

Consumer preferences for iced coffee determined by conjoint analysis: an exploratory study with Norwegian consumers

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TITLE:

Consumer preferences for iced coffee determined by conjoint analysis:

An exploratory study with Norwegian consumers

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SUMMARY

The main aim of this paper is to investigate consumer preferences for extrinsic attributes of iced coffee, explore consumers' coffee consumption habits, find new market opportunities and segment consumers based on similar products preferences. A sample of 101 consumers of iced coffee was recruited during 2012 in Norway. Twelve iced coffee products combining different levels of attributes: coffee type, origin, calories and price were presented on screen and rated according to consumers' willingness to buy (WTB). Mixed Model ANOVA, Principal Component Analysis (PCA) and Partial Least Squares Discriminant Analysis (PLS-DA) were applied to analyze data. Results show that the most preferred products for the consumer sample as a whole were low price – low calorie products while age has a significant effect on WTB for different iced coffee products. Four different consumer segments based on type of iced coffee and country of production preferences were identified and discussed.

KEYWORDS

Iced coffee, Conjoint Analysis, Rating, Willingness to buy, Consumers preference, Segmentation, Norway.

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25 INTRODUCTION

26 Iced coffee is now increasing its consumption in Scandinavian countries which have the world's highest
27 levels of coffee consumption (International Coffee Organisation, 2011). Since the early 1980s, iced coffee
28 has been very popular in the USA, Greece and Japan as a refreshing drink where it is usually drunk in
29 small bottles for take-away consumption, or enjoyed for quenching thirst while sitting outside at a café
30 (Petit & Sieffermann, 2007). In 1999 one of the main Norwegian food companies started introducing
31 various types of iced coffee on the food market, and several other brands have followed since this product
32 category has grown in popularity in the recent years. As the iced coffees on the Norwegian market do not
33 have much variety except for the different types of coffee, more information is needed for understanding
34 consumer preferences and choice attributes for this type of product. In addition, since Norwegian
35 consumers have sensory experience with iced coffee, it is highly relevant to consider the impact of
36 various factors such as nutritional, economic, ethnocentric and sensory properties. To the best knowledge
37 of the authors, no studies are available which investigate the consumption of iced coffee in Norway, with
38 particular reference to extrinsic factors affecting consumption. Petit & Sieffermann (2007) investigated
39 the effect of the physical testing environment on liking and consumption of iced coffee by French
40 consumers. With regard to consumer motivations and attitudes, there is a general lack of studies that
41 investigate consumer preferences and motivation for coffee consumption (Rozin & Cines, 1982), with the
42 exception of fair trade or environmentally friendly coffee (De Pelsmacker, et al., 2005; Reynolds, 2004).
43 One of the most applied predictive statistical model which determine consumer response towards
44 different product profiles is Conjoint Analysis (Annunziata & Vecchio, 2013; De Pelsmaeker,
45 Dewettinck, & Gellynck, 2013; Saito & Saito, 2013). CA is defined as a method for analyzing the effect
46 of a number of designed factors (e.g. packaging, information factors, etc.) on consumer acceptance or
47 choice (Næs, Brockhoff, & Tomic, 2010). CA includes a set of techniques able to measure buyers'
48 tradeoffs among multiattribute products or services, including foods (Claret et al., 2012; Cox, et al., 2007;
49 Næs, et al., 2010; Næs, et al., 2010a). CA is used to estimate the structure of consumer evaluations on a
50 set of product profiles consisting in predetermined combinations of product attributes (Green &

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51 Srinivasan, 1978). In this paper, we will use Willingness To Buy (WTB) ratings collected on a 9-point
52 category scale ranging from 1 “I would definitely not buy” to 9 ”I will definitely buy”. In CA, relating
53 consumer preferences to individual differences in demographics, attitudes, habits, etc. is important,
54 because it helps to understand consumer behaviour and provides useful information for improving the
55 process of product development and developing targeted marketing strategies (Endrizzi, Menichelli,
56 Johansen, Olsen, & Næs, 2011). The data presented in this paper are extracted from a large consumer
57 experiment conducted in Norway during autumn 2012. In particular, this paper investigates consumers’
58 preferences for iced coffee varying in several extrinsic attributes. This information is particularly useful
59 for iced coffee producers in Scandinavia, considering Scandinavia have the world’s highest levels of
60 consumption. In the present paper, only the data concerning the rating group of participants will be
61 investigated.

62

63 The paper addresses four questions: (i) What type of iced coffee attributes increases consumers’
64 willingness to buy, (ii) Are coffee consumption habits related to iced coffee consumption habits, (iii) Do
65 conjoint experimental results match self-reported purchase habits for iced coffee and (iv) What are the
66 main iced coffee preference (WTB) segments and who are the people in each of these segments. To
67 achieve this goals the study was organized in two complementary steps: (i) a qualitative approach and (ii)
68 a quantitative approach. The qualitative approach aimed to identify, by means of, which attributes and
69 levels were considered the most relevant in a decision-making process when choosing iced coffee. The
70 quantitative approach applied CA to determine consumer preference for the different levels of the
71 selected attributes, and the relative importance that these attributes have for iced coffee buyers. The
72 quantitative study was completed with a socio-demographic, attitudinal and behavioural questionnaire
73 focusing in particular on iced coffee and (warm) coffee consumption habits.

74

MATERIAL AND METHODS

Focus group: selection of attributes and levels

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77 A discussion was carried out in October 2012 in the South of Norway, in order to identify the most
78 relevant attributes that Norwegian consumers take into account when purchasing iced coffee. The
79 participants were 10 people (N=10) aged between 21 and 56 years. Consumers were selected based on
80 three main criteria: age, gender and frequency of buying/drinking iced coffee. The FG was basically
81 structured in two different topics. The first topic concerned the description of situation of buying/drinking
82 iced coffee, such as motivations for buying/drinking, location, type of outlet, alone/with other people,
83 time of the day, flavors, prices, brands, packaging and quantity. The second topic regarded the
84 characteristics of a typical iced coffee drinker, such as age, lifestyle, etc. The FG discussion was
85 conducted by an experienced moderator while an assistant took notes. The most relevant attributes and
86 levels from a consumer perspective were identified and selected to design the conjoint study. Moreover,
87 the FG provided inputs on iced coffee consumption habits that were used to develop the conjoint study.

