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

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1   **TITLE:**

2   **Consumer preferences for iced coffee determined by conjoint analysis:**

3   **An exploratory study with Norwegian consumers**

4

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8

9   **SUMMARY**

10   The main aim of this paper is to investigate consumer preferences for extrinsic attributes of iced coffee,

11   explore consumers' coffee consumption habits, find new market opportunities and segment consumers

12   based on similar products preferences. A sample of 101 consumers of iced coffee was recruited during

13   2012 in Norway. Twelve iced coffee products combining different levels of attributes: coffee type, origin,

14   calories and price were presented on screen and rated according to consumers' willingness to buy (WTB).

15   Mixed Model ANOVA, Principal Component Analysis (PCA) and Partial Least Squares Discriminant

16   Analysis (PLS-DA) were applied to analyze data. Results show that the most preferred products for the

17   consumer sample as a whole were low price – low calorie products while age has a significant effect on

18   WTB for different iced coffee products. Four different consumer segments based on type of iced coffee

19   and country of production preferences were identified and discussed.

20

21   **KEYWORDS**

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

23   Norway.

24

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1

INTRODUCTION

Iced coffee is now increasing its consumption in Scandinavian countries which have the world's highest levels of coffee consumption (International Coffee Organisation, 2011). Since the early 1980s, iced coffee has been very popular in the USA, Greece and Japan as a refreshing drink where it is usually drunk in small bottles for take-away consumption, or enjoyed for quenching thirst while sitting outside at a café (Petit & Sieffermann, 2007). In 1999 one of the main Norwegian food companies started introducing various types of iced coffee on the food market, and several other brands have followed since this product category has grown in popularity in the recent years. As the iced coffees on the Norwegian market do not have much variety except for the different types of coffee, more information is needed for understanding consumer preferences and choice attributes for this type of product. In addition, since Norwegian consumers have sensory experience with iced coffee, it is highly relevant to consider the impact of various factors such as nutritional, economic, ethnocentric and sensory properties. To the best knowledge of the authors, no studies are available which investigate the consumption of iced coffee in Norway, with particular reference to extrinsic factors affecting consumption. Petit & Sieffermann (2007) investigated the effect of the physical testing environment on liking and consumption of iced coffee by French consumers. With regard to consumer motivations and attitudes, there is a general lack of studies that investigate consumer preferences and motivation for coffee consumption (Rozin & Cines, 1982), with the exception of fair trade or environmentally friendly coffee (De Pelsmacker, et al., 2005; Raynolds, 2004).

One of the most applied predictive statistical model which determine consumer response towards different product profiles is Conjoint Analysis (Annunziata & Vecchio, 2013; De Pelsmaeker, Dewettinck, & Gellynck, 2013; Saito & Saito, 2013). CA is defined as a method for analyzing the effect of a number of designed factors (e.g. packaging, information factors, etc.) on consumer acceptance or choice (Næs, Brockhoff, & Tomic, 2010). CA includes a set of techniques able to measure buyers' tradeoffs among multiattribute products or services, including foods (Claret et al., 2012; Cox, et al., 2007; Næs, et al., 2010; Næs, et al., 2010a). CA is used to estimate the structure of consumer evaluations on a set of product profiles consisting in predetermined combinations of product attributes (Green &

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

75 **MATERIAL AND METHODS**

76 **Focus group: selection of attributes and levels**

3

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

4

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).

