

# Sensory characterization of Donuts with egg substitute

Report\_2667\_Donut\_AFI\_01.04.19



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Date: 01.04.2019  
Page: 1 of 12  
Appendix: 3  
Initials: TAJA  
Task no.: 857241

**Customer:** Contactperson: Nanna Vardar Berthel  
Company: Arla Foods Ingredients Group P/S  
Address: Sønderhøj 10  
City: DK-8260 Viby

**Periode:** The test has been completed 21.03.2019.

**Procedure:** DS/EN ISO 13299:2016, 2. Edition 2016-04-21

**Results:** Illustrated as bargraph and spider plots, se result section figures 1 – 6. The vocabulary developed 20.03.2019, see UK version appendix 1 and DK version appendix 2. See appendix 3 for Pictogram: how to evaluate donut

**Storage:** The sample material will be destroyed immediately after the end of the test, unless otherwise agreed in writing.

**Terms:** The test has been carried out in accordance with Danish Technological Institute general terms and conditions, which apply at the time of the conclusion of the agreement. The test results apply only to the tested items. The test report may only be reproduced in extracts if the laboratory has approved the extract in writing.

**Division:** Agro Tech, Technological Institute, DK-8000 Aarhus C

**Signature:** Tanja Frydenlund Jaedeke  
Technical Consultant



| TESTDATA  |  |                            |                 |            |   |
|---|--|----------------------------|-----------------|------------|---|
| Initials  | TAJA   | Test No.                   | 2667            | Accredited | - |
| Project name  | Sensory characterization of Donuts with egg substitute       |                            |                 |            |   |
| Test type   | Profile test   |                            |                 |            |   |
| <b>Assignment</b>   |  |                            |                 |            |   |
| Arla Foods Ingredients has requested a sensory characterization of donuts with egg substitute (test product), in conjunction with a sensory characterization of donuts with egg (reference product) Both fresh donuts and donuts that have been stored frozen, are evaluated in this test. Only the crumb is evaluated regarding assessment of appearance and taste attributes. |  |                            |                 |            |   |
|   |  |                            |                 |            |   |
| Vocabulary develop.   | 20.03.2019   |                            |                 |            |   |
| Test date   | 21.03.2019   |                            |                 |            |   |
|   |  |                            |                 |            |   |
| <b>Sample preparation/treatment</b>   |  |                            |                 |            |   |
| The donuts are cut into quarters (see appendix 3 - Pictogram: how to evaluate donut). One quarter is cut open, hence assessment of taste attributes, are evaluated only on the crumb (no crust)   |  |                            |                 |            |   |
| Serving amount  | 1 donut per evaluation                                       |                            |                 |            |   |
| Tableware name/No.  | Cater Source, paptallerken, bionedbrydelig m. coating, 18 cm |                            |                 |            |   |
| Neutralizing  | Tap water and cream crackers                                 |                            |                 |            |   |
| <b>Serving temperature</b>  |  |                            |                 |            |   |
| Customer requirements   | Room temperature   |                            |                 |            |   |
| Intern evaluation   | 20 +/- 0,5 °C  |                            |                 |            |   |
| Thermometer no.   | 6644/6670  |                            |                 |            |   |
|   |  |                            |                 |            |   |
| <b>Samples</b>  |  |                            |                 |            |   |
|   |  |                            |                 |            |   |
| Code  | ID for graphs  | Other information          | DTI sample code |            |   |
| 70002610-57-01  | FRISK REF  | Fresh with egg             | 2667-3394       |            |   |
| 70002610-57-02  | FRISK TEST   | Fresh with egg substitute  | 2667-3395       |            |   |
| 70002610-55-01  | FROST REF  | Frozen with egg            | 2667-3396       |            |   |
| 70002610-55-02  | FROST TEST   | Frozen with egg substitute | 2667-3397       |            |   |



### Short description of profiling method

The profiling method is based on a classical descriptive analysis (QDA)<sup>1</sup> in which a screened and trained panel of selected assessors evaluates the products by using their senses and expressing their perceived intensity of an attribute using an unstructured line scale.

The scale used for assessment is a 15 cm unstructured graphical line-scale as shown below.

Low intensity

High intensity



Usually the assessors put a mark on the scale relative to the intensity of the attribute to be assessed. However, in this study the attributes were predefined and the reference was marked in the center of the scale. Thus the assessors assessed if the samples had a lower or higher intensity of a given attribute, compared to the reference.

### Assessment

Each sample was identified by a 3-digit code on the cups so the individual assessor was not able to recognize the identity or an order of the samples or have any preferences for or against the sample. The assessors gave their assessments of all attributes for one sample on computer before receiving next sample.