88

89 Conjoint study

90 *Participants*

91 A sample of 101 consumers (N=101) were recruited in the region South of Oslo (Norway) in November
92 2012 with an on-line recruitment questionnaire using the EyeQuestion system (Logic8 BV, The
93 Netherlands). Consumers were recruited according to three main criteria: usage frequency of iced coffee,
94 gender and age. Regular consumers of iced coffee aged between 20 and 60 years were selected to take
95 part in the experiment. Finally, for each participating consumer a reward of NOK 300 was attributed to
96 the leisure time organization or club of their choice.

97

98 *Consumer test*

99 The consumer test was held in the sensory lab of Nofima (Ås, Norway) and included four sessions. In the
100 introductory session, a sample of iced coffee was served to the consumers in neutral plastic cups in order
101 to focus the consumers on the product as a warm up sample. In the second session, the conjoint task,
102 consumers rated their probability of buying for different iced coffee profiles presented on screen in the

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103 form of mock-up products. This session is described in details below. The third session involved hedonic
104 ratings on iced coffee samples and is not investigated in this paper. The last session consisted in a
105 questionnaire investigating the consumers' consumption habits for coffee and iced coffee (frequency,
106 location, usage of cream/sugar, etc.) and some socio-demographic characteristics. The participants were
107 seated in separate booths. Data collection was performed on individual computers in the EyeQuestion
108 system (Logic8 BV, The Netherlands).

Selection of iced coffee attributes and levels: conjoint analysis design and iced coffee samples

110 Based on the results obtained from the FG attributes were selected: coffee type, calories, origin and price.
111 Regarding coffee type, two different levels were chosen: "Espresso" and "Latte" as they are among the
112 most frequently consumed coffee types in Norway and they represent two distinct strengths of coffee
113 taste. With concern to the calories, the FG discussion highlighted the importance of calories in consumer
114 choice especially for older consumers. The two levels of calories ("60" and "90 kcal/100 ml") were
115 chosen based on typical calorie levels of iced coffee products that are present on the market. Concerning
116 the country of origin two levels were chosen: "Norway" as the market leader is a Norwegian company,
117 and "Italy" due to its high reputation for coffee products. Finally, as purchasing prices three different
118 levels were chosen, thus representing the high, middle and low end of the prices in the Norwegian market
119 for iced coffee products ("NOK 17", "NOK 23" and "NOK 29", approximately from € 2.2, € 3 and € 3.8
120 per unit). Full factorial design was not appropriate in the present study due to the large number of
121 possible factor and level combinations ($2 \times 2 \times 2 \times 3 = 24$) that should be presented to consumers. In
122 order to effectively test the attribute effects on buyer's preference while reducing the number of product
123 profiles presentations, a fractional factorial design of 12 hypothetical products was constructed (Table 1).
124 This orthogonal array design was created by using the statistical package SAS version 9.3.

Conjoint analysis data collection

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128 Photographs of 12 mock-up products, one for each product profile were created and presented
129 monadically on computer screen and following a balanced randomized order across consumers. Prior to
130 the task, a standard profile picture was shown pointing at the four attributes of interest (only indicating
131 “country”, “price”, “calories” and “coffee type” without any specific level) in order to make participants
132 aware of the location of relevant information on the pictures. For each picture, consumers’ probability of
133 buying was elicited with the question: “Imagine that you are purchasing iced coffee. How likely is it that
134 you would buy this particular iced coffee?”. Answers were gathered on a 9-point scale from 1 (Extremely
135 unlikely) to 9 (Extremely likely).

Statistical data analysis

138 The conjoint rating data were analysed with the purpose to identify significant effects at population level,
139 then define and characterise consumer segments based on individual preferences. This was achieved by
140 applying the following statistical models: Mixed Model ANOVA, Principal Component Analysis (PCA)
141 and Partial Least Squares Discriminant Analysis (PLS-DA).

Mixed model ANOVA

144 In conjoint experiments based on rating scales, the population effects from consumer evaluations are
145 typically analyzed by mixed model ANOVA (Næs et al., 2010). This model includes Calories, Coffee,
146 Origin and Price as main effects, and of the six possible two-way interaction effects the following four
147 were included: Price*Calories, Coffee*Calories, Calories*Origin and Price*Coffee. These main effects
148 and interactions were included as fixed factors, while a Consumer effect was included as random factor.
149 Furthermore, random interaction effects between Consumer and the four factors were included to account
150 for individual preferences. The model is written:

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152 *Probability of buying = Mean + Consumer + Price*Calories + Coffee*Calories + Calories*Origin*
153 *+Price*Coffee+Consumer*Coffee+Consumer*Calories + Consumer*Origin+*
154 *Consumer*Price + random noise*

156 Mixed model ANOVA was run in Minitab v. 16.2.3 (Minitab Inc.). Further details can be found in SM1.

Segmentation: PCA and PLS-DA

159 PCA and PLS regression are statistical methods that allow to interpret complex multivariate data in a
160 manageable and useful way (Cadena, Cruz, Faria, & Bolini, 2012; Cruz et al., 2011; Souza et al., 2011).

161 These methods determine latent variables which are linear combinations of original measured variables.

162 Taking advantage of variable correlations, the methods reduce the dimensionality of the original data and
163 summarize it to structured information.

164 We conducted a segmentation of consumers based on individual preferences by applying PCA on the
165 WTB matrix. Then, common socio-demographic and behavioural characteristics were investigated within
166 segments by performing Partial Least Squares Discrimination Analysis (PLS-DA). Further details can be
167 found in SM2.

168 Table S1 Table S2

RESULTS AND DISCUSSION

Sample description: socio-demographic characteristics

172 The sample includes 101 consumers (N=101). Around 2/3 were women while in terms of age consumers
173 were between 19 to 57 years with a mean of 35 years. Concerning the area of living, almost 75 % live in
174 towns while 25 % live in cities or countryside. In terms of occupation, about 39% were students while
175 60% had a professional occupation.

Drivers of iced coffee consumption

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178 The four main drivers that lead consumers to drinking iced coffee are “*I want to indulge myself*” followed
179 by “*It will keep me awake*” and “*I need new energy* (Figure 1). Therefore consumers’ main motivations
180 for iced coffee consumption are enjoyment and relaxation, as well as energy and caffeine intake.

Most preferred iced coffee products

183 In order to identify the most preferred type of iced coffee for the consumer sample as a whole, we
184 analyzed the willingness to buy (WTB) of consumers for the twelve different iced coffee products by
185 applying the mixed model ANOVA as described above. The residuals approximate a normal distribution
186 quite well supporting the tests below for indicating the relative importance of the factors.

