

COFFEE TASTE PERCEPTIONS BASED ON A SENSORY TEST

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Abstract

Coffee is the second most consumed beverage in the world after the water, and the second most traded liquid after oil (Associação Industrial e Comercial de Café, 2021).

Even before tasting, there are different elements that interfere in peoples' sensory and hedonic expectations, such as shape, colour, or aroma, among others (Doom et al, 2017; Piqueras-Fizman & Spence, 2015; Shankar et al., 2010).

In Portugal, for instance, espresso is the favourite coffee, and coffee capsules are the preferred type by both men and women (Borges, 2016). In this sense, for the experiment, we will use coffee machines using capsules. These machines can be found in almost every household, and each person may use different coffee cups or mugs, which shows the importance of the experiment. Given that some taste perceptions may vary according to age and gender (Bruwer et al., 2011 e Corso, 1971), the sample comprises Portuguese students from four different schools. The sample consists of 112 respondents, students and employees at IPG Campus, who are mostly people under the age of 25 and who may represent the next generation of coffee consumption for the next decades. Therefore, this study may be somewhat innovative and bring useful insights for the future coffee market.

Keywords: expectations, perceptions, sensory test, coffee, shape

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1. INTRODUCTION

Coffee is one of the most consumed beverages in the world (International Coffee Organization, 2021). Whether as domestic consumption or in a social context, no one is indifferent to the fragrance, characterized by its intense flavor and strong aroma. Coffee consumption is a habit acquired and disseminated worldwide, with high importance in the international economy, representing one of the main export products for almost forty undeveloped countries (Associação Industrial e Comercial de Café, 2021).

Coffee industry generates billions of dollars in revenue and supports the livelihoods of millions of small farmers in more than 52 countries. Nonetheless, there are some vulnerabilities in the coffee production system, namely in the uneven way the sector is organized, that we cannot neglect. Most significant revenues from their sale are in the northern hemisphere of the globe, while coffee producing countries, traditionally in the southern hemisphere, continue to see their impoverished small farmers. The COVID-19 pandemic context has accentuated these vulnerabilities and created others (see table X), forcing many smallholders to alternative livelihoods (Guido, Knudson & Rhiney, 2020).

Table 1. Imports of coffee

Imports of coffee by selected importing countries - October 2020

In thousand 60-kg bags

	October 2019	October 2020	% change	November - October 2018/19	November - October 2019/20	% change
Total	11 612	11 283	-2.8%	135 972	129 698	-4.6%
European Union	7 264	6 791	-6.5%	80 636	77 888	-3.4%
Japan	678	644	-5.1%	8 112	7 310	-9.9%
Norway	69	71	2.2%	806	804	-0.3%
Russian Federation	519	572	10.1%	5 797	6 270	8.2%
Switzerland	283	350	24.0%	3 135	3 477	10.9%
Tunisia	42	30	-29.2%	487	515	5.7%
United Kingdom	471	584	24.2%	5 676	5 118	-9.8%
United States of America	2 286	2 241	-2.0%	31 324	28 316	-9.6%