109

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

111   Based on the results obtained from the FG attributes were selected: coffee type, calories, origin and price.

112   Regarding coffee type, two different levels were chosen: "Espresso" and "Latte" as they are among the

113   most frequently consumed coffee types in Norway and they represent two distinct strengths of coffee

114   taste. With concern to the calories, the FG discussion highlighted the importance of calories in consumer

115   choice especially for older consumers. The two levels of calories ("60" and "90 kcal/100 ml") were

116   chosen based on typical calorie levels of iced coffee products that are present on the market. Concerning

117   the country of origin two levels were chosen: "Norway" as the market leader is a Norwegian company,

118   and "Italy" due to its high reputation for coffee products. Finally, as purchasing prices three different

119   levels were chosen, thus representing the high, middle and low end of the prices in the Norwegian market

120   for iced coffee products ("NOK 17", "NOK 23" and "NOK 29", approximately from € 2.2, € 3 and € 3.8

121   per unit). Full factorial design was not appropriate in the present study due to the large number of

122   possible factor and level combinations (2 x 2 x 2 x 3 = 24) that should be presented to consumers. In

123   order to effectively test the attribute effects on buyer's preference while reducing the number of product

124   profiles presentations, a fractional factorial design of 12 hypothetical products was constructed (Table 1).

125   This orthogonal array design was created by using the statistical package SAS version 9.3.

126

127   *Conjoint analysis data collection*

5

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).

136

137 **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).

142

143 ***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:

151

6

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*

155

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

157

158 *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 charactistics were investigated within

166 segments by performing Partial Least Squares Discrimination Analysis (PLS-DA). Further details can be

167 found in SM2.

168 Table S1Table S2

169 **RESULTS AND DISCUSSION**

170

171 **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.

176

177 **Drivers of iced coffee consumption**

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.

181

182 **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.

195

196 **Population effects**

197 *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

8

204   price from 23 NOK to 17 NOK per 250 ml (Figure 2). These results indicate that there may be a market

205   potential for calorie reduced iced coffee products. It is however important to note that in this experiment,

206   product profiles were presented on-screen without involving tasting. Research studies have demonstrated

207   that low calorie products often perform poorly in hedonic tests compared to their full calorie counterparts

208   (Ares, et al., 2008; Roininen, et al., 2000).

209   *Interaction effects*

210   Only one interaction between conjoint factors is significant: *Calories*Price*, confounded with

211   *Coffee*Origin* (p-values <0.01). The confounding means that it is not statistically possible to identify

212   which of the two interactions is observed, presents both these potential interactions. Consumers on

213   average are more reluctant to pay increasing prices for iced coffee products at low calorie content,

214   decreasing their WTP faster than for high calorie content and has a preference for Espresso iced coffee is

215   associated with a preference for production in Norway. On the other hand, preferences for Latte iced

216   coffee are independent of production origin. Note that as both Calories and Price show significant main

217   effects on consumer's WTB, while neither Coffee nor Origin showed significant main effects, it is

218   reasonable to identify the observed interaction effect as that of *Calories*Price.*

219

220   **Preference heterogeneity and consumer segmentation**

221   *Coffee type and Origin segments*

222   In order to determine consumer segments based on individual preference patterns in the conjoint rating

223   task, a PCA model was run on the data matrix of consumers' Willingness To Buy (WTB) for each

224   product profile as described above. We identified four Principal Components (PCs): coffee type (on PC1,

225   restituting 37% of the variance), price (on PC2, 24%), origin (on PC3, 12%) and calories (on PC4, 8%).

226   Further details can be found in SR1. Thus consumers mostly differed in their coffee type preferences,

227   such that it is interesting to conduct a consumer segmentation on that attribute. Further details can be

228   found in SR2. Figure 3 shows the PCA correlation loadings plot for PC1 and PC3, where distinct product

229   groups appear according to coffee type and origin attribute levels.. We created manually four consumer

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).

234

235   *Segment characteristics*

236   *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.

244

245   *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.

251

252   *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

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.

260

261 *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.

277

278 **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

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

308 analysis in order to provide more valuable information and asset for the food industry (De Pelsmaeker et

309 al., 2013).