187 The ANOVA model is significant ($p < 0.01$) which means that there are significant statistical differences
188 on WTB among the twelve iced coffee products presented to consumers. Then, Tukey’s test was
189 computed to discover which of the 12 presented iced coffee products consumers were most willing to
190 buy. The most preferred product is P11 (Latte, low calories, produced in Italy and at the lowest price)
191 followed by P4 (Espresso, low calories, produced in Norway and at the lowest price) and P3 (Latte, low
192 calories, produced in Norway and at medium price). Accordingly, no systematic preferences emerge in
193 terms of iced coffee type and country of production. This hints to the presence of consumer segments
194 with diverging preferences, as will be investigated below.

Population effects

Main effects

198 The mixed model ANOVA results shows that both calories and price present significant effects (p -values
199 < 0.01), while the factors coffee and origin are not statistically significant at a 5% level. The significant
200 effects are estimated to be negative, that is to say that consumers on average prefer low calories and low
201 prices to high calories and higher prices (Figure 2). Based on the fitted model, consumers’ WTB increase
202 by 12,6% (0.5 units on the 9-point WTB scale) when reducing calorie content from 90 kcal/100 ml to 60
203 kcal/100 ml and consumers’ WTB increase by 37.7% (1.5 units on the 9-point WTB scale) when reducing

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price from 23 NOK to 17 NOK per 250 ml (Figure 2). These results indicate that there may be a market potential for calorie reduced iced coffee products. It is however important to note that in this experiment, product profiles were presented on-screen without involving tasting. Research studies have demonstrated that low calorie products often perform poorly in hedonic tests compared to their full calorie counterparts (Ares, et al., 2008; Roininen, et al., 2000).

Interaction effects

Only one interaction between conjoint factors is significant: *Calories*Price*, confounded with *Coffee*Origin* (p-values <0.01). The confounding means that it is not statistically possible to identify which of the two interactions is observed, presents both these potential interactions. Consumers on average are more reluctant to pay increasing prices for iced coffee products at low calorie content, decreasing their WTP faster than for high calorie content and has a preference for Espresso iced coffee is associated with a preference for production in Norway. On the other hand, preferences for Latte iced coffee are independent of production origin. Note that as both Calories and Price show significant main effects on consumer's WTB, while neither Coffee nor Origin showed significant main effects, it is reasonable to identify the observed interaction effect as that of *Calories*Price*.

Preference heterogeneity and consumer segmentation

Coffee type and Origin segments

In order to determine consumer segments based on individual preference patterns in the conjoint rating task, a PCA model was run on the data matrix of consumers' Willingness To Buy (WTB) for each product profile as described above. We identified four Principal Components (PCs): coffee type (on PC1, restituting 37% of the variance), price (on PC2, 24%), origin (on PC3, 12%) and calories (on PC4, 8%). Further details can be found in SR1. Thus consumers mostly differed in their coffee type preferences, such that it is interesting to conduct a consumer segmentation on that attribute. Further details can be found in SR2. Figure 3 shows the PCA correlation loadings plot for PC1 and PC3, where distinct product groups appear according to coffee type and origin attribute levels.. We created manually four consumer

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230 segments directly corresponding to the distribution of consumers in the four quadrants. As the clusters
231 were defined based on consumers' similarity of WTB for attributes coffee type and origin, they will be
232 referred to as "Latte/Italy" (26 consumers), "Espresso/Italy" (24 consumers), "Espresso/Norway" (30
233 consumers) and "Latte/Norway" (21 consumers).

Segment characteristics

WTB product profiles

237 The four consumer segments are presented by calculating their respective mean WTB values for each of
238 the factors investigated (Figure 4a-d). The two Latte groups clearly prefer iced coffee "Latte" to
239 "Espresso" and vice versa for the Espresso groups. All segments prefer low calories to high calories iced
240 coffee while the production origin plays a role in segmenting consumers in the four identified groups, and
241 finally all segments prefer lower prices. To describe the consumer segments by socio-demographic
242 characteristics, warm coffee consumption habits and iced-coffee consumption habits, a PLS-DA approach
243 was applied as described above. In the following, only statistically significant results are reported.

Personal attributes

246 Results indicates significant relationships between age and the first segment (Latte/Italy) and the fourth
247 segment (Espresso/Norway) but in opposite directions. More specifically, younger consumers are more
248 attracted to Latte iced coffee from Italy, while older consumers prefer Espresso iced coffee from Norway.
249 In terms of general characteristics such as health conscious, ethnocentrism, taste, place of living (e.g.
250 countryside, city), gender and BMI we did not detect any significant difference among the four segments.

Warm coffee habits

253 With regard to warm coffee consumption habits, four sub-groups of variables successfully discriminated
254 the consumer segments: *Warm coffee type*, *Cream & sugar*, *Consumption frequency* and *Location*.

255 Results shows that from a general perspective there is a strong relationship between warm coffee habits

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256 and iced coffee preferences reflected in the segments belonging. For example, consumers in
257 Espresso/Norway segment show the highest consumption of “Regular”, “Espresso” and “Americano”
258 warm coffee types, and the lowest consumption of “Latte”. An opposite relationship has been found for
259 segment “Latte/Italy”. Further details can be found in SR3.

Iced coffee habits

262 The PLS-DA results indicate that none of the iced coffee characteristics investigated, such as when
263 drinking during the day (e.g. wake up, afternoon, etc.), location of drinking (e.g. home, work, university,
264 etc.), motivation of drinking (e.g. thirsty, energy, etc.), frequency consumption, how long drink, etc.
265 significantly differentiated the four consumer segments. The questionnaire also investigated consumers’
266 purchase habits in terms of brands and iced coffee types, with special emphasis on a Norwegian brand (A)
267 and a foreign brand (B). Results show that consumers in Latte/Italy and Latte/Norway segments were
268 regular purchasers of a Latte product from brand A, while this product was negatively linked to segment
269 Espresso/Norway.

270 Consumers in segment Latte/Norway were also purchasers of a caramel flavored product from brand B,
271 while the same product was significantly *not* characteristic of purchases by consumers in segments
272 Espresso/Italy and Espresso/Norway. On the other hand, these groups typically purchased a caffeine-rich
273 product from brand A which was not consumed by consumers in segments Latte/Italy and Latte/Norway.

274 Conclusively, there is a clear consistence between consumers’ iced coffee product choices in real life and
275 their willingness-to-buy ratings from the conjoint experiment, which are reflected in their segment
276 belonging.