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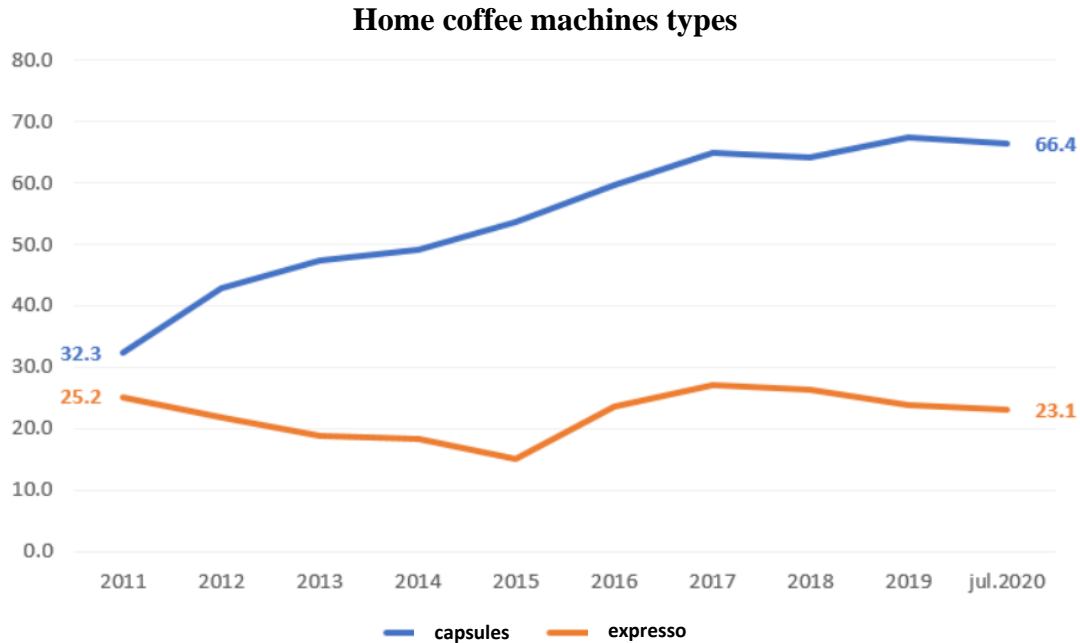
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Source: (International Coffee Organization, 2021)

Portugal is a country with a strong tradition in the consumption of this beverage, namely the famous “espresso”. According to data available (Associação Industrial e Comercial de Café, and European Coffee Federation, 2021), 80% of the country's adult population consumes coffee in a daily basis. Each Portuguese drink 2.5 cups of coffee per day, which corresponds to an average of 5 kg per person and per year. Out-of-home consumption is predominant, which goes against the trend in the rest of Europe, where 80% prefer to drink coffee at home.

However, nowadays we can find a coffee machine in almost every household. In fact, the number of coffee machines sold in Portugal is rising since 2011 when the introduction of this equipment (see graphic 1). The Marktest TGI study in 2020, found 7 352 thousand individuals who report having a coffee machine in their homes, which represent 85,9% of the Portuguese residents aged 15 and over.

Figure 1. Evolution of the introduction of espresso coffee machines by types from 2011 to 2020.



Source: (Marktest, 2021)

Scientific knowledge about coffee consumption preferences and patterns, as well as buying behaviors, is fragmented, often focused on a limited number of specific issues. In a recent systematic review of 54 articles, Samoggia and Riedel found that the main reasons for coffee consumption may be grouped and labeled according to different aspects, namely: functional, taste and pleasure, habit, tradition and culture and socialization (Samoggia & Riedel, 2018).

Some researchers suggest that coffee might have the potential of a functional food thanks to its biochemical properties and the possible health benefits (Corso, Kalschne, & Benassi, 2018). The Caffeine readily available in coffee and other foods and beverages is the most widely consumed psychoactive substance in the world and is used to mitigate sleepiness, enhance performance (Clark & Landolt, 2017).

There are several elements that, even before tasting, interfere with people's sensory and hedonic expectations such as color or aroma, for example (Doom et al., 2017; Piqueras-Fiszman e Spence, 2015; Shankar et al., 2010). Some perceptions of taste may also vary according to age and gender (Bruwer et al., 2011 e Corso, 1971). In a convenience sample of 625 respondents target in Portugal, Borges (2016), found that men consume more coffee than women, and its consumption is more related with lunch time, and in the working place. The study also shown that price tag, fair trade certification, health, discounts, type of coffee, and recommendations from friends and family, are more valued by women than by men (Borges, 2016).

The multisensory attributes of the packaging provide an important source of information, namely in attracting consumers' attention (Maísa M.M. de Sousa, 2020). According to a survey, the shape of the mug, influence people's expectations regarding

the taste of the coffee (Doorn et al., 2017). Surprisingly, it is one of the few studies that analyses the influence of sensory aspects on people's expectations regarding the taste of coffee. However, despite some interesting findings in a cross-cultural context, the experiment was conducted online, which may raise some concerns.