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316

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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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398

399 **FIGURE LEGENDS**

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

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

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

406 **Figure 4 – Average WTB value and standard errors on mock-up products varying in attributes a)**
407 **Coffee type, b) Calories, c) Origin and d) Price for each of the four consumer segments**
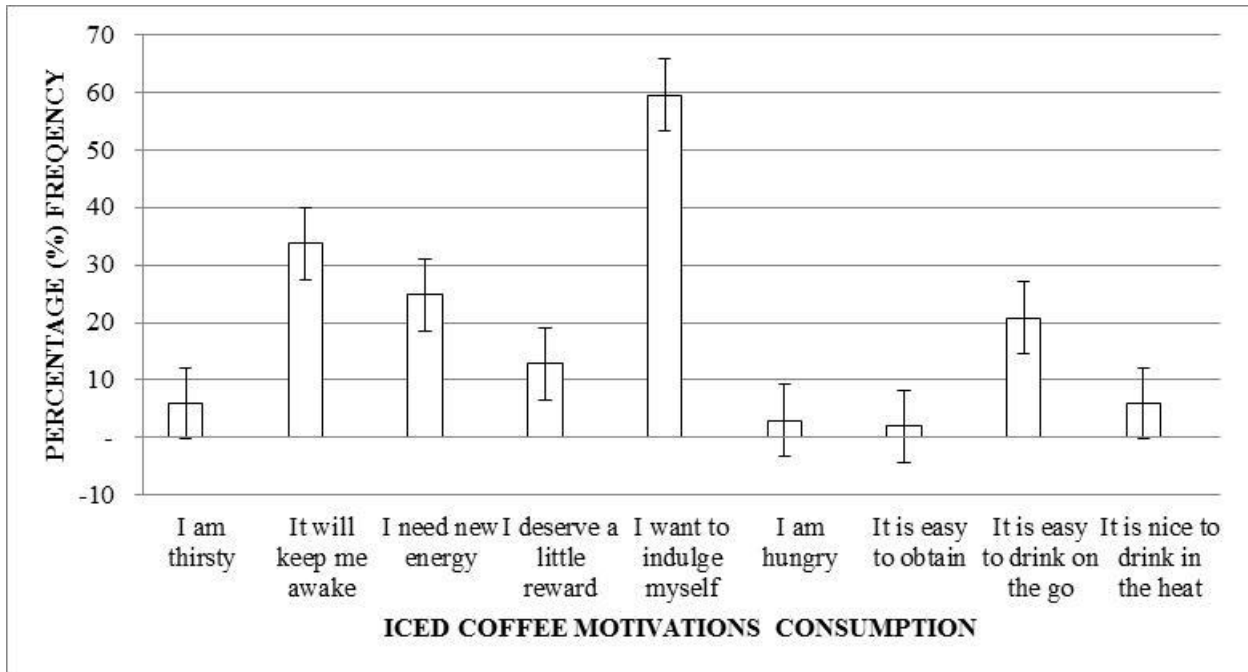
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Figure 1