CONCLUSIONS

279 This study aimed at exploring consumers’ iced coffee consumption habits and investigating consumer
280 preferences for extrinsic attributes of iced coffee. Since our aim was not to provide representative data for
281 all the country, but rather it was to explore the relationships among variables (e.g. coffee habits, purchase

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282 motivations, etc.) we state a positive argument for the validity of our results related to sample size
283 (N=101). Experience from literature shows that above N=100 consumers a sample is good enough for
284 detecting important effects. This validity is also supported by the fact that the results (ANOVA) are
285 significant. A larger sample was impossible for economic reasons while we did not provide any economic
286 benefits for consumers, therefore no social bias. Results show that the most preferred products for the
287 consumer sample as a whole were low price – low calorie products. This indicates that there may be a
288 market potential for calorie reduced iced coffee products. Further, four consumer segments were
289 identified that differed in coffee type and production origin preferences: Latte/Italy, Latte/Norway,
290 Espresso/Italy and Espresso/Norway. In terms of personal and socio-demographic characteristics
291 attributes investigated, only age has a significant effect on consumer's WTB various coffee types:
292 younger consumers present higher WTB for "Latte" products while older consumers show higher WTB
293 for "Espresso" and vice versa. None of the other personal characteristics investigated, such as health
294 conscious, ethnocentrism, taste, place of living (e.g. countryside, city), gender and BMI present
295 significant effect on WTB of the four segments.

296 The two consumer groups attracted by the espresso mock-ups reported a high warm coffee consumption
297 and typically purchase iced coffee products with a high caffeine content. The two consumer groups
298 attracted by the latte mock-ups reported lower warm coffee consumption levels, usually add milk, cream
299 and/or sugar in their coffee, and typically purchase latte iced coffee products with low caffeine content
300 and flavoured iced coffee products. Thus, there is a clear consistence between consumers' attributes
301 preferences in the conjoint experiment, their real life choices in terms of iced coffee and their warm
302 coffee consumption habits.

303 Finally, since we did not find in the literature any similar studies about iced coffee it is not possible to
304 compare our findings with other researches. Future researches maybe conduct similar studies in other
305 countries to compare the results and investigate whether the willingness to buy for low calorie iced coffee
306 products persists after product tasting and product exposure over time. Therefore, a final recommendation
307 for further research is also to refine a methodology that incorporate sensory characteristics within conjoint

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analysis in order to provide more valuable information and asset for the food industry (De Pelsmaecker et al., 2013).

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REFERENCES

- Annunziata, A., & Vecchio, R. (2013). Consumer perception of functional foods: A conjoint analysis with probiotics. *Food Quality and Preference*, 28(1), 348–355.
- Ares, G., Giménez, A., & Gámbaro, A. (2008). Understanding consumers' perception of conventional and functional yogurts using word association and hard laddering. *Food Quality and Preference*, 19(7), 636–643.
- Cadena, R. S., Cruz, A. G., Faria, J. A. F., & Bolini, H. M. A. (2012). Reduced fat and sugar vanilla ice creams: Sensory profiling and external preference mapping. *Journal of dairy science*, 95(9):4842-4850.
- Claret, A., Guerrero, L., Aguirre, E., Rincón, L., Hernández, M. D., Martínez, I., ... Rodríguez-Rodríguez, C. (2012). Consumer preferences for sea fish using conjoint analysis: Exploratory study of the importance of country of origin, obtaining method, storage conditions and purchasing price. *Food Quality and Preference*, 26(2), 259–266.
- Cox, D. N., Evans, G., & Lease, H. J. (2007). The influence of information and beliefs about technology on the acceptance of novel food technologies: A conjoint study of farmed prawn concepts. *Food Quality and Preference*, 18(5), 813–823.

Running title: CONSUMER PREFERENCES FOR ICED COFFEE PRODUCTS

- 332 Cruz, A. G., Cadena, R. S., Faria, J. A. F., Oliveria, C. A. F., Cavalcanti, R. N., Bona, E., ... DA SILVA,
333 M. A. A. P. (2011). Consumer acceptability and purchase intent of probiotic yoghurt with added glucose
334 oxidase using sensometrics, artificial neural networks and logistic regression. *International Journal of*
335 *Dairy Technology*, 64(4), 549–556.
- 336 De Pelsmacker, P., Driesen, L., & Rayp, G. (2005). Do Consumers Care about Ethics? Willingness to Pay
337 for Fair-Trade Coffee. *Journal of Consumer Affairs*, 39(2), 363–385.
- 338 De Pelsmaeker, S., Dewettinck, K., & Gellynck, X. (2013). The possibility of using tasting as a
339 presentation method for sensory stimuli in conjoint analysis. *Trends in Food Science & Technology*,
340 29(2), 108–115.
- 341 Endrizzi, I., Menichelli, E., Johansen, S. B., Olsen, N. V., & Næs, T. (2011). Handling of individual
342 differences in rating-based conjoint analysis. *Food Quality and Preference*, 22(3), 241–254.
- 343 Green, P. E., & Srinivasan, V. (1978). Conjoint Analysis in Consumer Research: Issues and Outlook.
344 *Journal of Consumer Research*, 5(2), 103–123.
- 345 International Coffee Organisation. (2011). International Coffee Organisation.
- 346 Næs, T., Almlí, V. L., Bølling Johansen, S., & Hersleth, M. (2010). Alternative methods for combining
347 design variables and consumer preference with information about attitudes and demographics in conjoint
348 analysis. *Food Quality and Preference*, 21(4), 368–378.
- 349 Næs, T., Brockhoff, P., & Tomic, O. (2010). *Statistics for sensory and consumer science*. (Wiley, Ed.).
350 Chichester, UK.
- 351 Petit, C., & Sieffermann, J. M. (2007). Testing consumer preferences for iced-coffee: Does the drinking
352 environment have any influence? *Food Quality and Preference*, 18(1), 161–172.
- 353 Raynolds, L. T. (2004). The globalisation of organic agro–food networks. *World Development*, 32(5),
354 725–743.
- 355 Roininen, K., Lähteenmäki, L., & Tuorila, H. (2000). An application of means-end chain approach to
356 consumers' orientation to health and hedonic characteristics of foods. *Ecology of Food and Nutrition*,
357 39(1), 61–81.