The pandemic context may have influenced some changes in consumption habits. Beyond important changes in production (Guido et al., 2020; Tamru et al., 2020), coffee capsules are now the big trend and the preferred type by both Portuguese men and women (Borges, 2016). Therefore, new investigations are required.

The present research intends to add new insights to the field. The study is aimed to characterize the habits and preferences of Portuguese coffee consumers, in the academic context. Students can represent the next generation of coffee consumers for the next decades. Therefore, this study may be somewhat innovative and bring useful insights for the market.

2. METHODOLOGY

In order to verify and evaluate the consistency of the questionnaire to be applied, a pre-test was carried out through the application of 11 questionnaires and students and employees of the Polytechnic Institute of Guarda.

The online survey was organized in two parts:

The first part containing a brief explanatory text on the scope of the investigation, its interveners, mentions related to the aspects contemplated in the GDPR, namely, confidentiality and anonymity of the survey, as well as the estimated time to answer it.

The second part consists of twelve questions, starting with an issue that would make possible to distinguish consumers from non-consumers:

a) non-consumers were targeted to the last three questions of socioeconomic characterization, in which they would be registered: gender, age and professional situation.

b) coffee consumers continued to answer a set of questions that allow us to characterize them in terms of the average number of coffees consumed per day, the place where they usually have coffee, occasions when they usually drink coffee, the name most used when they order coffee, reasons that motivate consumption, typology most appreciated, what is the importance of the attributes listed when choosing coffee.

The survey was applied from May 29th to June 12th, in 2019, to IPG students and staff (teaching and non-teaching), assigned to the institution's four organic units, resulting in a sample of 112 questionnaires, for the first part of the study, and 99 for the second part of the study. After coding the data, they were introduced into a database and later processed in the SPSS program (Statistical Package for the Social Sciences), version 27.0.

Therefore, statistical techniques of univariate analysis were used, with the use of descriptive statistical measures and tests for the normality of distributions. Then, exploratory factor analysis was used in order to find factors that could explain the importance of different attributes in the choice of coffee.

3. RESULTS

3.1 Sample description

Next, we will proceed to a socio-economic description, the coffee consumer profile and main motivations.

3.1.1 Socio-economic sample description

The socio-economic description (gender, age group, professional situation) of the sample is shown in Table 2.

Table 2. Socio-economic sample description

Variable		N	%
Gender	Male	59	52.7
	Female	53	47.3
	Total	112	100
Age	Less than 26 years old	71	63.4
	From 26 to 35 years old	11	9.8
	From 36 to 45 years old	7	6.3
	From 46 to 55 years old	18	16.1
	More than de 55 years old	5	4.4
	Total	112	100
Professional status	Students	86	76.8
	Staff/Teachers	26	23.2
	Total	112	100

Source: Survey to coffee consumers

3.2 Coffee consumers

Bearing in mind that the main objective was to study of coffee consumers profile, we decided to create a sub-sample of the main sample. This sub-sample contains only all respondents who claimed to be coffee consumers (second part of the study). This is composed of 99 respondents. As can be seen from the values presented in table 3, this follows in a very close way the socio-economic characterization of the total sample. So, the majority sample is represented by males, under the age of 26 and students of the Polytechnic Institute of Guarda.

Table 3. Socio-economic sample description of coffee consumers

Variable		N	%
Gender	Male	52	52.5
	Female	47	47.5
	Total	99	100
Age	Less than 26 years old	61	61.6
	From 26 to 35 years old	10	10.1
	From 36 to 45 years old	6	6.1
	From 46 to 55 years old	17	17.2
	More than de 55 years old	5	5.1
	Total	99	100
Professional status	Students	74	74.7
	Staff/Teachers	25	25.3
	Total	99	100

Source: Survey to coffee consumers

3.2.1 Average coffee consumption by age group

When questioning respondents about the number of coffees they drink per day, we find that the average is 2.19 coffees. Only 2 people say they drink more than 4 coffees a day.