Figure 2

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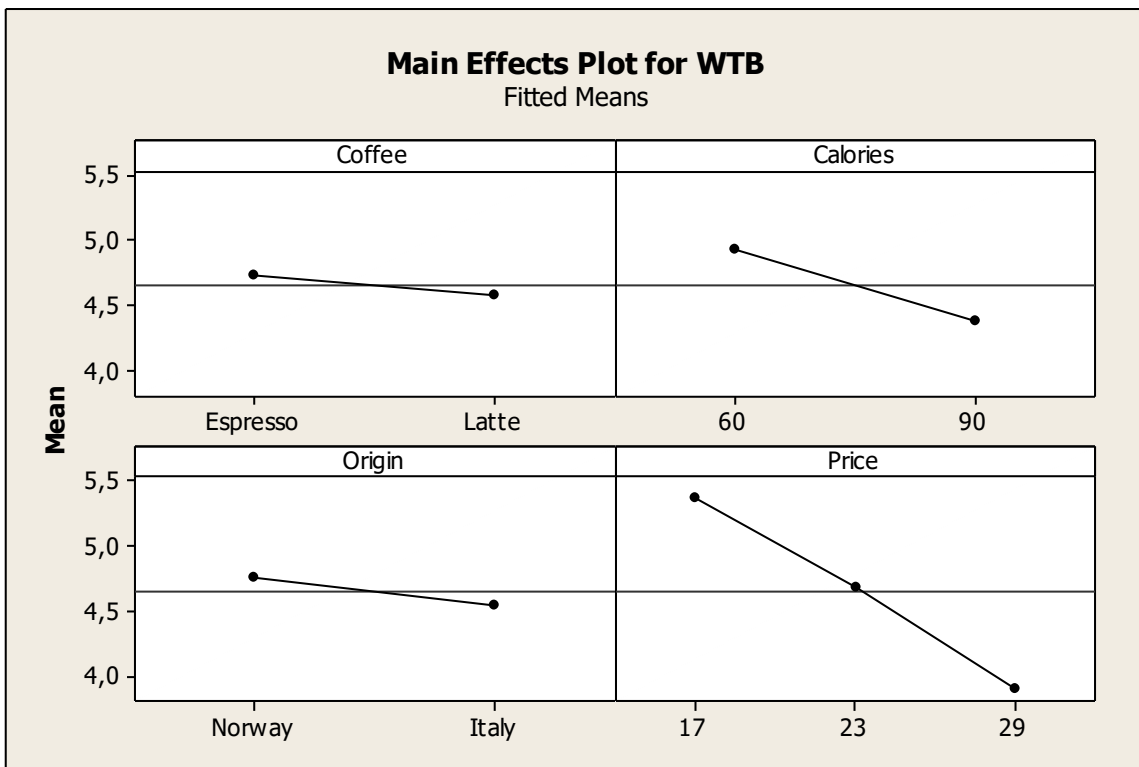
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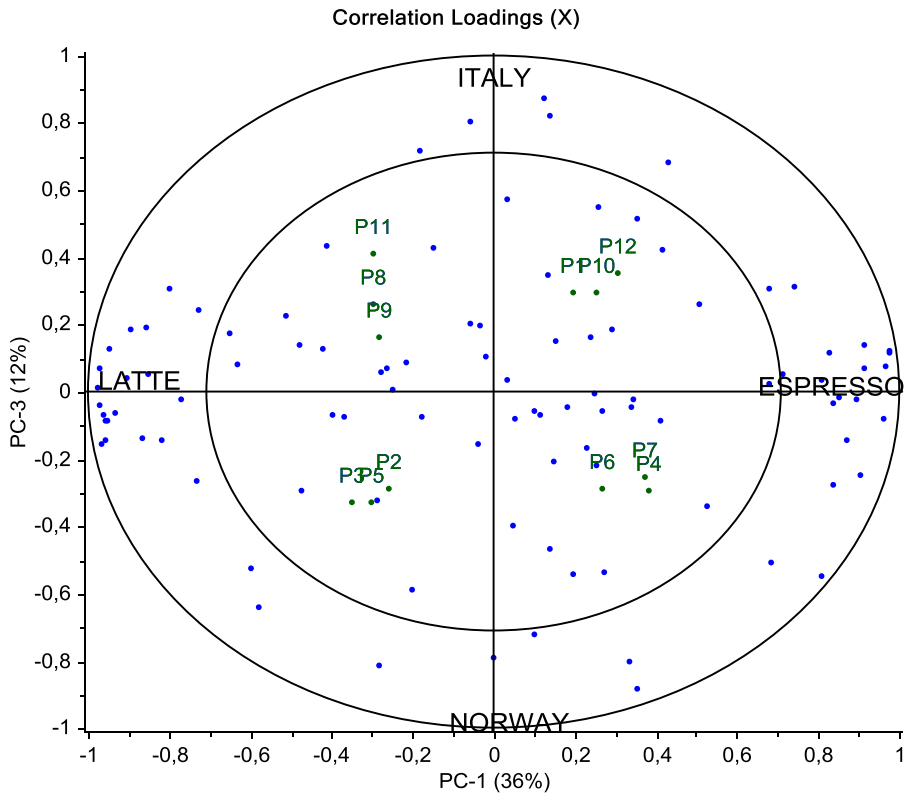
Figure 3

