

# Consumer preferences for extrinsic and intrinsic meat stock attributes

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Tiivistelmä – Referat – Abstract <p>Food consumption is changing, and consumers show increasing interest for how food is being produced and processed. Insights into consumer wants and needs has therefore never been more important for a food company developing a new product. The goal of this thesis is twofold. First, to investigate sensory characteristics in liquid meat stocks and second, to study Finnish consumers' attitudes towards such stock products. This was achieved by performing a sensory study on three newly developed meat stocks, using a generic descriptive analysis method. A consumer survey was conducted investigating 551 Finnish consumers' usage frequency and factors influencing purchase intentions of stock products. In SPSS, ANOVA tests were used to identify significant mouthfeel, appearance and flavour differences between five meat stock samples. Socio-demographic differences in user frequency of stock products and other factors influencing purchase intentions were determined using an ordered logit model, in STATA. The results from the sensory study suggest that roasting of meat, bones and vegetables before cooking leads to darker colour and stronger flavours but is not perceived to consistently improve overall pleasantness. Results from the consumer study suggest that stock cubes are the most popular type of stock product purchased. Furthermore, the most important factors when purchasing stock products are flavour, previous experience with the product and convenience. Interest in origin of raw materials, environmental-friendliness and animal welfare was shown to be affected by consumers' age and area of living (urban/rural). Similarly, differences in gender, age and area of living affect user frequency. To conclude, these results suggest that both extrinsic and intrinsic meat stock attributes are relevant to differentiate liquid stocks from other stock products and provide novel input into future marketing strategies.</p>			
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Tiivistelmä – Referat – Abstract <p>Konsumtion av livsmedel förändras och konsumenterna visar allt större intresse för hur mat produceras. Insikt om konsumenternas behov och efterfråga har därför aldrig varit viktigare för ett företag som utvecklar en ny produkt. Målet med detta slutarbete är tvåfaldigt. Ett, att utreda de sensoriska produkttegenskaper i tre köttbuljonger och två, studera finländska konsumenters inställning till buljongprodukter. Detta uppnåddes i en sensorisk studie av tre köttbuljonger genom att utföra en allmän beskrivande analysmetod. Därefter genomfördes en konsumentundersökning, för att utreda användningsgraden av köttbuljong, samt undersöka vilka faktorer som påverkar konsumenternas köpbeteende. I SPSS utfördes ANOVA test för att identifiera signifikanta skillnader i munkänsla, utseende och smak mellan fem olika köttbuljonger. Sociodemografiska skillnader i användning av buljongprodukter samt olika faktorer påverkan på köpintresse undersöktes med hjälp av en logistisk regressionsmodell, i STATA. Resultaten från den sensoriska undersökningen indikerar att rostning av kött, ben och grönsaker före kokning leder till att buljongen får en mörkare färg och starkare smak men förbättrar nödvändigtvis inte buljongens behaglighet. Resultaten från konsumentundersökningen antyder på att buljongtärningar är den populäraste av buljongprodukter och de viktigaste faktorerna när konsumenterna köper buljongprodukter är smaken, tidigare erfarenheter av en produkt och bekvämlighet. Skillnader i konsumenternas intresse för råvarornas ursprung, miljövänlighet och djurens välmående visade sig vara beroende av konsumenternas ålder och var man bor (stad/landsbygd). På samma sätt är skillnader i användningsgrad av buljongprodukter olika, beroende på kön, ålder och var man bor. För att sammanfatta, de här resultaten visar på att både yttre och inre produkttegenskaper är relevanta för att skilja på flytande buljong och andra buljongprodukter och förser framtida marknadsföringsstrategier med aktuell information.</p>			
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## 1 INTRODUCTION

Consumers are the final step in the company value chain (Porter, 1990) and their preferences need to be met for food manufacturers to succeed in the marketplace. Saturated markets and global trade increases competition for food manufacturers, at the same time enabling consumers to choose, not only between different food products but between different brands and variations within the same product group. There is no longer a need to purchase food merely for nutritional value, rather, most consumers choose their food based on personal preferences and social, cultural, environmental or ethical norms and beliefs (Cecchini et al., 2018). Consumers are interested in where their food is coming from and how it is produced (Font-i-Furnols et al., 2011; Grunert et al., 2018). In order to gain competitive advantage food companies can either work more efficiently with lower costs and comparable customer value or they can differentiate and create greater customer value through unique activities (Porter, 1990). Product differentiation is attained through product attributes communicated via product labels and marketing (Carlsson et al., 2005; Symmank, 2019), convincing consumers to pay a premium price for a product supporting personal values and preferences (Michel & Wismer, 2011; Botelho et al., 2017). The high failure rate (50 – 75%) of new food products has been linked to lack of market knowledge and understanding of consumer behaviour (Dijksterhuis, 2016; Stewart-Knox & Mitchell, 2003). Therefore, gathering information, in order to understand the market environment and consumer needs, is highly valuable for a food company developing novel products (Stewart-Knox & Mitchell, 2003). It is useful to understand which attributes makes a product more attractive and even more, how the consumers react to certain attributes.