### Statistics and preparation of test data

The results from the sensory evaluation are statistically analyzed using Analysis of Variance (ANOVA) and Duncan's multiple range tests, to find if there is a significant difference between products for each attribute. Mean value for one product for an attribute is the mean value of the assessors' scores for all replicates. Graphical presentations are presented as a bargraph or as spider plots and showing mean values for all attributes for one or more products. NS indicate no significant difference, significant level are indicated by \* (5%), \*\* (1%) and \*\*\* (0,01%)

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<sup>1</sup> DS/EN ISO 13299:2016, 2. Edition 2016-04-21

# Overall comparison: Spiderplot



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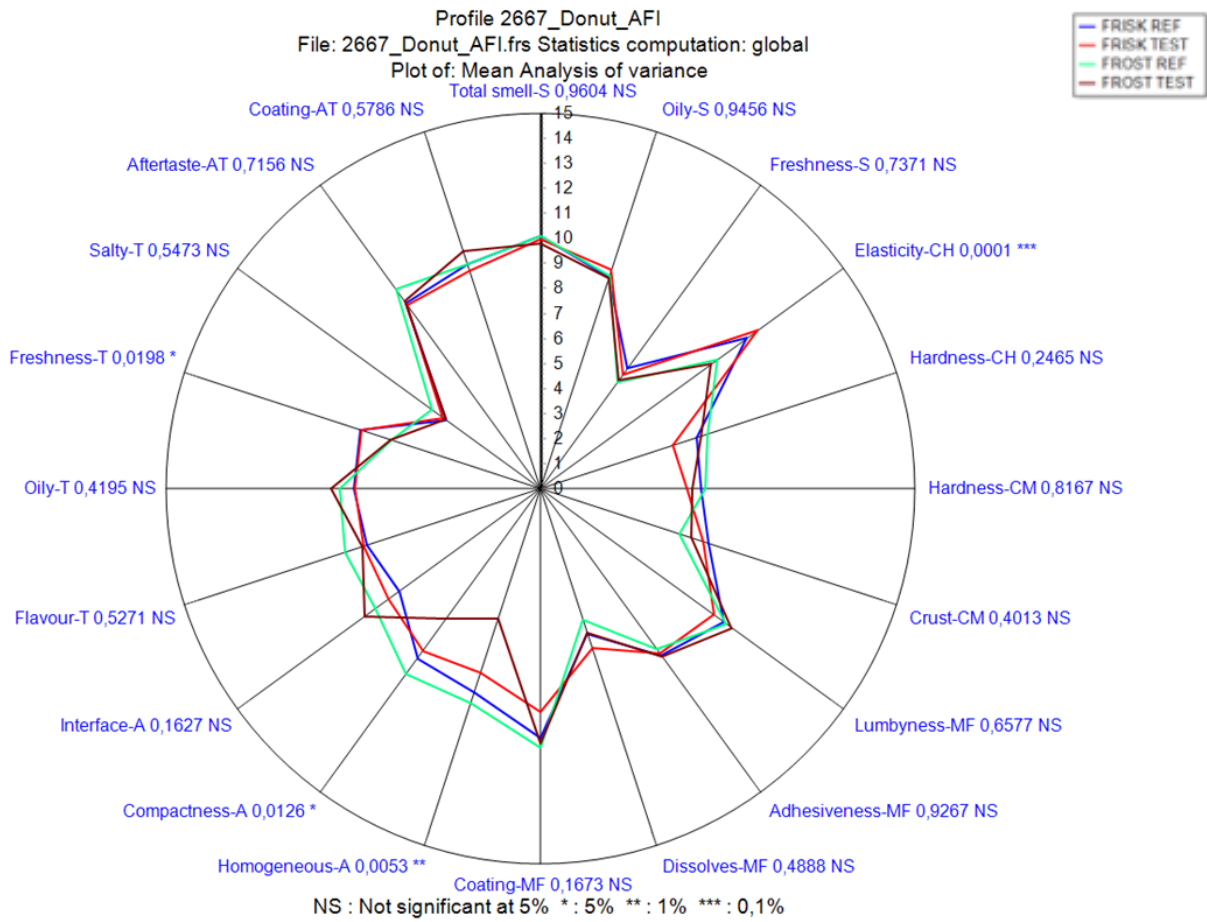


Fig.1: Grapical spiderplot - showing the mean values of Donuts for attributes as presented in vocabulary appendix 1. The axes can be compared with the arbitrary scale used for the assessment (15 cm line scale) with the starting point (0) in the centre and maximum at the outer circle. NS = not significant at 5%, \*:5%, \*\*:1% and \*\*\*:0,1%

**Comments:** The overall result shows that there are some few differences between the samples tested in this survey. There is significant difference in four out of twenty attributes. There is significant difference in the following attributes: Elasticity-CH, Homogeneous-A, Compactness-A and Freshness-T

See Vocabulary appendix 1 for definitions upon attributes.