If we analyze this average by gender, we find that males consume on average more than females (2,307 / 2,063).

Regarding age, it is the age group over 55 who consumes the most coffee, with an average of 2.80 coffees per day and in reverse, is the age group of 26 to 35 who consumes less coffees per day (1.90), Table 4.

It is also noteworthy that students in general drink less coffee on average (2.10) than IPG employees (2.44).

Table 4. Average coffee consumption by age group

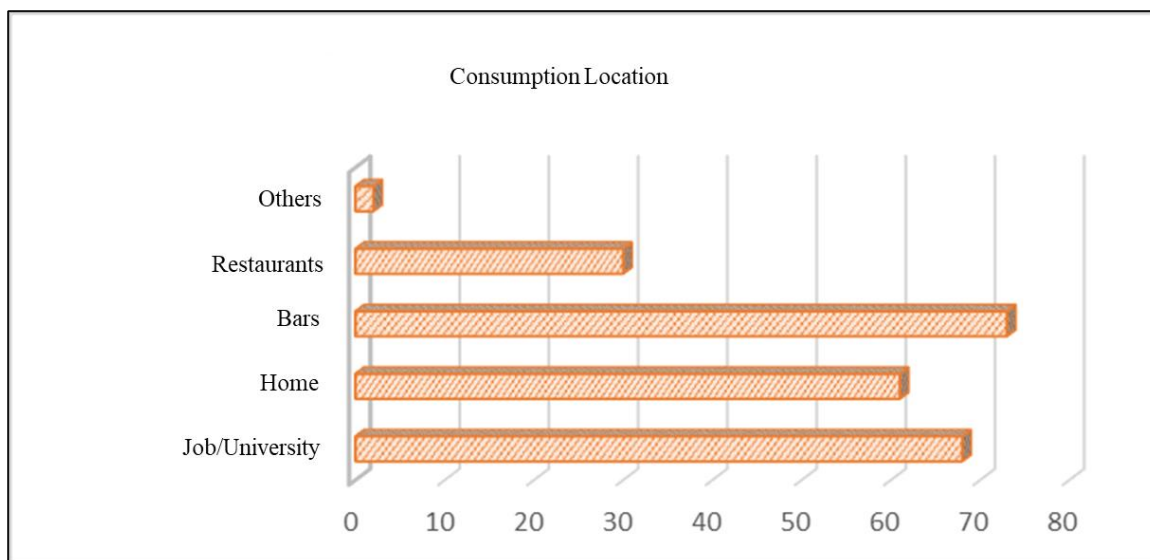
Age	N	Average
Less than 26 years old	61	2.13
From 26 to 35 years old	10	1.9
From 36 to 45 years old	6	2.33
From 46 to 55 years old	17	2.35
More than de 55 years old	5	2.80
Total	99	100

Source: Survey to coffee consumers

3.2.2 Coffee consumption location

Regarding to places of consumption, it appears that the Bars is the preferred place (73 responses), followed by Job/University (68) and already more distant Home (61) and Restaurants (30), as we can see in the Figure 2.

Figure 2. Coffee consumption location



Source: Survey to coffee consumers

3.2.3 Coffee consumption occasion

As shown in Table 5, regarding consumption occasions, we find that it is at lunchtime that most people drink coffee. In addition, and in reverse, it is at bedtime that almost all respondents say they never drink coffee.