Food product development is a continuous process (Linnemann et al., 2006). Food companies need to constantly improve and develop new products and production processes, in order to meet rapid changes in consumer wants and needs. Consumer preferences in quality attributes need to be understood in order to maintain and increase consumer interest for existing and newly developed products (Troy, 2010). Exploring quality attributes is complex since consumers perspectives are subjective and not always in line with actual quality (Henchion et al., 2014). A product can be perceived as high quality according to one customer and low quality for another (Issanchou, 1996). Additionally, one food product can have greater value to a consumer, compared to similar competing products, if the product attributes fit the consumer's preferences (Font-i-Furnols, 2014; Maehle et al., 2015). Sensory qualities of food and

especially taste is a main driver for food preference (Garcia-Bailo et al., 2009; Hasselbach., 2008). However, attitudes and beliefs on how the product has been made, handled or distributed can also have a great influence on consumer perception (Claret et al., 2014; Grunert et al., 2018). Intrinsic attributes are the physical characteristics of the product, appearance, flavour, smell, sound and texture, while extrinsic attributes are not part of the physical product but related as brand, packaging, labels, claims and price (Symmank, 2019). Extrinsic attributes can work as indicators of quality, in response to concerns for safety, health and ethical factors (Bernués et al., 2013). Understanding the effects of product attributes and the possible interactions between intrinsic and extrinsic is therefore important in new product development success (Hoppert et al., 2012; Johansen et al., 2010).

Stock products brings convenience and richness to food preparation, providing soups, sauces, stews and other dishes with thickness, smoothness, creaminess, consistency and deep flavour. Stock is a liquid resulting from simmering meat, bones, vegetables and herbs in water (Snitkjær, 2010). When finished, the stock can be used as such or further processed in order to make fonds, stock gels or stock cubes (McGee, 2004). In today's meat industry, by-products such as animal bones are usually either thrown away or further processed as material in animal feed, fertilizer or fuel (Nollet & Toldrá, 2011). Meat stock production can take advantage of these by-products and produce high quality meat stock products. The culture of making stock at home has almost disappeared but is still practiced in some restaurants. The time-consuming process has made most consumers and even some professional chefs to switch over to using pre-prepared commercial stock products (Barham, 2001; McGee, 2004).

## **1.1 Study background and objectives**

The objective of this research was to investigate the intrinsic and extrinsic attributes in meat stock products, since both are known to affect consumers purchase decision (Johansen et al., 2010). Intrinsic attributes were studied in three newly developed liquid meat stocks, by performing a generic descriptive analysis (GDA). Sensory characteristics (appearance, mouthfeel and flavour) in the test products were compared to two similar reference products. A consumer survey study was subsequently conducted, investigating Finnish consumers' usage frequency of stock products and factors influencing consumer preferences for stock products, including extrinsic attributes. These studies were conducted in order to get a deeper

understanding of Finnish consumers' attitudes towards stock products, and novel insights for assessing the likely market success of a new meat stock product.

This thesis was conducted in cooperation with a Finnish food manufacturing company, starting a meat stock production for the Finnish market. The introductory part of the thesis explores factors explaining global meat consumption, since stock products are usually made from meat. Previous research on food product development is then further investigated to study the importance of understanding consumers and markets for new product success. Hypotheses and expectations on the effect of product attributes on consumers purchase interest are based on previous consumer research on different food product attributes. Although there has been previous research on meat stock from a gastronomic perspective (Snitkjær, 2010), studies on production process and flavour development (Cambero et al., 2000; Parker, 2014; Choudhury, 2008), and sensory studies (Kim et al., 2017; Kohno et al., 2005; Fatima, 2013), there appears to be a gap in research on the effect of product attributes on purchase interest intentions for meat stock products amongst Finnish consumers, which this study aims to fill.

## **1.2 Global meat consumption**

Global developments in consumer demand for different food products are shifting due to increased income and demographic changes, such as a population growth, ageing populations, diversification of households, and health crisis such as Covid-19 (Bodirsky et al., 2015; Rude, 2020). Total meat consumption is expected to further increase globally (Figure 1), caused by growing populations and increased income in developing countries, especially in Asia, Africa and Latin-America (see Appendix A, Figure 7). Demand for more expensive meat such as beef and sheep are expected to increase in developing countries. However, growth rates are not expected to be as high as in the previous decade (OECD/FAO, 2018).



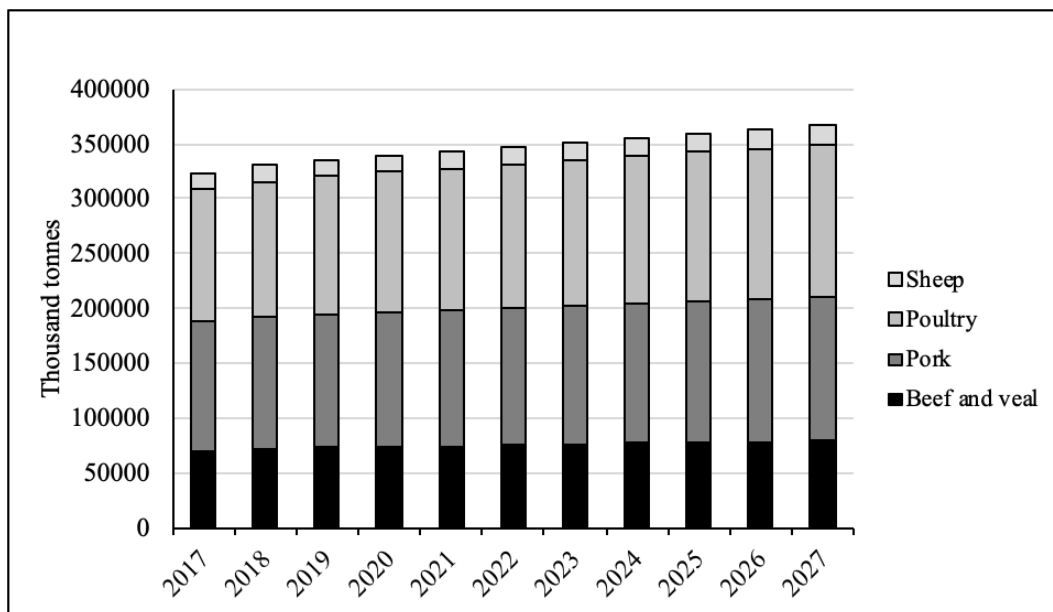


Figure 1. Total world estimated yearly consumption of beef and veal, pork, poultry and sheep meat (2017 – 2027) (www.data.oecd.org).