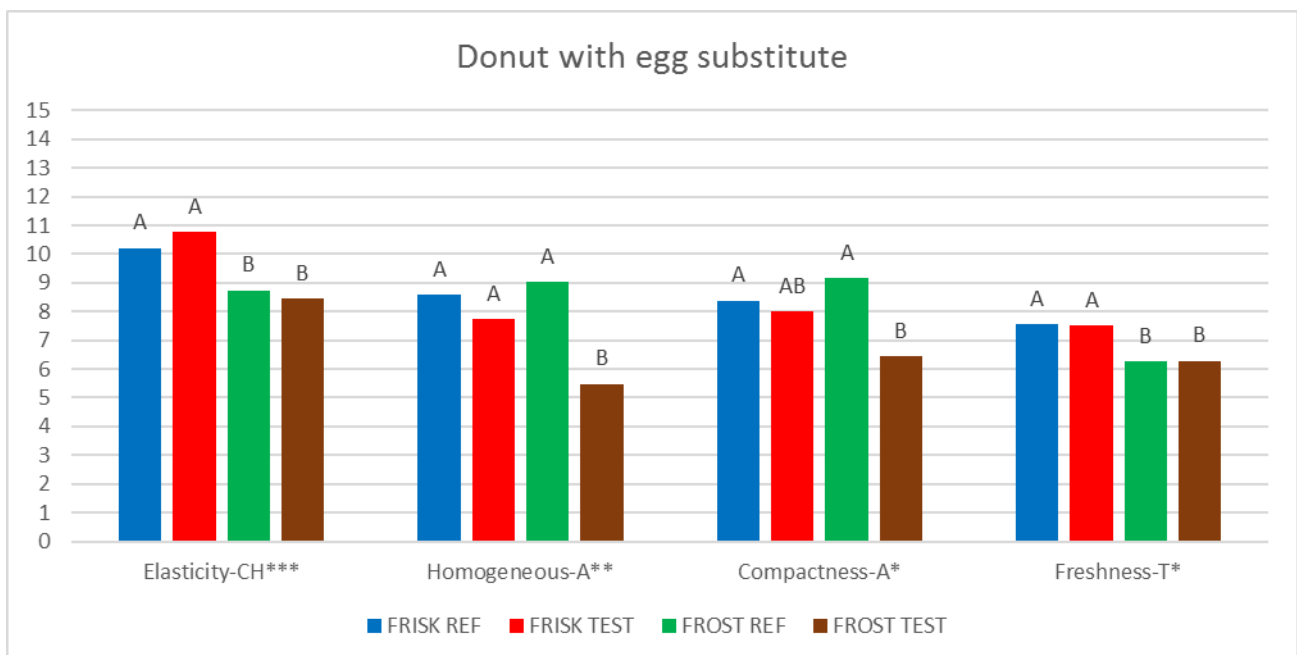


Fig.2: Graphical barplot - An analysis of variance and Duncan’s multiple range tests are made for each attribute, to test for statistical difference of mean values of the twelve samples. The lines can be compared with the arbitrary scale used for the assessment (15 cm line scale) with the starting point (0) at the bottom. The graphical barplot are showing the attributes where there’s significantly difference

Note: Two samples with the same letter (grouping) are NOT significantly different.

**Comments:** FRISK REF and FRISK TEST groups and has more elastic response to pressure, when pressed with index finger, compared to FROST REF and FROST TEST who groups and has less elastic response to pressure.

FRISK REF, FRISK TEST and FROST REF groups and are more homogeneous, the amount of holes and hole size are homogeneous distributed within the crumb, compared to FROST TEST which is more less homogeneous.

FROST TEST differs from FRISK REF and FROST REF by being airier. FRISK TEST doesn’t differ hence it have letters grouping with the three other samples tested in this survey.

FRISK REF and FRISK TEST groups and has more fresh taste, compared to FROST REF and FROST TEST who groups and has more stale/dusty taste.

See Vocabulary appendix 1 for definitions upon attributes.