Table 5 – Coffee consumption occasion

Consumption occasion	Average	Median	Mode	Standard deviation
Waking up	1.63	1	1	0.113
Breakfast time	2.94	3	1	0.155
Morning break	3.08	3	4	0.138
Lunch time	3.73	4	5	0.138
Afternoon break	2.69	3	1	0.133
Dinner time	2.14	2	1	0.135
After dinner or night out	2.82	3	1	0.158
Bed time	1.34	1	1	0.09

Source: Survey to coffee consumers

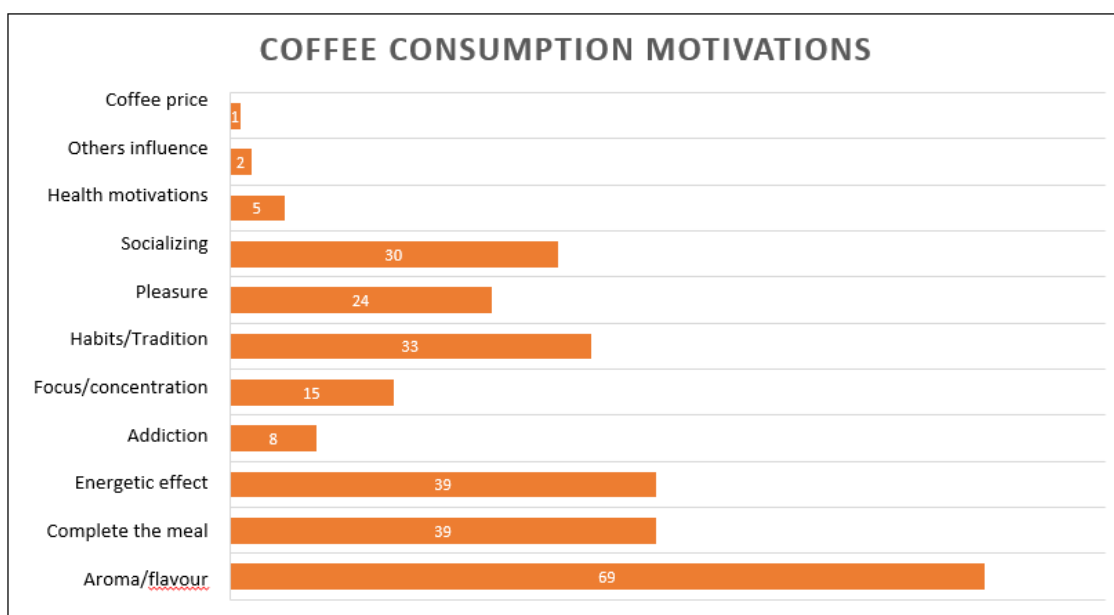
3.2.3 Names used to order coffee in Portugal

Although there may be different designations for ordering a coffee, depending on the region where we are from, the study appears that a large part of respondents, are from regions that do not belong to Lisbon or Porto, since only 3% of respondents say “*Bica*” and none say “*Cimbalino*”, which is a very typical way of ordering coffee in Porto region. Thus, from the analysis of the questionnaire data, we found that the most frequent way to order a coffee is even using the word “*Café*”, with 68 answers, representing more than 2/3 of the answers given.

3.2.4 Coffee consumption motivations

Regarding the motivations why people consume coffee, they are listed in Figure 3 below.