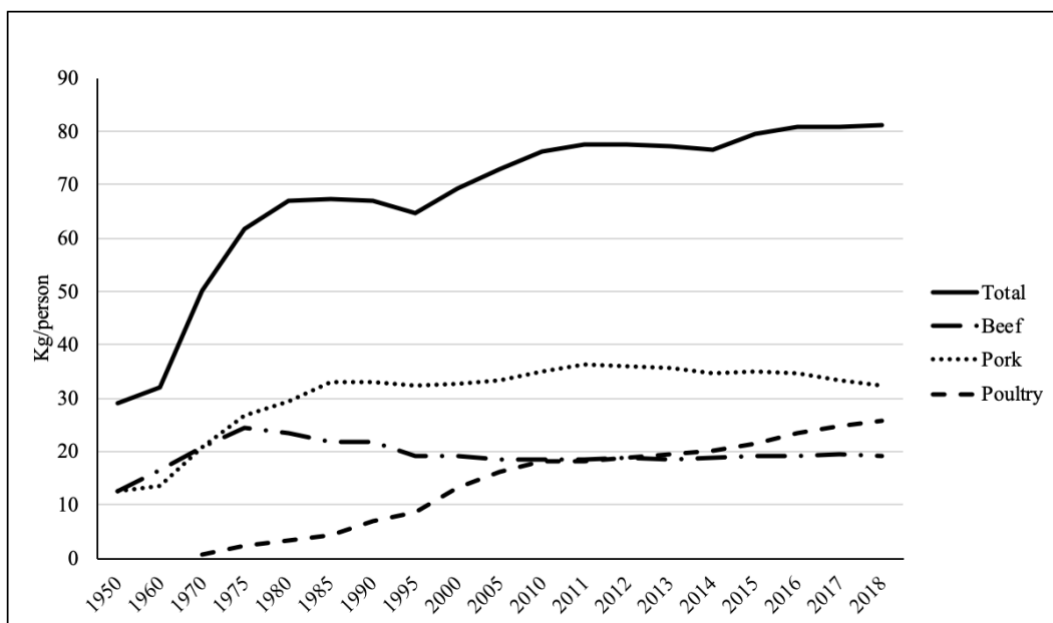


Figure 2. Yearly meat consumption in Finland kg/cap (1950 – 2018) (www.lihatiedotus.fi).

In Western (EU and North America) countries with mature markets, the meat industry faces increasing international competition and limited growth potential (Henchion et al., 2014; OECD/FAO, 2018). Meat consumption in developed countries is expected to further increase, but with growth rates lower than in the developing countries (see Appendix A, Figure 7). Meat consumption in Finland is showing similar trends with meat consumption still increasing but with lower rates than previous decades (Figure 2). Poultry meat sees the most rapid expansion both globally (Figure 1) and in Finland (Figure 2). In Western countries, consumers are increasingly interested in organic food in the last decade (Willer et al., 2014). In addition to health concerns, the increasing interest for food traceability, environmental impacts and animal welfare (Pouta et al, 2010) will mostly likely have a lasting effect on future meat consumption patterns. In spite of these overall trends, we are missing a deeper understanding of Finnish consumers' attitudes towards and sensory preferences for processed, such as stock products.

## **2 SENSORY STUDY ON MEAT STOCK**

### **2.1 Meat stock**

Stocks and broths have been a traditional food around the world for centuries (McGruther, 2016). Stock is different from broth, even though both terms are used interchangeably in the literature (Parker, 2014). Time of cooking broth is usually shorter than stock and often made from meat while stock is made from both meat and bones (McGruther, 2016). The longer cooking time for stocks (usually between 3 - 10 hours) is necessary in order to break down the collagen in the bones. Bone broth is a third variation, similar to stock, and has in recent years become popular in the food and health industry, especially within the Paleo diet (Gimbar, 2017). The cooking time of bone broth can go from half a day up to two days, in order to extract as much as possible of the gelatine, nutrients and minerals from the meat and bones (McGruther, 2016). Unlike broth and stock being used as ingredients in different foods, there is a rising trend of bone broth being sold in restaurants, to be consumed as such (Gimbar, 2017). There are various forms of stock products which are made from traditional stocks but further processed for time saving and convenience purposes (Kim et al., 2017). While a traditional meat stock is made with no artificial additives, commercial stock products usually contain preservatives or have high salt content in order to extend product shelf life (Barham, 2000). Fonds and gels are concentrated forms of stock, while stock cubes are made from dehydrated meat stock and mainly consist of salt, sugar, starch and fat (Moretti et al., 2016; Gupta & Bongers, 2011).

### 2.1.1 *Production of meat stock*

Meat is an expensive ingredient in meat stock production but provides the stock with lots of flavour. Bones on the other hand, by-products in the meat industry, are less expensive and great sources of gelatine (McGee, 2004). Stocks are usually made from chicken, pork, beef, lamb, veal, fish or vegetables. Cartilaginous bones, such as joints and knuckles, are especially rich in collagen and therefore often used in meat stock recipes, in order to obtain gelatine. Gelatine works as a natural thickening agent in sauces and makes a stock solidify when cooled down (McGee, 2004). Bones rich in marrow are used in stock production in order to extract the fatty marrow, including minerals like calcium, phosphorus, sodium, magnesium, potassium, fluorides and chlorides (Chimegee & Dashmaa, 2018). Vegetables are often used in order to attain more flavours (McGee, 2004). While the time for making stock is different, depending on the recipe, the basic steps are often the same.