Running title: CONSUMER PREFERENCES FOR ICED COFFEE PRODUCTS

- 358 Rozin, P., & Cines, B. M. (1982). Ethnic differences in coffee use and attitudes to coffee. *Ecology of*
359 *Food and Nutrition, 12*, 79–88.
- 360 Saito, H., & Saito, Y. (2013). Motivations for Local Food Demand by Japanese Consumers: A Conjoint
361 Analysis with Reference-Point Effects. *Agribusiness, 29*(2), 147–161.
- 362 Souza, S. S., Cruz, A. G., Walter, E. H. M., Faria, J. A. F., Celeghini, R. M. S., Ferreira, M. M. C., ...
363 Sant'Ana, A. de S. (2011). Monitoring the authenticity of Brazilian UHT milk: A chemometric approach.
364 *Food Chemistry, 124*(2), 692–695.
- 365
- 366

367 **TABLE LEGENDS**

368 **Table 1 – Hypothetical iced coffee profiles obtained by means of the orthogonal array design.**

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395 **Table 1**

PRODUCT	TYPE OF COFFEE	CALORIES (kcal/100 ml)	COUNTRY OF ORIGIN	PRICE (NOK)
1	Espresso	90	Italy	Kr. 29,-
2	Latte	90	Norway	Kr. 23,-
3	Latte	60	Norway	Kr. 23,-
4	Espresso	60	Norway	Kr. 17,-
5	Latte	90	Norway	Kr. 29,-
6	Espresso	60	Norway	Kr. 29,-
7	Espresso	90	Norway	Kr. 17,-
8	Latte	90	Italy	Kr. 17,-
9	Latte	60	Italy	Kr. 29,-
10	Espresso	90	Italy	Kr. 23,-
11	Latte	60	Italy	Kr. 17,-
12	Espresso	60	Italy	Kr. 23,-

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FIGURE LEGENDS

Figure 1 – Iced coffee consumption motivations expressed in percentage frequency with standard errors

Figure 2– Main effects of the four factors in conjoint rating. Calories and Price have significant main effects while Coffee and Origin do not.

Figure 3 – PCA correlation loadings showing sample and consumer distributions according to attributes Coffee (PC1) and Origin (PC3)

Figure 4 – Average WTB value and standard errors on mock-up products varying in attributes a) Coffee type, b) Calories, c) Origin and d) Price for each of the four consumer segments

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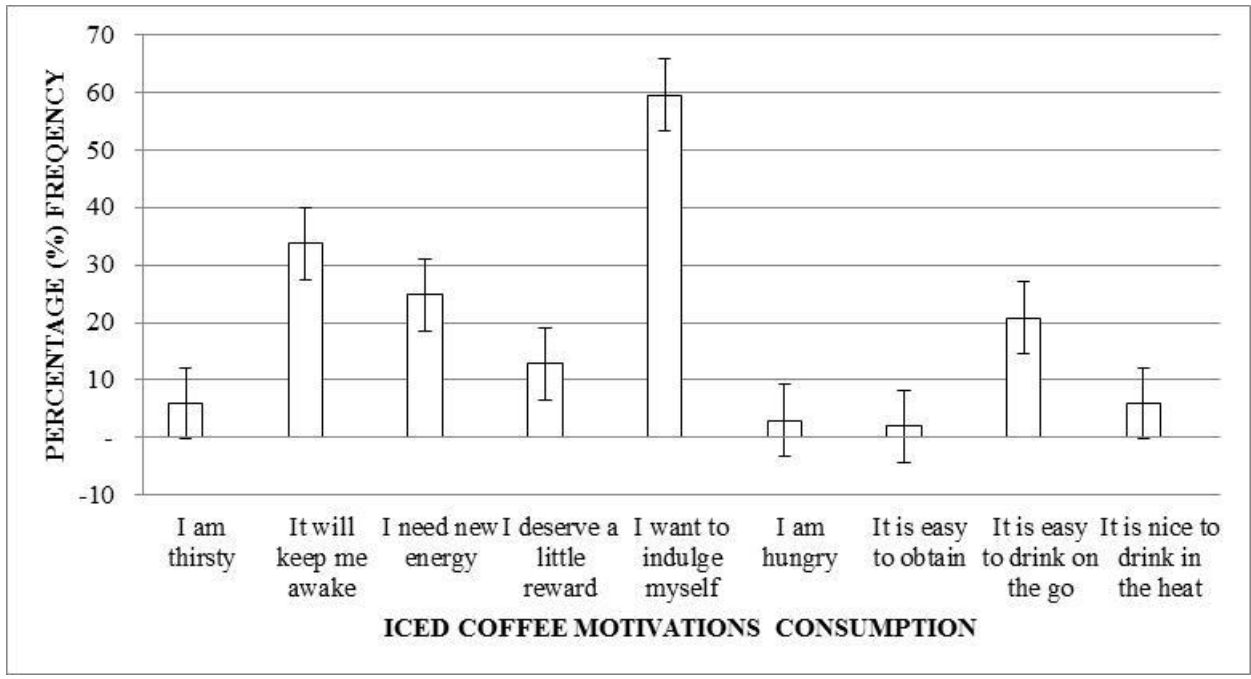
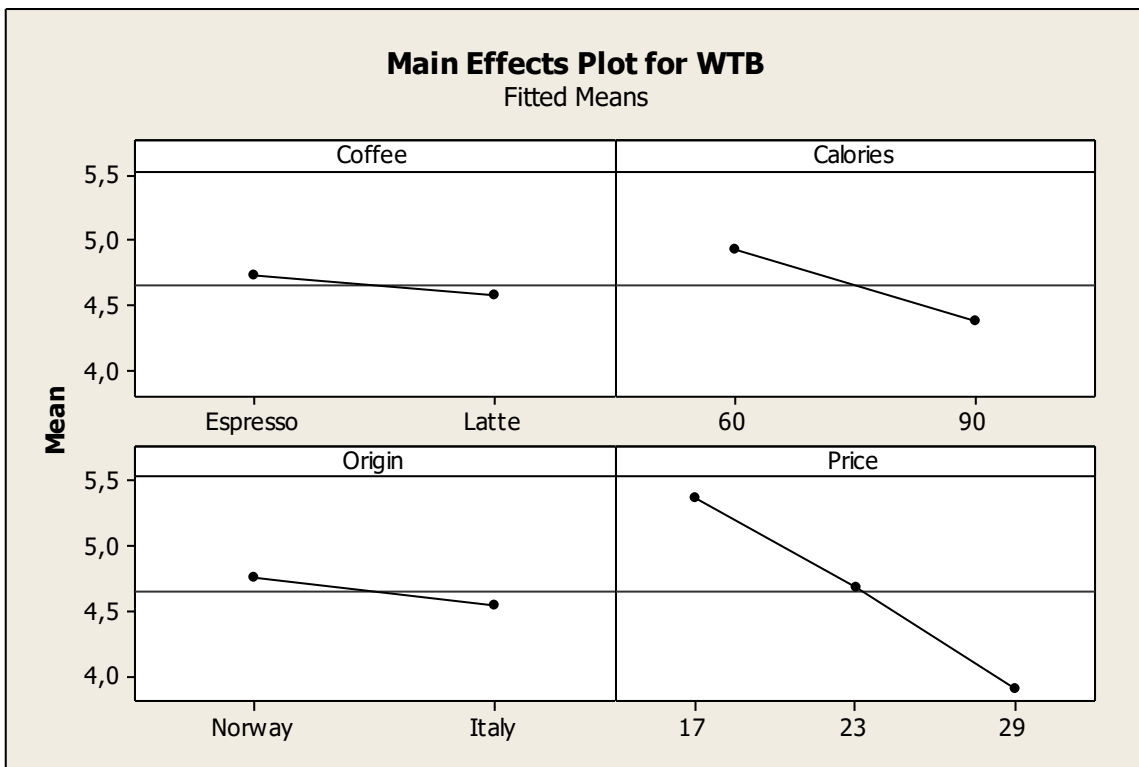