**Comparison: FRISK REF vs. FRISK TEST**



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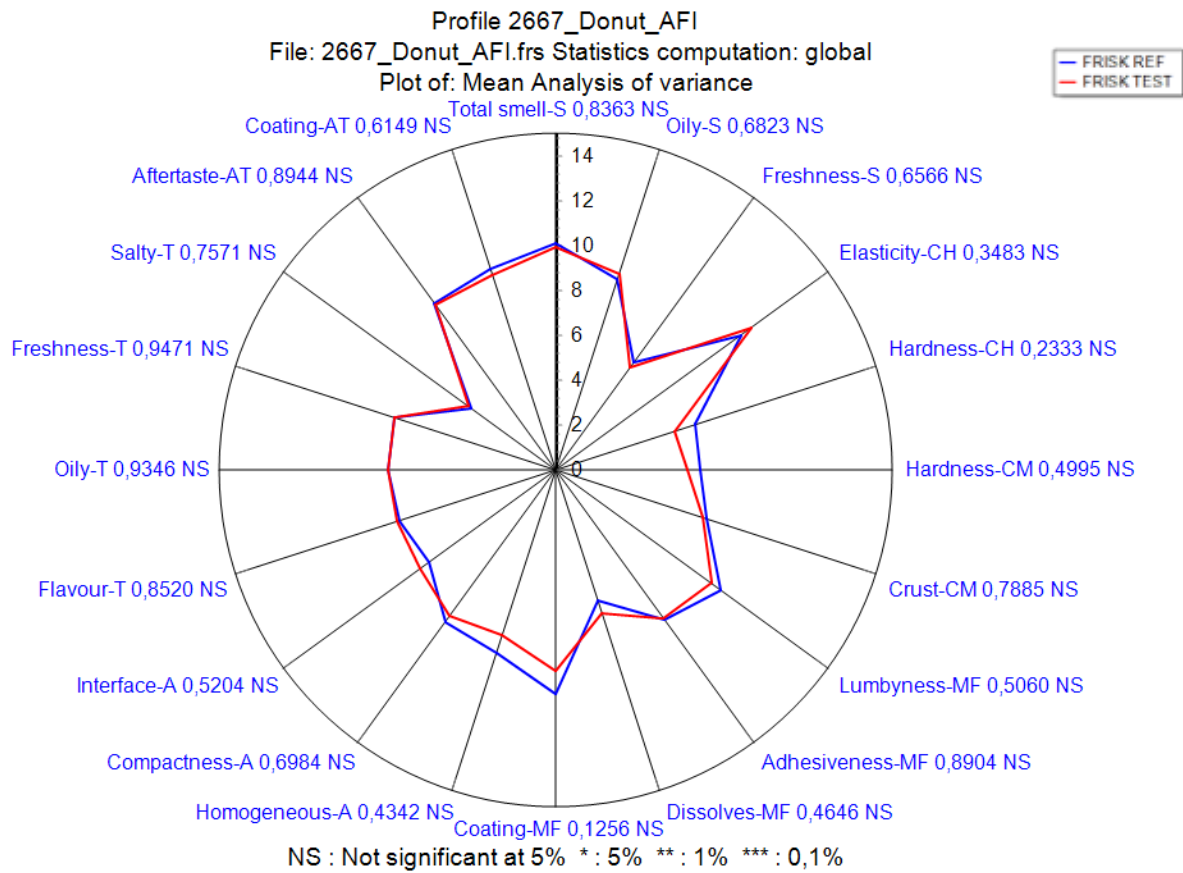


Fig.3: Grapical spiderplot - showing the mean values of Donuts (FRISK REF vs. FRISK TEST) for attributes as presented in vocabulary appendix 1. The axes can be compared with the arbitrary scale used for the assessment (15 cm line scale) with the starting point (0) in the centre and maximum at the outer circle. NS = not significant at 5%, \*:5%, \*\*:1% and \*\*\*:0,1%

**Comments:** The result shows that there are no differences between the samples tested in this survey.

The result shows that there are no significant differences when comparing fresh made Donuts, regardless if it's reference production with egg or test production with egg substitute.

See Vocabulary appendix 1 for definitions upon attributes.