Peter Barham explains the process of making stock in his book *The Science of cooking* (2000). Bones, meat and vegetables are cut into small pieces and often roasted. The roasting process is optional but believed to provide the final stock with more flavour and colour due to the Maillard reaction (Shahidi et al., 2014). After roasting the meat, bones and vegetables and additional herbs are added to cold water. The importance of starting with cold or hot water is debated. Starting with cold water is said to result in a clearer stock since adding the meat and bones directly into hot water, causes the meat to quickly release tiny separate proteins, resulting in a cloudy stock (McGee, 2004). Scum, from the connective tissues in the meat and bones will rise to the surface as the stock is simmering and will make the stock cloudy if not removed (Barham, 2000). The longer the stock is simmering the more flavour will be extracted, with standard cooking time being 8 hours (McGee, 2004). The next step is straining the stock, removing the meat, bones, and vegetables and followed by filtering. The stock is now ready to be used but can also be further reduced (boiled down) in order to concentrate flavour and change consistency.

### 2.1.2 *Study objective and hypotheses*

The goal of the following sensory study was to compare the sensory characteristic of three novel meat stocks to two similar commercial stocks. The main difference between the new products and the reference samples was that the ingredients were only cooked and not roasted in the

newly developed products. Roasting of bones, meat and vegetables is optional but believed to bring out more flavour and darker colour. The reference stocks were also made with more ingredients such as vegetables and mushrooms. The first hypothesis was that the roasting of bones and vegetables in the making of the two reference stocks would contribute to darker colours. Similarly, the second hypothesis was that roasting of bones would contribute to stronger flavour.

## **2.2 Methods**

The sensory evaluation study consisted of a generic descriptive analysis (GDA) using a trained panel. Descriptive sensory analysis is a technique which allow the researcher to obtain sensory descriptions of products to determine which attributes are most distinct and key to overall acceptance if used together with hedonic tests (Lawless & Heymann, 2010). This technique is often used within product development to study the sensory aspects of a new product or a change in ingredients or process of an already existing product (Tuorila & Appelbye, 2016). It is commonly used to study differences in a products sensory dimensions compared to similar competing products. A generic descriptive analysis requires 8 – 12 panellists that are trained to use and understand the meaning of attributes found in the product samples. Untrained consumers should therefore never be used in this method (Lawless & Heymann, 2010). The panellists are not asked for their hedonic response to the product but trained to give objective descriptions of the perceived sensory attributes.

### *2.2.1 Samples*

Three of the evaluated products Beef 1, Beef 2 and Pork were newly developed test products from the sponsoring company. These stocks were made with fresh bones, meat and vegetables and no other additives but salt, spices and herbs (the exact composition of herbs and proportions cannot be revealed here as it is company's IP). All test products were made in a 3580 L stainless steel cooking pot. The pot was filled with fresh bones and spices (about 1000 kg), meat (200 kg) and water (2000 L), giving a final weight of 3300 kg. Beef 1 and Beef 2 had the same amount of bones and meat, but additional herbs were added to Beef 2 (Table 1). The Pork stock was made with the same ingredients as Beef 1 but with pork spine bones and pork meat trimmings instead of beef (Table 1). The cooking pot was heated up to 97 °C, followed by a 10hour cooking phase at 102 °C. When the cooking phase was completed, the stock (about

2000 kg) was pumped through a filter to a holding tank, keeping the temperature of the stock at 90 °C before packing. Salt was added at this point to make up 0.2 % of total outcome. The reference products were beef stocks, made in Finland similarly to the company stocks with no artificial additives.

During the evaluation sessions, all samples (approximately 75 mL/sample) were served in 150 mL Styrofoam cups, in order to keep the temperature as consistently as possible throughout the evaluation. The sample stocks were heated up to 75 – 80 °C and the temperature was 55 – 60 °C when served to the panellists. The KLL stock had an original 0.4 % higher salt content, so additional salt was therefore added at this point to all other samples, to keep the salt content equal. The samples were also presented in 10 mL clear, plastic cups for the panellists to evaluate appearance attributes.

Table 1. Ingredients in meat stock samples.

Beef1	Beef 2	Pork	KLL	SPLL
Water	Water	Water	Water	Water
Beef spine bones	Beef spine bones	Pork spine bones	Beef bones	Beef bones
Beef meat (MSM)	Beef meat (MSM)	Pork meat trimmings	Beef meat	Onion
Onion	Onion	Onion	Carrot	Beef meat
Salt	Salt	Salt	Onion	Champignons
Black pepper	Parsley	Black pepper	Parsnip	Carrot
Allspice	Lovage	Allspice	Salt	Parsnip
Bay leaf	Thyme	Bay leaf	Parsley	Leek
	Black pepper		Thyme	Salt
	Allspice		Black pepper	Lovage
	Bay leaf		Bayleaf	Parsley
				Black pepper
				Thyme
				Bay leaf

### 2.2.2 Panellists and sessions

The study was performed with one session for developing the vocabulary, one training session and two evaluation sessions. The panel consisted of 10 people (N=5 males, 5 females) from different departments in the sponsoring company. All but one were first time panellists with no previous experience in food evaluation. The first session consisted of a short introduction of

the study, explaining the method and all participants were served three different meat stock samples (Beef 1, Beef 2 and KLL). The panellists were told to individually observe, taste and smell the samples and describe flavour, odour and appearance by writing them down on a piece of paper. The panellists then, as a group discussed the attributes and agreed on a 15 attributes profile for appearance, odour, mouthfeel and flavour. They also jointly decided on suitable scaling for all attributes. Line scale anchors were based on the intensity of attributes found in all in the meat stock samples.