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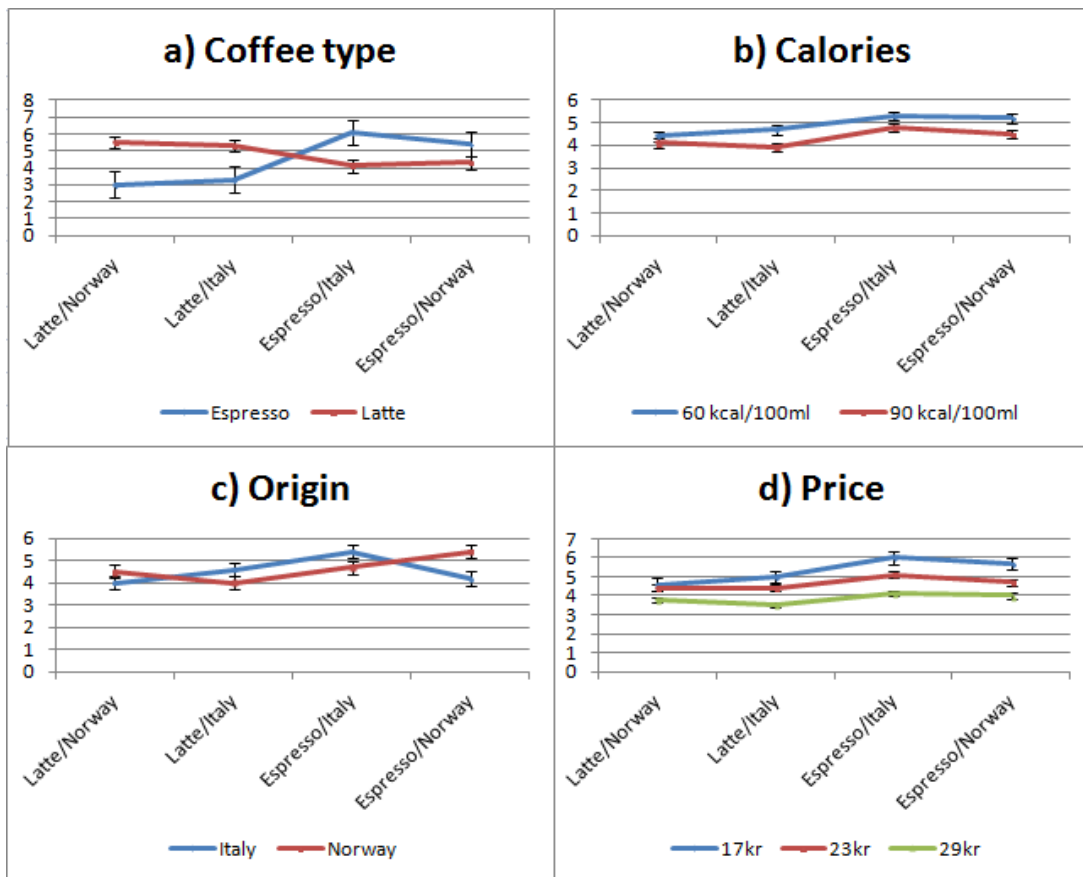473

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477   **Figure 4**
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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.

494

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).

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).

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530 **SUPPLEMENTARY RESULTS**

531 **SR 1 -** *Coffee type and Origin segments*

532 Consumers did not really differ in their preferences for calorie content, indicating that the mean

533 preference for low calorie content highlighted by the ANOVA is valid at individual level as well. As

534 expected, results along PC2 showed a large majority of consumers projected in the direction of low price

535 preferences (results not shown).

536

537 **SR2 -** *Coffee type and Origin segments*

538 As a possible interaction of Coffee*Origin was detected in the mixed model ANOVA, consumer

539 segments were defined on a criteria of common WTB values regarding attributes Coffee type and Origin.

