAILS**

Dr. Anita Setarehnejad  
Email: ASetarehnejad@cardiffmet.ac.uk  
Tel: 029 2041 6455
Appendix 4 – Participant Information Sheet

Ethics reference number:

Participant Information Sheet

I am a third year student currently studying food science and technology in Cardiff Metropolitan University. I am conducting a study looking at the effect of using an egg replacer in cake.

The samples contain the following allergens; Gluten, Lactose, Egg and Soya.

Please taste each of the three samples in the order they are presented. Two samples are the same and one is different. Indicate on the questionnaire provided which sample is different from the other two. You may cleanse your pallet in between samples using the cracker and water provided.

All information given will kept confidential. If you still wish to participate, please complete the sensory questionnaire. By completing the anonymous questionnaire and returning it, you are confirming that you have read and understood what is involved in the study and you are agreeing to take part of this study.

Right to withdraw: You can leave at any point during the study. Completion of the questionnaire is taken as your consent to use the data. Questionnaire cannot be removed after the test as they can’t be identified.

If you have any queries or require further information, please contact me via my supervisor Dr. Anita Setarehnejad (asetarehnejad@cardiffmet.ac.uk).

Thank you for your time.

xxxxxx
Appendix 5 – Sensory Analysis Questionnaire

Triangle test:

Type of sample: Reduced Egg Cake

Note: This Product contains the following allergens/culturally sensitive ingredients: Gluten, Lactose, Egg and Soya

In total you will be asked to taste 3 different samples on 1 tray.

Instructions to tasters:

Taste the samples on the tray from left to right. Two samples are alike; one is different. Select the odd/different sample and identify it by placing a X in the corresponding box.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Indicate odd sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

If you wish to comment on the reasons for your choice or on the characteristics of the sample, you may do so here:

.........................................................................................................................................................................................
.........................................................................................................................................................................................
.........................................................................................................................................................................................
.........................................................................................................................................................................................

Many thanks for your time, please replace all items back through the hatch, except for used ‘spit cups’ which should be placed in the black bin before you leave the room.

You may withdraw from the test at any time by simply leaving the room.
Appendix 6 – Weight and Volume Data

<table>
<thead>
<tr>
<th>Weight (g)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>100% Egg</td>
<td>176.0</td>
<td>174.1</td>
<td>178.6</td>
<td>178.7</td>
</tr>
<tr>
<td>75% Egg</td>
<td>175.3</td>
<td>179.5</td>
<td>176.1</td>
<td>176.6</td>
</tr>
<tr>
<td>50% Egg</td>
<td>178.3</td>
<td>173.3</td>
<td>181.0</td>
<td>177.0</td>
</tr>
<tr>
<td>25% Egg</td>
<td>178.1</td>
<td>159.3*</td>
<td>177.4</td>
<td>179.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Volume (ml)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>100% Egg</td>
<td>312.7</td>
<td>310.7</td>
</tr>
<tr>
<td>75% Egg</td>
<td>326.1</td>
<td>329.3</td>
</tr>
<tr>
<td>50% Egg</td>
<td>324.3</td>
<td>320.8</td>
</tr>
<tr>
<td>25% Egg</td>
<td>298.3</td>
<td>299.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average weight (g)</th>
<th>Average Volume (ml)</th>
<th>Specific Volume (ml/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Egg</td>
<td>176.9</td>
<td>311.7</td>
</tr>
<tr>
<td>75% Egg</td>
<td>176.9</td>
<td>327.7</td>
</tr>
<tr>
<td>50% Egg</td>
<td>177.4</td>
<td>322.6</td>
</tr>
<tr>
<td>25% Egg</td>
<td>178.2</td>
<td>298.8</td>
</tr>
</tbody>
</table>

Appendix 7 – Texture Analysis

Graph 1 – 100% egg
Graph 2 – 75% egg/25% egg replacer

Graph 3 – 50% egg/50% egg replacer

Graph 4 – 25% egg/75% egg replacer
Graph 5 – Week old 100% egg

Graph 6 – Week old 75% egg/25% egg replacer

Graph 7 – Week old 50% egg/50% egg replacer
Graph 8 – Week old 25% egg/75% egg replacer

Appendix 8 – SPSS Printouts

### Friedman Test

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol_100</td>
<td>1.00</td>
</tr>
<tr>
<td>Vol_75</td>
<td>2.00</td>
</tr>
</tbody>
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**Test Statistics**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Chi-Square</th>
<th>df</th>
<th>Asymp. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>2.000</td>
<td>1</td>
<td>.157</td>
</tr>
</tbody>
</table>

*a. Friedman Test*

### Friedman Test

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol_100</td>
<td>1.00</td>
</tr>
<tr>
<td>Vol_50</td>
<td>2.00</td>
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</tbody>
</table>

**Test Statistics**

<table>
<thead>
<tr>
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<th>Chi-Square</th>
<th>df</th>
<th>Asymp. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>2.000</td>
<td>1</td>
<td>.157</td>
</tr>
</tbody>
</table>

*a. Friedman Test*

### Friedman Test

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol_100</td>
<td>2.00</td>
</tr>
<tr>
<td>Vol_25</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**Test Statistics**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Chi-Square</th>
<th>df</th>
<th>Asymp. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>2.000</td>
<td>1</td>
<td>.157</td>
</tr>
</tbody>
</table>

*a. Friedman Test*

Appendix 9 – Log Book