In the training session, the panellists individually evaluated two samples, SPLL and KLL, based on the vocabulary and scaling which was decided in the first session. This was followed by a review of all attributes and scales, and unsuitable attributes or attributes too difficult to distinguish were discarded. The final number of attributes was 13, two for appearance, two for mouthfeel and nine for flavour (Table 2).

Table 2. Sensory attributes and scales for rating of intensity

Attribute	Scale
<b>Appearance</b>	
Clarity	(1 = very cloudy - 9 = very clear)
Colour	(1 = yellowish - 9 = brownish)
<b>Mouthfeel</b>	
Viscosity	(1 =high - 9 = low)
Oily	(1 = not at all - 9 = very oily)
<b>Flavour</b>	
Strength of flavor	(1 = weak - 9 = very strong)
Fried meat	(1 = weak - 9 = very strong)
Roasted root	(1 = not at all - 9 = very strong)
Saltiness	(1 = not at all - 9 = very strong)
Bitterness	(1 = not at all - 9 = very strong)
Sweetness	(1 = not at all - 9 = very strong)
Rancid	(1 = not at all - 9 = very strong)
Aftertaste (duration)	(1 = direct - 9 = protracted)
Pleasantness	(1 = not at all - 9 = very pleasant)

In the evaluation sessions, the panellists were divided into two groups of five. The evaluation took place in the R&D department of the sponsoring company in a quiet, well-lit room. The panellists were seated away from each other and were told not to communicate with each other during the evaluation. The tables were prepared with one cup of water, one cup for spitting out,

a napkin, a pen and the evaluation form. The panellists were then served a tray with five samples in Styrofoam cups, Beef 1, Beef 2, Pork, SPLL and KLL (Table 1). The samples were coded with a three-digit random number, in randomized order for each panellist. Samples were rated on the predetermined numeric scale, ranging from 1 to 9 and anchored at endpoints suitably for each attribute (Table 2). The panellists were told to evaluate one attribute at a time for all five stock samples on the tray in front of them, always starting with the sample to the left and go right. Panellists were informed to take a sip and properly taste the sample before swallowing or spitting it out. Water was put out for panellists to rinse their mouths with when going from one sample to another. The second evaluation took place one week later in the same place at the same times 10 am and 2 pm. The samples were the same as in the first evaluation session, coded with the same numbers but in different randomized order for each panellist.

### *2.2.3 Data analysis*

The data was collected using evaluation forms, with 1 – 9 numeric line scales for each attribute. The results were analysed using IBM SPSS statistical analysis software (version 25). Significant differences between samples were determined by using One-way ANOVA and Tukey's post hoc test. A univariate analysis (Two-way ANOVA) was used to study the interactions between sample and session.

## **2.3 Results**

Sensory characteristics in five meat stocks, four made from beef and one made from pork, were evaluated. Evaluated attributes were based on product appearance, mouthfeel and individual flavours. Mean ratings for each sample on every attribute are visualized as a radar chart in Figure 3. Differences between samples are seen in lines deviating from each other.