Figure 1

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445 **Figure 2**

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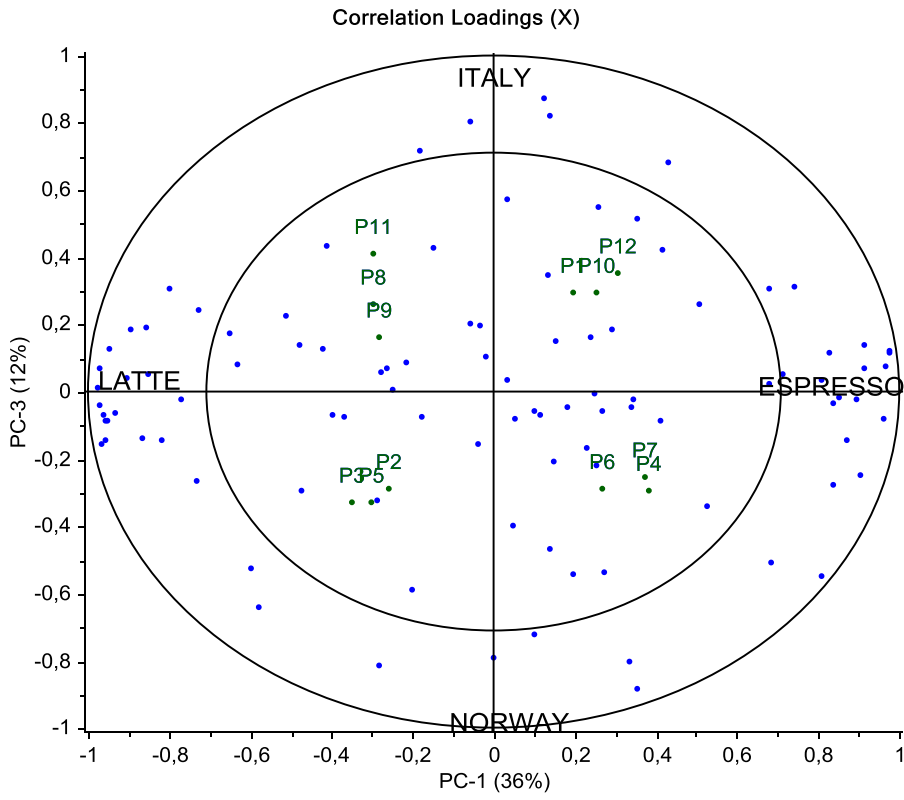


Figure 3

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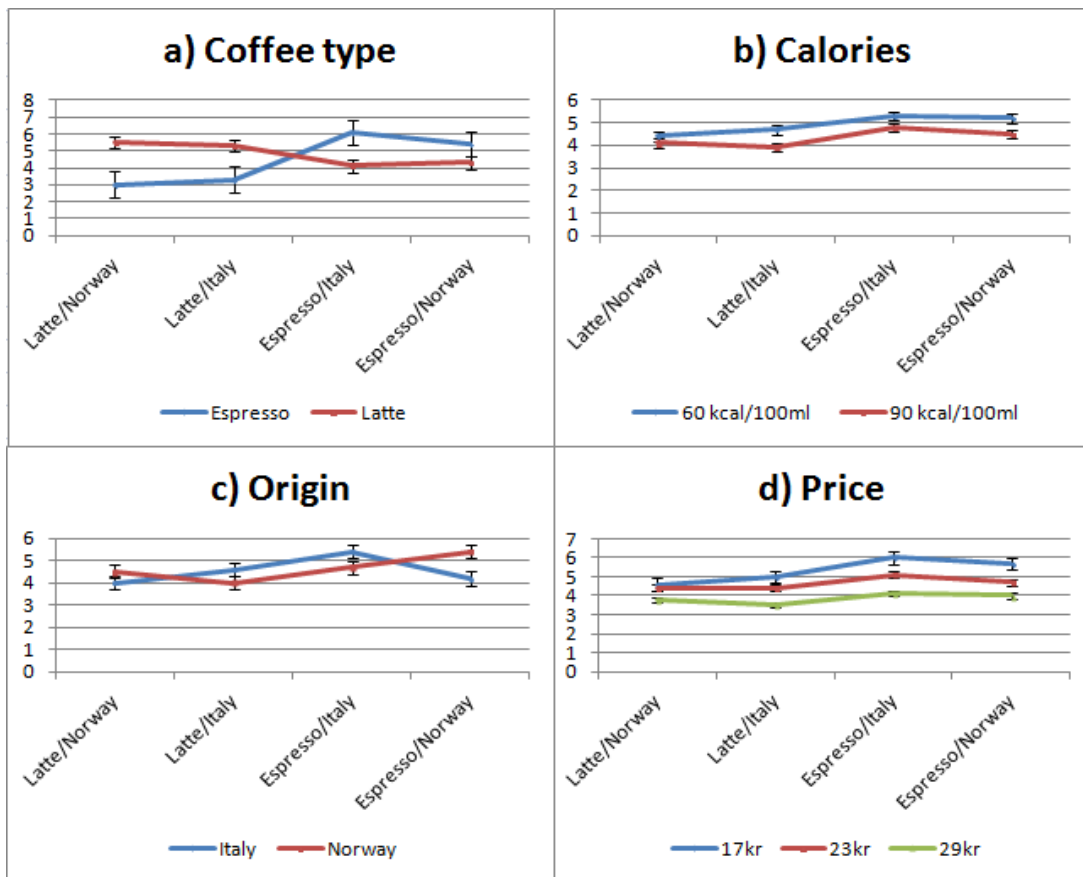


Figure 4

484 **SUPPLEMENTARY TEXT**

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486 **SUPPLEMENTARY MATERIAL AND METHODS**

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488 ***SM1 - Mixed model ANOVA***

489 ANalysis Of VAriance (ANOVA) is one of the most used methodologies when investigating product
490 differences in sensory and consumer studies since the main purpose of this method is to identify and
491 quantify the factors that are responsible for the variability of the response (Næs, Brockhoff, et al., 2010).
492 In the model applied, note that interactions Price*Calories and Price*Coffee are confounded with
493 Coffee*Origin and Price*Origin, respectively.