**Comparison: FROST REF vs. FROST TEST**



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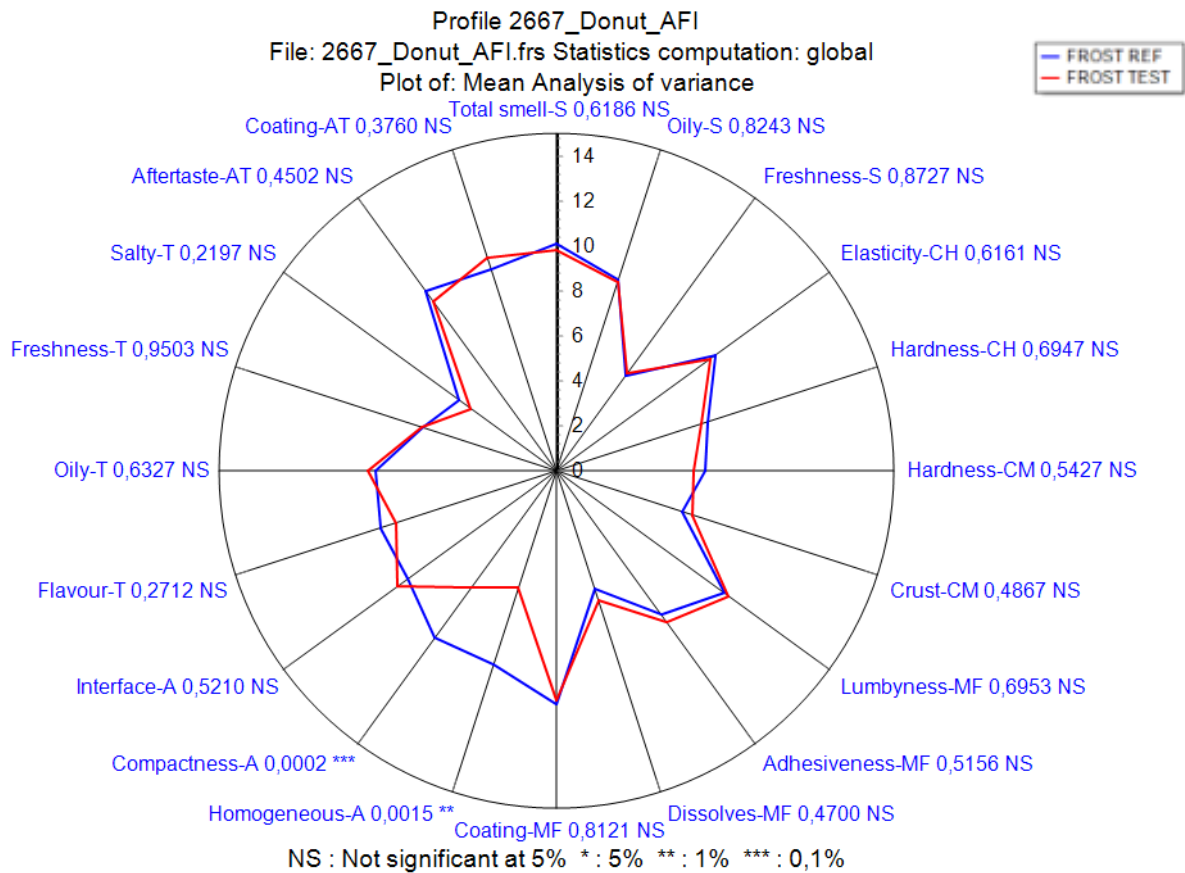


Fig.4: Grapical spiderplot - showing the mean values of Donuts (FROST REF vs. FROST TEST) for attributes as presented in vocabulary appendix 1. The axes can be compared with the arbitrary scale used for the assessment (15 cm line scale) with the starting point (0) in the centre and maximum at the outer circle. NS = not significant at 5%, \*:5%, \*\*:1% and \*\*\*:0,1%

**Comments:** The result shows that there are only few differences between the samples tested in this survey. There is significant difference in two out of twenty attributes. There is significant difference in the following attributes: Homogeneous-A and Compactness-A

FROST REF are more homogeneous, the amount of holes and hole size are homogeneous distributed within the crumb, compared to FROST TEST which is more less homogeneous. FROST TEST appears airier compared to FROST REF which appears more compact/dense

See Vocabulary appendix 1 for definitions upon attributes.