Figure 3. Coffee consumption motivations



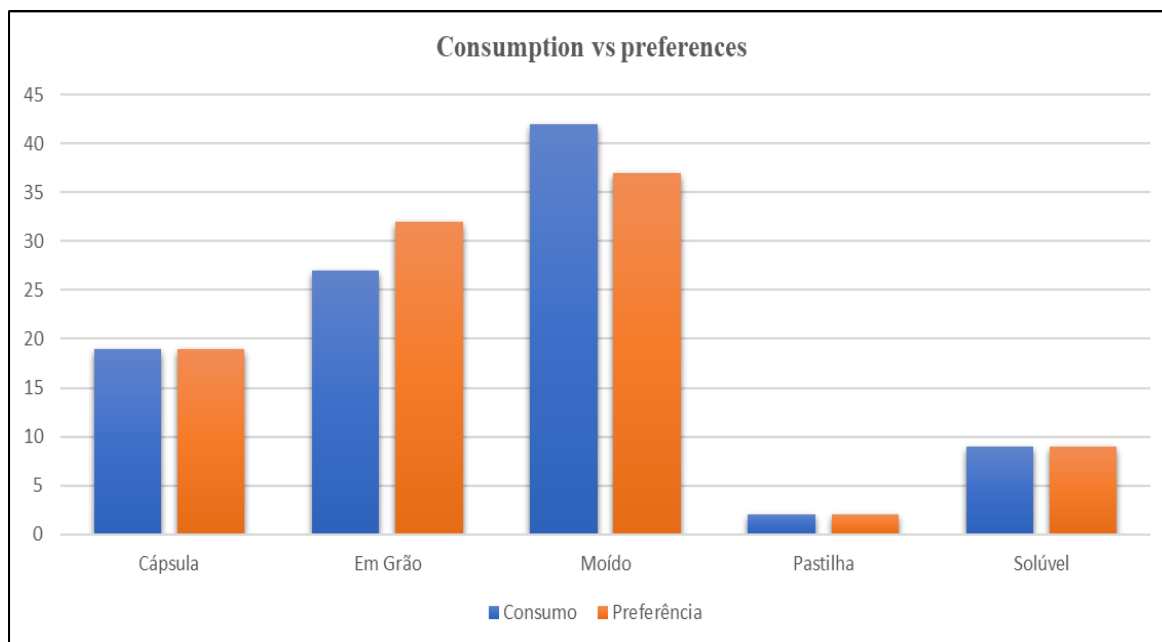
Source: Survey to coffee consumers

Graphic 3 highlights the reasons that are linked to the aromas and flavor that coffee has, as well as the fact that people have coffee to complete the meal and at the same time is a source of energy, in result of the caffeine consumed.

3.2.5 Consumption versus preferences

Regarding consumption and preference for coffee typology, the results of which are shown in Figure 4, we see that there are no significant differences. There is only a small difference in the typology of “*Grão*” (beans) and “*Móido*” (ground), in which people say they consume more “*Móido*” (ground), although they prefer more coffee in “*Grão*” (beans).

Figure 4. Consumption versus preferences



Source: Survey to coffee consumers

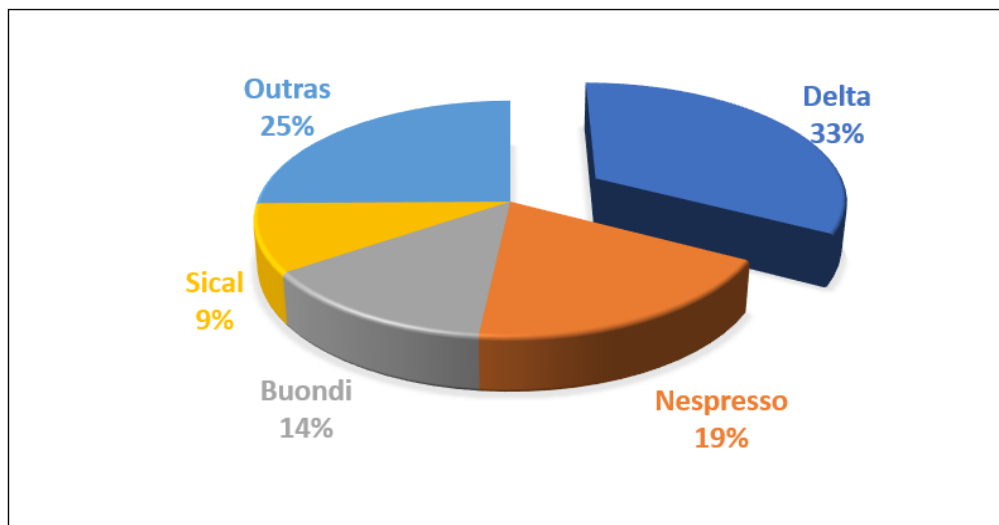
From the analysis of graph 4, it is important to enhance the fact that only 2% of the respondents consume and prefer coffee tablets (*pastilha*), which seems to demonstrate a great environmental concern.

3.2.6 Top 4 coffee brands

Regarding the coffee brands popularity, there was a high number of brands mentioned, namely more than twenty different brands, some of them International, although with little representation. This situation may be related to the existence of international students at the Polytechnic Institute of Guarda.