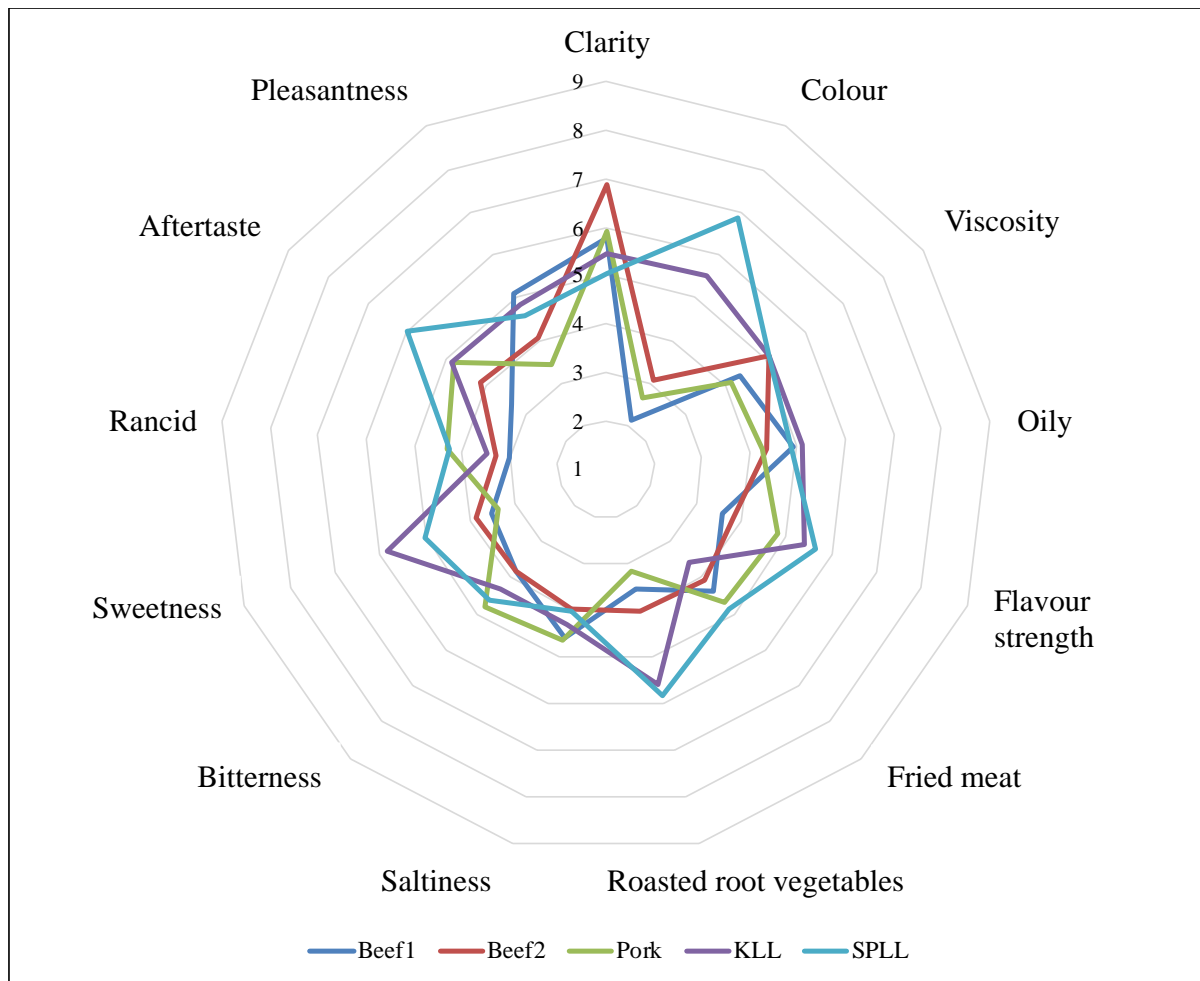


Figure 3. Sensory profiles of the meat stocks. The means of 13 attributes presented as a radar chart. Coloured lines represent samples evaluated for each attribute on a 1 – 9 scale.

### 2.3.1 Mean ratings

Column charts comparing mean ratings and standard deviations for each attribute are presented in figures 4, 5 and 6. The ratings are mean values from all participants (N=10) and from both sessions. Beef 2 had the clearest appearance but was significant different only to one of the reference stocks, SPLL. The two reference stocks were both darker compared to the company stocks, with means significantly higher for ‘colour’. The reference stocks had highest means of ‘roasted root vegetables’ and over-all ‘flavour strength’, significantly differing from all other samples. KLL scored highest for sweetness, significant to all others, except for SPLL. SPLL had the longest duration of ‘aftertaste’, significant to Beef 1 and Beef 2. Beef 1 received the highest score for ‘pleasantness’ but the difference was significant only to Pork. Six attributes (clarity, viscosity, oily, fried meat, saltiness and bitterness) showed no significant difference between samples.



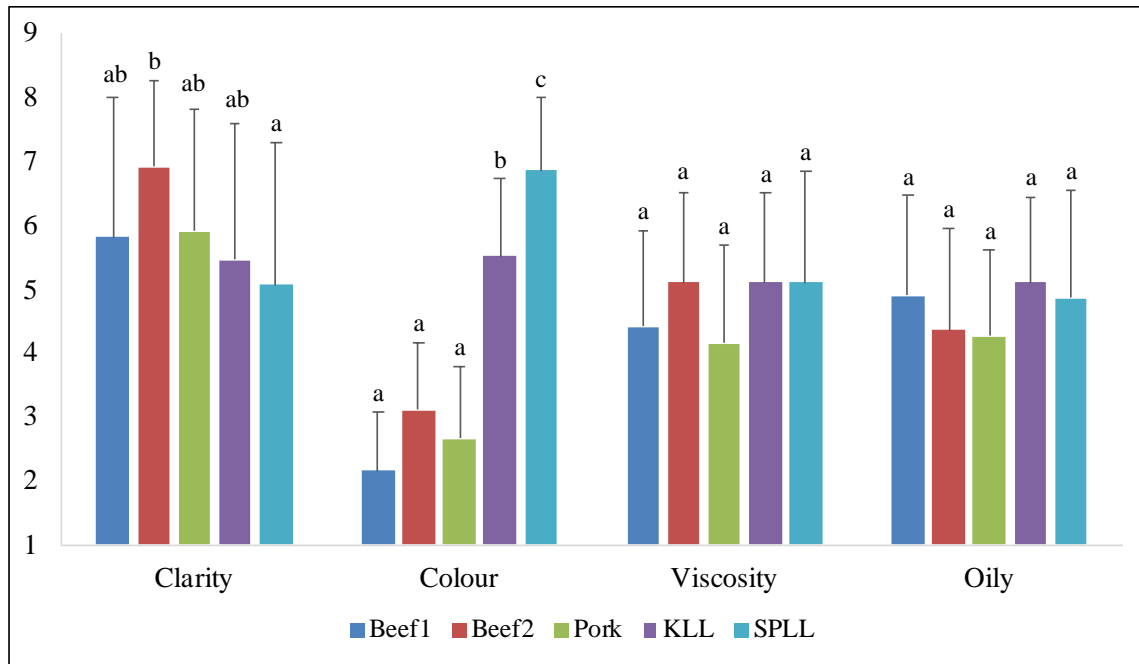


Figure 4. Mean ratings and standard deviations of attributes (N=10 panellists, 2 replicates) – clarity, colour, viscosity, oily (N=4). Significant differences are defined using One-way ANOVA and Tukey’s test. Symbols a, b and c mark significant difference between mean values,  $p < 0.05$ .