**Comparison: FRISK REF vs. FROST REF**



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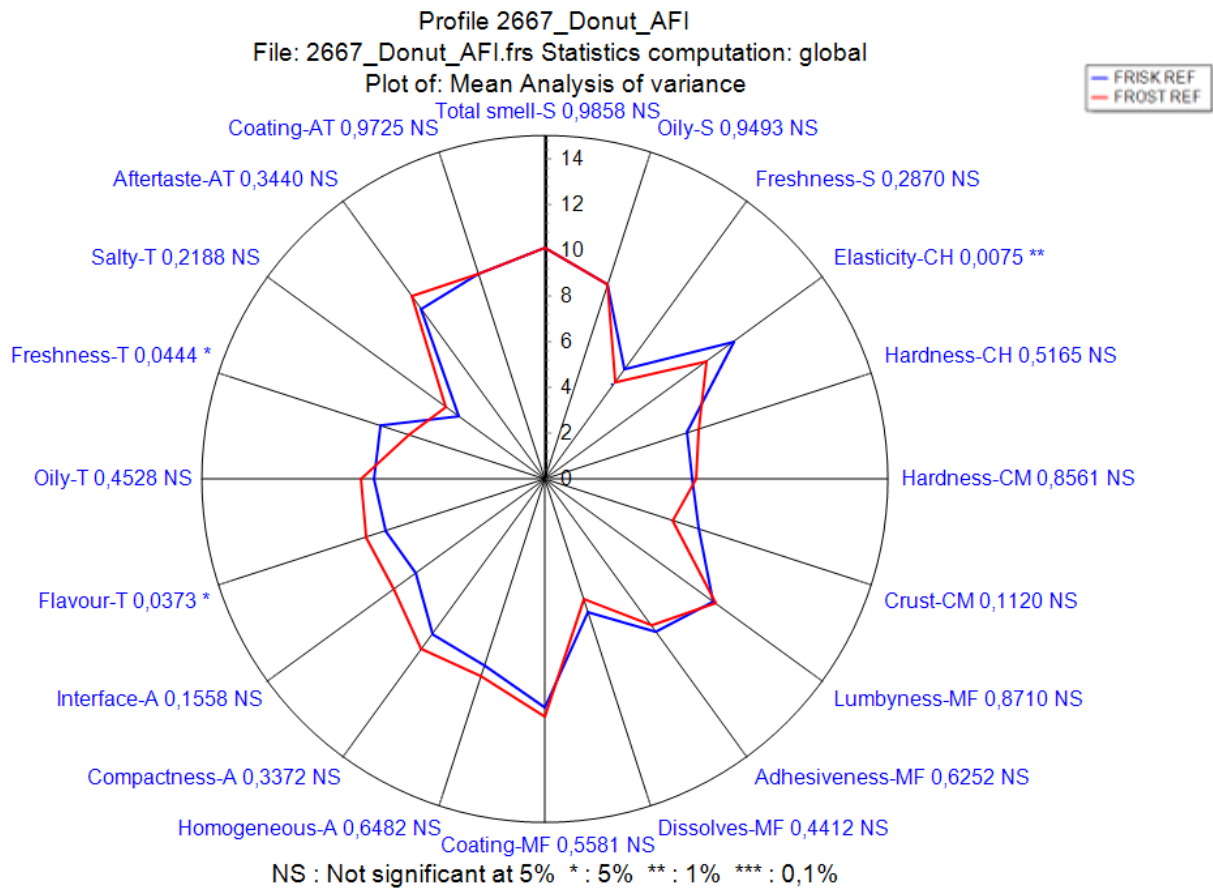


Fig.5: Grapical spiderplot - showing the mean values of Donuts (FRISK REF vs. FROST REF) for attributes as presented in vocabulary appendix 1. The axes can be compared with the arbitrary scale used for the assessment (15 cm line scale) with the starting point (0) in the centre and maximum at the outer circle. NS = not significant at 5%, \*:5%, \*\*:1% and \*\*\*:0,1%

**Comments:** The result shows that there are only few differences between the samples tested in this survey. There is significant difference in three out of twenty attributes. There is significant difference in the following attributes: Elasticity-CH, Flavour-T and Freshness-T.

FRISK REF has more elastic response to pressure, when pressed with index finger. FRISK REF is less flavor intense, compared to FROST REF which have more explosion of taste at first impression/mouthfeel. FRISK REF has more fresh taste, compared to FROST REF which have more stale/dusty taste.

See Vocabulary appendix 1 for definitions upon attributes.



**Comparison: FRISK TEST vs. FROST TEST**



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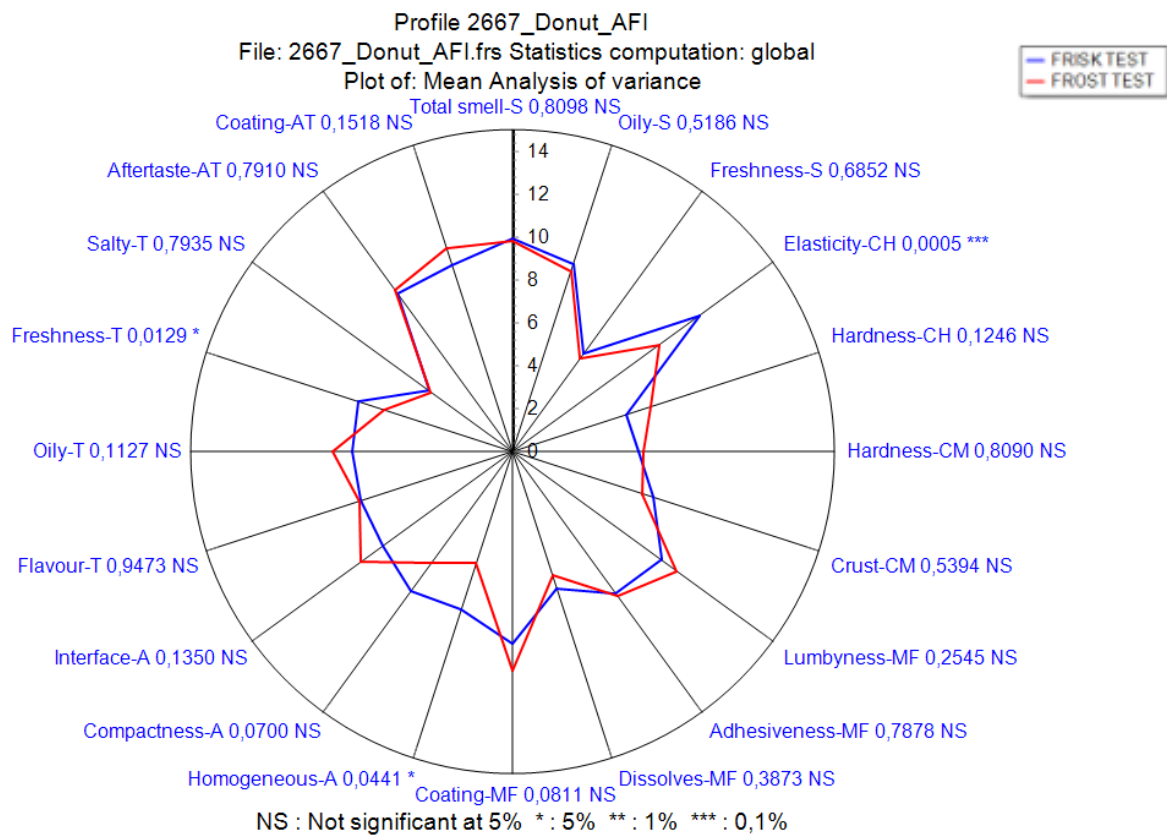