Below is a graphic with the main coffee brands identified by the respondents.

Figure 5. Top 4 coffee brands



Source: Survey to coffee consumers

3.3 Factors

With the objective to reduce the number of attributes taken into consideration when choosing a coffee, an exploratory factor analysis was used, in order to find factors that, in some way, could be related and that explained the importance attributed.

Therefore, considering that the quality of the factor analysis depends on the correlation between the variables, it was initially assessed using the sphericity and Bartlett test and the Kaiser-Meyer-Olkin (KMO) sample adequacy measure. For the retention of factors, we applied the Kaiser criterion, that is, we retained only factors whose eigenvalues are greater than one (Hair et al., 2010). For a better interpretation of the factors, a rotation of the varimax axes was used. The proportion of variance explained by the components remains constant, it is only distributed differently so that the differences between the combinations of the variables are maximized. Following what is prescribed by Hair et al. (2010), we only considered items whose weight in the factor was greater than 0.5 and whose commonality was greater than 0.5.

Table 6 shows us:

- 3 factors were found that explain 61,021% of the explained variance;
- Bartlett's sphericity test has associated significance levels less than or equal to 0.05, which leads to the conclusion that the variables are significantly correlated (Hair et al., 2010; Marôco, 2018; Pestana e Gageiro, 2014);
- The KMO sampling adequacy measures are higher than the minimum value of 0.5 proposed by Kaiser (1970;1974).

Table 6. Factor analysis results

	Nº Itens	KMO	Bartlett Test (Sig.)	Factors	Explained variance %
Attributes Importance in coffee choice	12	0.753	0.001	3	61.021

Source: Survey to coffee consumers

Then, the reliability analysis of each of the factors was carried out. For this purpose, Cronbach's Alpha was calculated for each of the factors.

Factor 1, shown in Table 7, consists of the items Aroma, Intensity, Flavour and Typology. In terms of importance, this is the one with the highest value with 4,008. Remember that the questions were placed on a 5-point Likert scale (1- Not important to 5 - Very important).

The value of Cronbach's Alpha is 0.786, which is much higher than the value considered acceptable.

Table 7 – Factor 1 - Connoisseurs

Factor 1 – Connoisseurs	
Intensity	,799
Flavour	,781
Aroma	,744
Typology (capsules, ground, beans,...)	,721

Source: Survey to coffee consumers

Factor 2, shown in table 8, by the items Country of Origin, Price, Awards/Distinctions, Promotions and Recommendations from Friends and Family. This factor presents the lowest importance level, with a weighted average of 2,335. This factor

has the highest value of Cronbach's Alpha, namely 0.793. It is also the factor that has the greatest number of items, that is, 5.

Table 8 – Factor 2 - Sensitives

Factor 2 – Sensitives	
Promotions	,805
Recommendations (family / friends)	,741
Price	,723
Awards / Distinctions	,612
Country of origin	,531

Source: Survey to coffee consumers

Factor 3, shown in Table 9, consists of the items Packaging, Place of Sale / Purchase and Brand. In terms of importance, it presents a value very similar to factor 2, with a weighted average of 2,848. This is the one with the lowest value of Cronbach's Alpha, more specifically 0.667, but still well above the minimum value considered to be acceptable, which is 0.5. In addition, it is the factor that has the least number of items (3).

Table 9 – Factor 3 - Committed

Factor 3 – Committed	
Brand	,758
Place where to buy	,754
Package	,658

Source: Survey to coffee consumers

Table 10 - Factors of the importance of attributes when choosing coffee

Factors	Nº of Items	Cronbach's Alpha	Average
Factor 1 - Connoisseurs	4	0.786	4.008
Factor 2 – Sensitives	5	0.793	2.335
Factor 3 - Committed	3	0.667	2.848

Source: Survey to coffee consumers

Next, we will analyze, at a descriptive and inferential level, the main differences between gender and the weight attributed to each of the factors previously identified.