540

541 *SR3 - Warm coffee habits*

542 Firstly, consumers in segment Espresso/Norway show the highest consumption of "Regular", "Espresso"

543 and "Americano" warm coffee types, and the lowest consumption of "Latte". An opposite relationship

544 has been found for segment "Latte/Italy" (Figure S1). Secondly, consumers in segment Espresso/Norway

545 typically consume warm coffee without any milk, cream or sugar, while consumers in segments

546 Latte/Italy and Latte/Norway add such ingredients. Thirdly, consumers in segments Espresso/Italy and

547 Espresso/Norway report the highest consumption frequency of warm coffee while consumers in segment

548 Latte/Italy show the lowest consumption frequency. Finally, consumers in segments Espresso/Italy and

549 Espresso/Norway typically report drinking warm coffee at their workplace or university, while consumers

550 in segment Latte/Italy are characterized by not consuming warm coffee in these locations. These results

551 are illustrated in Figure S1.

552 **REFERENCES**

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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).**

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

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

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

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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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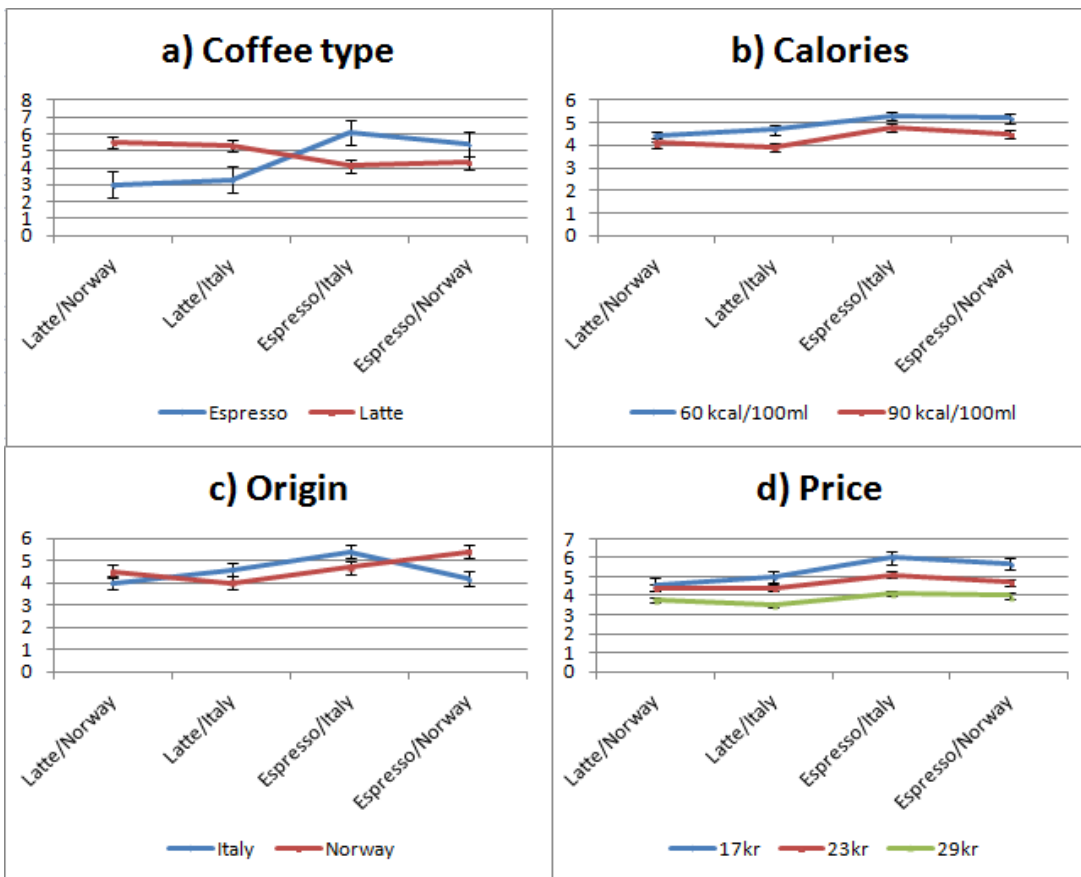
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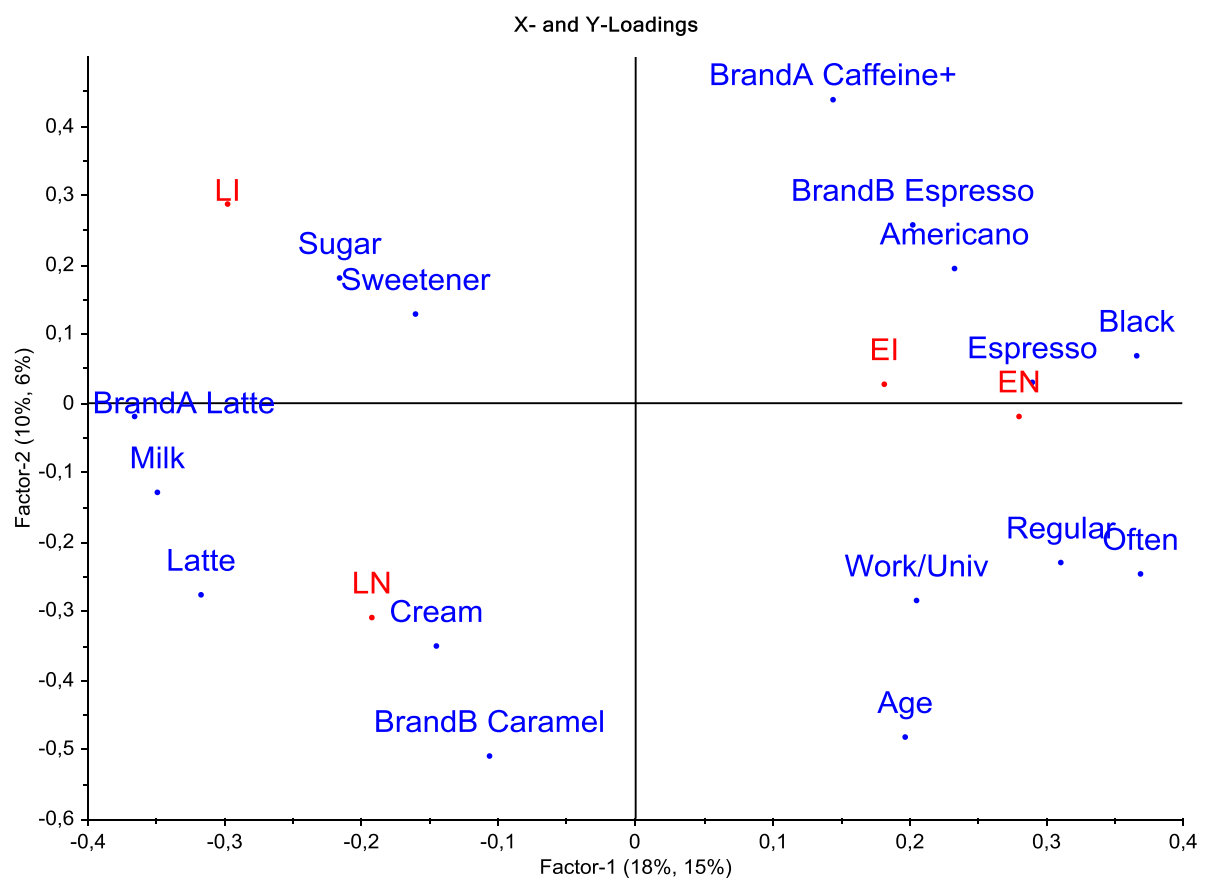
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Figure S1

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634   **Figure S2**

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