Fig.6: Grapical spiderplot - showing the mean values of Donuts (FRISK TEST vs. FROST TEST) for attributes as presented in vocabulary appendix 1. The axes can be compared with the arbitrary scale used for the assessment (15 cm line scale) with the starting point (0) in the centre and maximum at the outer circle. NS = not significant at 5%, \*:5%, \*\*:1% and \*\*\*:0,1%

**Comments:** The result shows that there are only few differences between the samples tested in this survey. There is significant difference in three out of twenty attributes. There is significant difference in the following attributes: Elasticity-CH, Homogeneous-A and Freshness-T.

FRISK TEST has more elastic response to pressure, when pressed with index finger. FRISK TEST are more homogeneous, the amount of holes and hole size are more homogeneous distributed within the crumb, compared to FROST TEST which is more less homogeneous. FRISK TEST has more fresh taste, compared to FROST TEST which have more stale/dusty taste.

See Vocabulary appendix 1 for definitions upon attributes.



| <b>Assesment of smell attributes</b>   |               |   |
|--|---------------|---|
| Total smell-s  | little → much | The total intensity of all odor attributes at first impression.   |
| Oily-s   | little → much | The smell of frying oil (the crust is assessed)   |
| Freshness-s  | little → much | Little = stale/dusty smell<br>Much = fresh smell  |
| <b>Assesment of consistency with hand, press with index finger.</b>  |               |   |
| Elasticity-ch  | little → much | Little = no elastic response to pressure.<br>Much = elastic response to pressure/resilient/bounce back  |
| Hardness-ch  | soft → hard   | The hardness of a sample by press with index finger   |
| <b>Assesment of consistency by mouth, at first bite by incisors.</b>   |               |   |
| Hardness-cm  | soft → hard   | The firmness of a sample at first bite with incisors.   |
| Crust-cm   | soft → crispy | Soft = a soft crust/feeling like no crust<br>Crispy = a crispy crust/there 's bite  |
| <b>Assessment of mouthfeel</b>   |               |   |
| Lumbyness-mf   | little → much | The sample lumps<br>Little = no lumps<br>Much = lumps into one or few big lumps   |
| Adhesiveness-mf  | little → much | Little = the sample is not sticky, flowing perfectly in the mouth<br>Much = the sample is sticky and hangs in the mouth, is going to be moved around in the mouth   |
| Dissolves-mf   | slow → fast   | The rate at which the sample dissolve and disappear<br>Slow = the sample dissolve very slow<br>Fast = the sample dissolve very fast   |
| Coating-mf   | little → much | Layer of fat that lies like a lining on the lips and in the mouth   |
| <b>Assessment of appearance of the crumb (no crust)</b>  |               |   |
| Homogeneous-a  | little → much | Little = the amount of holes and hole size are not homogeneous distributed within the crumb (unhomogeneous)<br>Much = the amount of holes and hole size are homogeneous distributed within the crumb<br>(bigger air pockets are not assessed)       |
| Compactness-a  | little → much | Little = airy<br>Much = compact/dense   |
| Interface-a  | little → much | Little = nice clean cut<br>Much = flaky/flossy interface  |
| <b>Assesment of taste attributes of the crumb (no crust)</b>   |               |   |
| Flavour intensity-t  | little → much | The total intensity of all taste attributes at first impression/mouthfeel<br>Low = no taste explosion<br>High = big taste explosion   |
| Oily-t   | little → much | The taste of frying oil   |
| Freshness-t  | little → much | Little = stale/dusty taste<br>Much = fresh taste  |
| Salty-t  | little → much | Little = bland, unsalted flavor<br>Much = salty flavor  |
| <b>Assessment of aftertaste...after the sample is swallowed</b>  |               |   |
| Aftertaste-at  | short → long  | Length of aftertaste, any aftertaste taking into account. Chewing to normal condition for swallowing and not further. A bitter aftertaste is included in aftertaste assessment.<br>short = the aftertaste is short<br>long = the aftertaste is long |
| Coating-at   | little → much | Layer of fat that lies like a lining on the lips and in the mouth after the sample is swallowed   |
| Suffix for smell = s, consistency with hand = ch, consistency with mouth =cm, mouthfeel = mf, appearance = a, taste = t, aftertaste = at |               |   |