Therefore, according to the analysis of the table below, we can say that male individuals attach greater importance to the **Connoisseurs** and **Sensitives** factors, while female individuals attach greater importance to the **Committed** factor.

Table 11 - Average of the importance of attributes in the purchase of coffee according to gender

Factors	Average	
	Male N=52	Female N=47
Factor 1 - Connoisseurs	4.027	3.987
Factor 2 – Sensitives	2.409	2.252
Factor 3 - Committed	2.809	2.891

Source: Survey to coffee consumers

In addition, we carried out the analysis of the different factors identified according to the age group. Therefore, three large age groups were created. One up to 25, another from 26 to 45 and a third over 45.

The data referring to the dimension and average of each of the factors can be found in the table below.

Table 12 - Average of the importance of attributes in the purchase of coffee by age groups

Factors	Average		
	Less than 26 yo N=61	26 to 45 yo N=16	Over 45 yo N=22
Factor 1 - Connoisseurs	4.096	4.162	3.653
Factor 2 – Sensitives	2.232	2.767	2.306
Factor 3 - Committed	2.839	3.039	2.733

Source: Survey to coffee consumers

Therefore, it is the group of respondents aged between 26 and 45 years who gives the most importance to issues related to **Connoisseurs**, specifically **Aroma**, **Intensity**, **Flavour** and **Typology**. In reverse, it is individuals over the age of 45 who least value these characteristics of the **Connoisseurs**. This situation is repeated for all other factors encountered.

In summary, we can say that the respondents who give greater importance to the **Connoisseurs** and **Sensitives** factors are male and aged between 26 and 45 years.

4. CONCLUSIONS

From the analysis of the data collected, we verified that the average daily consumption of coffee is slightly lower than the consumption verified in other studies (Industrial and Commercial Coffee Association, 2021) (Associação Industrial e Comercial de Café, 2021). This slight deviation verified may be related to the fact that the sample in study is eminently represented by a young age group (<26 years) with the consequent association with the tendency to lower consumption and also to lower economic resources due to their professional situation.

As for the consumption location, we found that the main locations are Bars and Job/University, which is in line with studies that point to this fact. Other studies support these facts.

Regarding the consumption occasion, the results point to a higher consumption of coffee at lunch (3.73), followed by the morning break (3.08) and breakfast (2.94). These results are in line with other investigations that indicate the morning period for the highest consumption of coffee.

Special attention is drawn to the fact that there is a considerable number of respondents who say that they drink coffee at a night out for socializing. This situation is related to the typology of the sample used, namely the high number of students.

On the other hand, the study points to consumption and a preference for ground coffee or beans, with capsules being the 3rd preference. This trend may demonstrate the growing environmental concern of the population.

The main reasons for consumption listed are related to the intrinsic characteristics of the product (aroma/flavour), which stands out considerably from the other two reasons presented, namely to complete the meal and the energy effect.

From the factor analysis carried out to the attributes accounted when purchasing a coffee, 3 essential profiles were identified: the **connoisseurs**, the **sensitives** and the **committed**. From this analysis, considering the gender and the age group of the consumers, it was possible to identify that the respondents who give greater importance to the Connoisseurs and Sensitives factors are male and aged between 26 and 45 years old, so in future actions of promotion for coffee brands, they should take this into account.

5. STUDY LIMITATIONS AND PERSPECTIVES FOR FUTURE INVESTIGATIONS

The first major limitation of the study is the small number of respondents.

In addition, the fact that the sample is very centered in an academic context conditions and limits the conclusions drawn.

On the other hand, and result of the pandemic in which we live, purchasing and consumption patterns are profoundly changing.

In this sense, we suggest new investigations with a larger and more diversified sample, which allows us to better characterize the profiles identified.

Taking into consideration recent investigations and data from the sector that point to an increase in the acquisition of capsule coffee machines and, consequently, to an increase in the consumption of capsule coffee, which may be related to the current conditions of the pandemic and confinement (Guido et al., 2020; Tamru et al., 2020).

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