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495 **SM 2 – Segmentation details**

496 In order to conduct a consumer segmentation based on individual preferences, PCA was applied on the
497 WTB matrix presenting product profiles in rows (P1, P2,...P12) and consumers in columns (C1,
498 C2....C101) (Table S1). The data were centered and scaled column wise to correct for different scale
499 usage across consumers. Segmentation was performed by visual delimitation of consumer groups based
500 on the PCA loadings of selected principal components. Defining groups visually from the consumer
501 preference patterns displayed in PCA ensures that consumers sharing the same attribute preferences fall
502 into the same segment, thus facilitating results interpretation.

503 Then, common socio-demographic and behavioural characteristics were investigated within segments by
504 performing Partial Least Squares Discriminant Analysis (PLS-DA). Endrizzi et al., (2011) define PLS-
505 DA as a method that relates acceptance patterns to external characteristics by identifying segments and
506 relate them to the consumer characteristics using some type of discriminant analysis (PLS discriminant
507 analysis; see e.g. (Barker & Rayens, 2003).

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508 PLS-DA was conducted on the behavioural, coffee habits and socio-demographics questionnaire matrix
509 presenting consumers in rows and questionnaire items in columns. The dependent variables were binary
510 variables (0/1) coding for segment belonging (Table S2). Cross-validation and significance testing by
511 jack-knifing at 5% level were used in order to detect significant predictor variables (Martens & Martens,
512 2000). As the questionnaire included several blocks of unrelated items (iced coffee habits, socio-
513 demographics...), there is a risk of obtaining somewhat spurious conclusions. This was addressed by
514 running several PLS-DA models, including either all blocks or selected subsets of blocks. Predictor
515 variables that systematically showed significance in different models are reported here, while predictor
516 variables with no stability across models were withdrawn. PCA and PLS-DA were conducted in the
517 multivariate statistics software package The Unscrambler X 10.2 (Camo Software AS, Norway).

SUPPLEMENTARY RESULTS

SR 1 - Coffee type and Origin segments

Consumers did not really differ in their preferences for calorie content, indicating that the mean preference for low calorie content highlighted by the ANOVA is valid at individual level as well. As expected, results along PC2 showed a large majority of consumers projected in the direction of low price preferences (results not shown).

SR2 - Coffee type and Origin segments

As a possible interaction of Coffee*Origin was detected in the mixed model ANOVA, consumer segments were defined on a criteria of common WTB values regarding attributes Coffee type and Origin.

SR3 - Warm coffee habits

Firstly, consumers in segment Espresso/Norway show the highest consumption of “Regular”, “Espresso” and “Americano” warm coffee types, and the lowest consumption of “Latte”. An opposite relationship has been found for segment “Latte/Italy” (Figure S1). Secondly, consumers in segment Espresso/Norway typically consume warm coffee without any milk, cream or sugar, while consumers in segments Latte/Italy and Latte/Norway add such ingredients. Thirdly, consumers in segments Espresso/Italy and Espresso/Norway report the highest consumption frequency of warm coffee while consumers in segment Latte/Italy show the lowest consumption frequency. Finally, consumers in segments Espresso/Italy and Espresso/Norway typically report drinking warm coffee at their workplace or university, while consumers in segment Latte/Italy are characterized by not consuming warm coffee in these locations. These results are illustrated in Figure S1.

REFERENCES

Running title: CONSUMER PREFERENCES FOR ICED COFFEE PRODUCTS

553 Barker, M., & Rayens, W. (2003). Partial least squares for discrimination. *Journal of Chemometrics*,
554 17(3), 166–173.

555 Endrizzi, I., Menichelli, E., Johansen, S. B., Olsen, N. V., & Næs, T. (2011). Handling of individual
556 differences in rating-based conjoint analysis. *Food Quality and Preference*, 22(3), 241–254.

557 Martens, H., & Martens, M. (2000). Modified Jack-knife estimation of parameter uncertainty in bilinear
558 modelling by partial least squares regression (PLSR). *Food Quality and Preference*, 11(1–2), 5–16.

559 Næs, T., Brockhoff, P., & Tomic, O. (2010). *Statistics for sensory and consumer science*. (Wiley, Ed.).
560 Chichester, UK.

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565 **TABLE LEGENDS**

566 **Table S1 – Structure of PCA data matrix for willingness to buy (WTB)**

567 **Table S2 – Structure of PLS-DA matrix for consumer segments description**

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592 **Table S1 – Structure of PCA data matrix for willingness to buy (WTB).**

Products	Product dummies					Consumers					
	P1	P2	P3	...	P12	C1	C2	C3	C4	...	C101
P1	1	0	0	...	0	WTB					
P2	0	1	0	...	0						
P3	1	0	1	...	0						
...						
P12	0	0	0	...	1						

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594 **Table S2 – Structure of PLS-DA matrix for segments description**

	Y: dependent variables (Binary variables coding for segment belonging)				X: independent variables		
Consumers	Latte/ Italy	Latte/ Norway	Espresso/ Italy	Espresso/ Norway	Coffee habits	Iced coffee habits	Socio- demographics
C1	1	0	0	0	Questionnaire items		
C2	0	0	1	0			
C3	1	0	0	0			
C4	0	1	0	0			
...			
C101	0	0	0	1			