| <b>Vurdering af lugt</b>  |                    |  |
|---|--------------------|--|
| Total lugt-l  | lidt → meget       | Den totale lugt intensitet af alle lugt egenskaberne ved første indtryk.   |
| Olieret-l   | lidt → meget       | Lugten af friture olie (skorpen er vurderet)   |
| Friskhed-l  | lidt → meget       | Lidt = ufrisk/støvet lugt<br>Meget = frisk lugt  |
| <b>Vurdering af konsistens med hånd, ved tryk med pegefingre.</b>   |                    |  |
| Elasticitet-kh  | lidt → meget       | Lidt = ingen elastisk respons ved tryk.<br>Meget = elastisk respons ved tryk/fjedrende   |
| Hårdhed-kh  | blød → hård        | Prøvens hårdhed ved tryk med pegefingre  |
| <b>Vurdering af konsistens med mund, ved første bid med fortænderne.</b>  |                    |  |
| Hårdhed-km  | blød → hård        | Prøvens hårdhed ved første bid med fortænderne   |
| Skorpe-km   | blød → sprød       | Blød = en blød skorpe/føles som skorpefri<br>Sprød = en sprød skorpe/der er bid i skorpen  |
| <b>Vurdering af mundfølelse</b>   |                    |  |
| Klumper-mf  | lidt → meget       | Prøven klumper sammen<br>Lidt = ingen klumper<br>Meget = klumper sammen til en eller få større klumper   |
| Klæg-mf   | lidt → meget       | Lidt = prøven er ikke klistret/klæg, flyder uden hindring rundt i munden<br>Meget = prøven er klistret/klæg, hænger i munden, skal flyttes rundt med tungen  |
| Opløselighed-mf   | langsomt → hurtigt | Den hastighed hvorved prøven opløses og forsvinder fra mundhulen<br>Langsomt = prøven opløses langsomt<br>Hurtigt = prøven opløses hurtigt   |
| Coating-mf  | lidt → meget       | Olieret belægning på læber og i mundhulen  |
| <b>Vurdering af udseende af krummen (skorpefri)</b>   |                    |  |
| Homogen-u   | lidt → meget       | Lidt = hul størrelse og hul mængde er ikke ensartet fordelt i krummen<br>Meget = hul størrelse og hul mængde er ensartet fordelt i krummen<br>(større luftlommer bedømmes ikke)  |
| Kompakt-u   | lidt → meget       | Lidt = luftig<br>Meget = tæt/kompakt   |
| Snitflade-u   | lidt → meget       | Lidt = pæn snitflade<br>Meget = flaget/flosset snitflade   |
| <b>Vurdering af smageegenskaber af krummen (skorpefri)</b>  |                    |  |
| Total smag-s  | lidt → meget       | Den totale intensitet af alle smags egenskaber ved første indtryk/mundfølelse<br>Lidt = ingen smags eksplosion<br>Meget = stor smags eksplosion  |
| Olieret-s   | lidt → meget       | Smag af friture olie   |
| Friskhed-s  | lidt → meget       | Lidt = ufrisk/støvet smag<br>Meget = frisk smag  |
| Salt-s  | lidt → meget       | Lidt = fad, usaltet smag<br>Meget = saltet smag  |
| <b>Vurdering af eftersmag...al sansning efter prøven er sunket</b>  |                    |  |
| Eftersmag-e   | kort → lang        | Eftersmagens længde af enhver eftersmag/alle eftersmags. Tygges indtil normal "synke tilstand" og ikke længere. Bitter eftersmag er inkluderet i vurdering af eftersmag.<br>kort = eftersmagen er kort<br>lang = eftersmagen er lang |
| Coating-e   | lidt → meget       | Olieret belægning på læber og i mundhulen efter prøven er sunket   |
| Suffix for lugt = l, konsistens med h = kh, konsistens med mund = km, mundfølelse = mf, udseende = u, smag = s, eftersmag = e |                    |  |