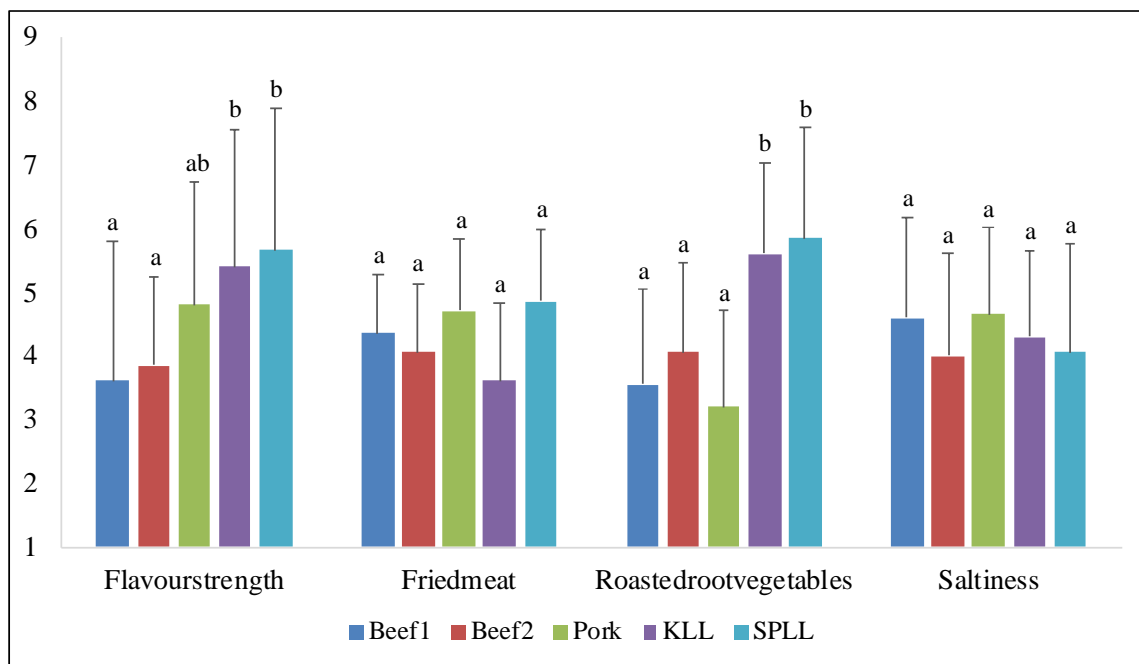


Figure 5. Mean ratings and standard deviations of attributes (N=10 panellists, 2 replicates) – flavour strength, fried meat, roasted root vegetables, saltiness (N=4). Significant differences are defined using One-way ANOVA and Tukey’s test. Symbols a, b and c mark significant difference between mean values,  $p < 0.05$ .

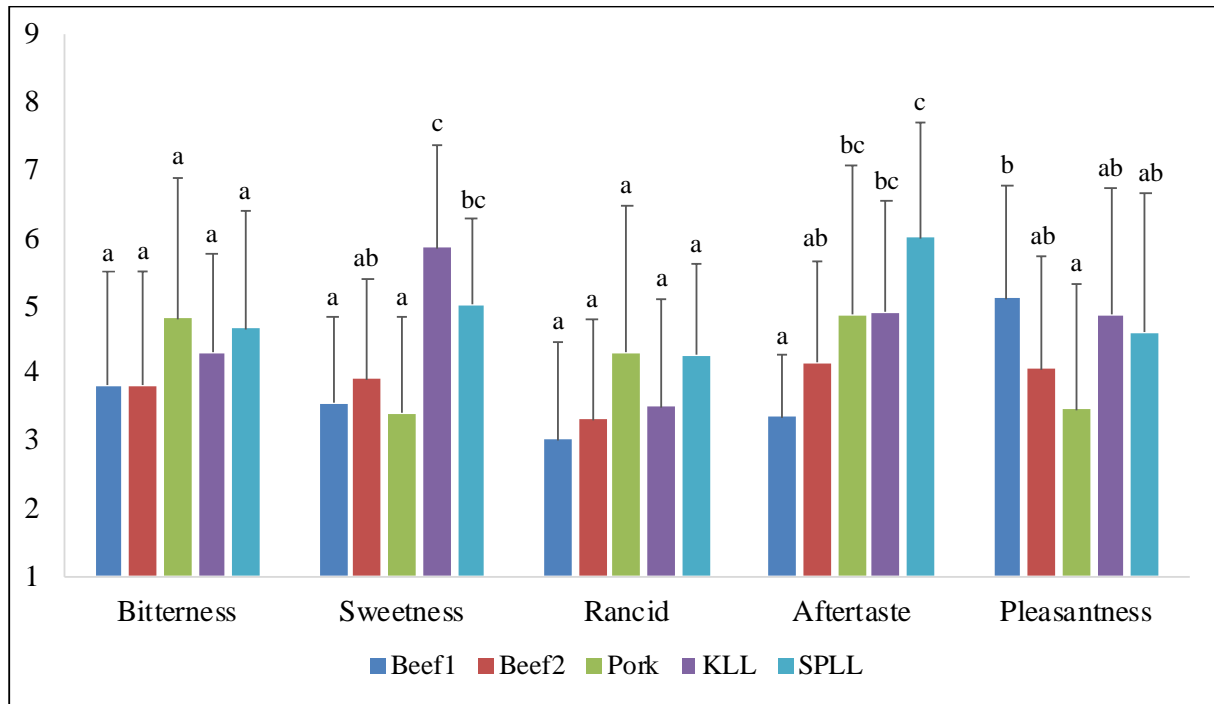


Figure 6. Mean ratings and standard deviations of attributes (N=10 panellists, 2 replicates) – bitterness, sweetness, rancid, aftertaste, pleasantness (N=5). Significant differences are defined using One-way ANOVA and Tukey’s test. Symbols a, b and c mark significant difference between mean values,  $p < 0.05$ .