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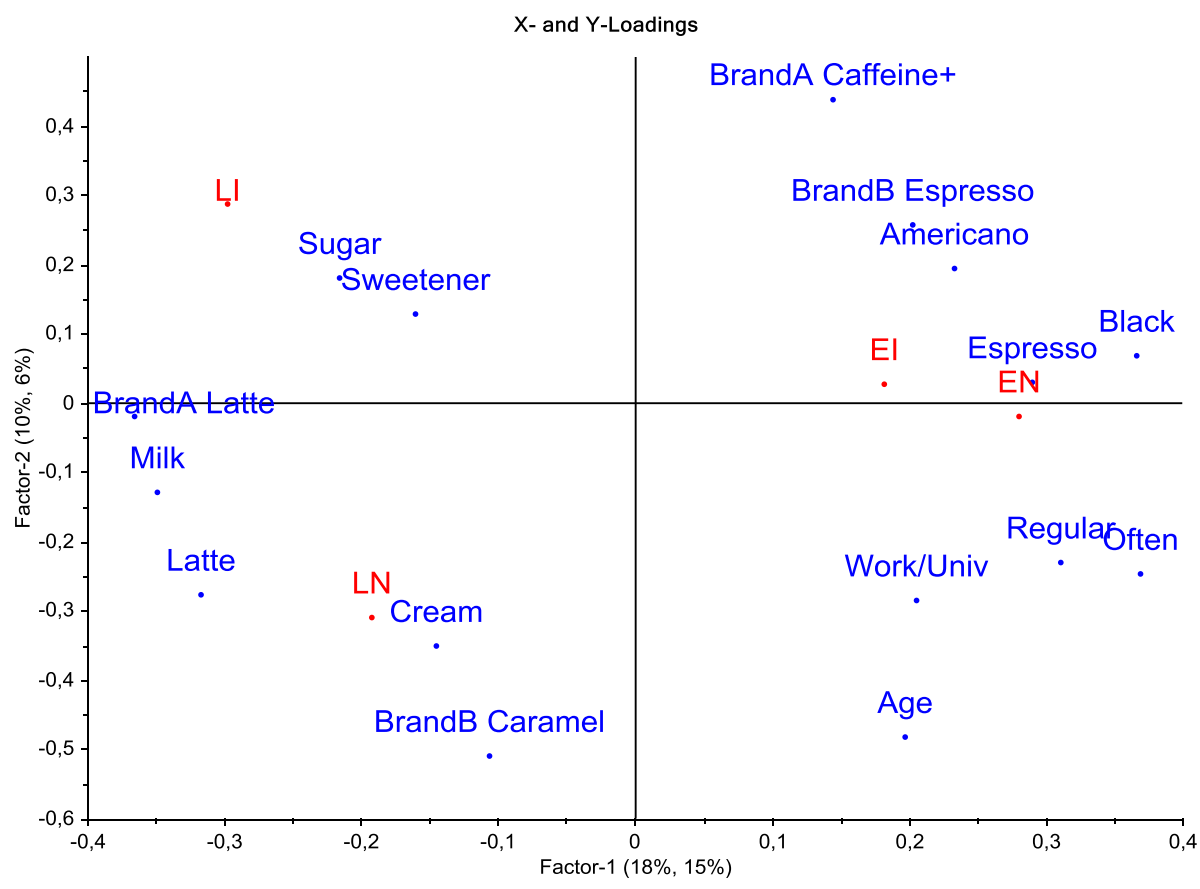
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599 **FIGURE LEGENDS**

600 **Figure S1 – PLS regression loadings plot of the main segment characteristics. LI: Latte/Italy, LN:**
601 **Latte/Norway, EI: Espresso/Italy and EN: Espresso/Norway)**

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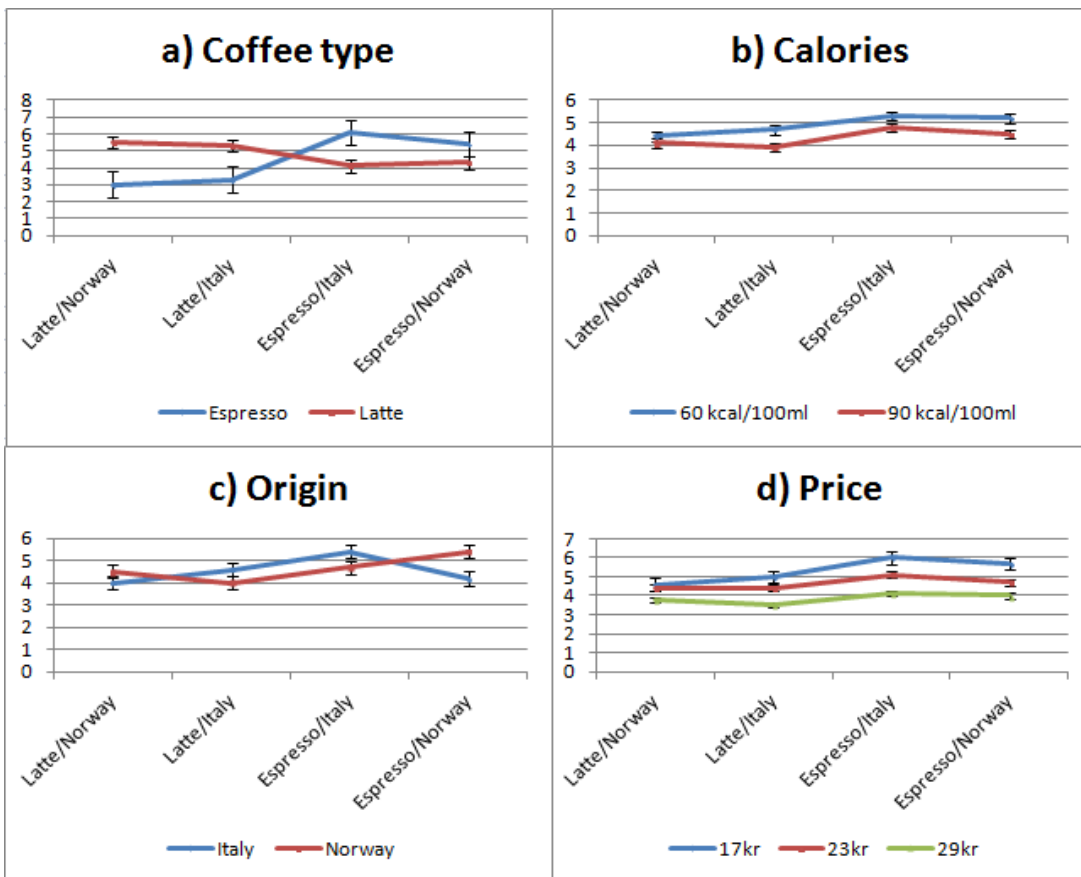
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Figure S1

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634 **Figure S2**

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