### 2.3.2 Sample and session

Table 3. Results from Two-way ANOVA on sample and session

	Sample		Session		Sample*Session	
	F (4,90)	Sig.	F (1,90)	Sig.	F (4,90)	Sig.
Clarity	2.757	<b>0.033</b>	1.959	0.165	4.443	<b>0.003</b>
Colour	69.752	<b>&lt; 0.001</b>	5.312	<b>0.023</b>	0.914	0.460
Viscosity	1.794	0.137	0.106	0.746	0.825	0.513
Oily	1.182	0.324	0.523	0.472	0.966	0.430
Flavour strength	7.693	<b>&lt; 0.001</b>	1.850	0.177	0.844	0.501
Fried meat	1.512	0.205	0.146	0.704	0.584	0.675
Roasted root vegetables	11.522	<b>&lt; 0.001</b>	0.036	0.851	1.908	0.116
Saltiness	0.692	0.600	0.061	0.806	0.775	0.544
Bitterness	1.368	0.251	0.028	0.867	0.375	0.826
Sweetness	11.281	<b>&lt; 0.001</b>	0.327	0.569	1.182	0.324
Rancid	2.449	0,052	0.004	0.952	0.857	0.493
Aftertaste	7.196	<b>&lt; 0.001</b>	1.344	0.249	1.130	0.347
Pleasantness	2.519	<b>0.047</b>	0.003	0.957	0.368	0.831

*Note.* Results of the independent variables (sample and session) and their interaction (sample\*session). Degrees of freedom values are presented in parentheses for each column. Significant p values (<0.05) are shown as bold.

As previously mentioned there were significant differences between the samples in 7 attributes; clarity (F[4,90] = 2.76, p = .033), colour (F[4,90] = 69.75, p<.001), flavour strength (F[4,90] = 7.69, p<.001), roasted root vegetables (F[4,90] = 11.52, p<.001), sweetness (F[4,90] = 11.28, p<.001), aftertaste (F[4,90] = 7.20, p<.001) and pleasantness (F[4,90] = 2.52, p=.047). The results for session indicate a difference between the two sessions for the colour attribute (F[1,90] = 5.31, p = 0.023). There was also an interaction between sample and session in the evaluation of clarity (F[4,90] = 4.44, p = 0.003).

### **3 CONSUMER SURVEY ON STOCK PRODUCTS**

To complement the insights from the sensory panel evaluation of meat stock attributes, a further analysis of extrinsic and intrinsic stock product attributes was conducted based on a consumer survey in Finland. The following section provide first literature background, before presenting methods and a joint discussion of results that encompasses both the results of the sensory analysis and consumer survey analysis (section 5).

#### **3.1 Literature review**

Three trends can be observed in European societies today. First, consumers interest in product quality and extrinsic food attributes is rising (Henchion et al., 2014; Fernqvist & Ekelund, 2014; Linnemann et al., 2006). Extrinsic attributes are product characteristics not part of the physical product but related to brand, packaging, information labels, claims and price (Symmank, 2019). Secondly, as consumers have access to more information than ever before on nutrition, dieting and health (Himmelsbach [TNS] et al., 2014), the interest in health and wellbeing is increasing (Global Wellness Institute, 2018). Third, the fast lifestyle of modern consumers has resulted in a higher demand for convenience (Buckley et al., 2007). The feeling of not having time has affected the way we consume food (Jabs & Devine, 2006) and many consumers are interested in the time-saving aspects of convenience food (Saghaian & Mohammadi, 2018; Costa et al., 2007).

##### *3.1.1 Extrinsic attributes*

In the past, intrinsic attributes such as appearance and flavour were almost conclusive in the buying decision, but consumers today are more concerned with social and environmental issues and therefore pay more attention to extrinsic attributes in their consumption (Linnemann et al., 2006). Price as an attribute can have both a negative and positive effect on purchase interest. Product demand is evidently driven up by lower price, but a lower price can simultaneously have a negative effect on expected quality, while a higher price can indicate higher product quality (Font-i-Furnols & Guerrero, 2014; Steiner, 2004). Several meat studies show attributes such as quality, taste, hormone free, country of origin and quality labels to be more important than price, to consumers (Verbeke & Viaene, 1999; Cicia & Colantuoni, 2010; Font-i-Furnols et al., 2011; Realini et al., 2013). Other studies show price to be more important to some

consumers (Baines et al., 2001; Du Plessis & du Rand, 2012), and price preferences have also been linked to age and gender (Font-i-Furnols et al., 2011; Steiner & Yang, 2010; Steiner et al., 2010).

Origin has been found to have great effect on purchase intentions of meat and local options are often preferred. Additionally, the importance of origin has been found to be stronger for women and older people. Studies also reveal that lower price of meat is generally preferred but is more important to men and younger people (Font-i-Furnols et al., 2011; Realini et al., 2013). A study in Finland investigating the effects of country of origin (CoO) and production methods on consumer choice of broiler meat, found similar results (Pouta et al., 2010). The study reported strong positive perceptions of domestically produced broiler. Organic production methods and production with emphasis on animal welfare was also preferred over consumer health effects. Older women showed strong domestic preferences and lower preferences for production processes while young men with low income showed weak domestic preferences and were more likely choosing price as very important. Price was less important to females with strong preference for organic production and animal welfare. This study concluded that trust in the domestic meat industry is high amongst Finnish consumers and thereby often enough to guarantee production quality (Pouta et al., 2010). However, the importance of origin differs significantly by product type and the value of origin has been found to be more important amongst fresh meat compared to processed products (Balcombe et al., 2016).

### *3.1.2 Health awareness*

The sector of healthy eating, nutrition and weight loss accounted for \$702 billion of the total \$4.5 trillion global wellness economy (2017). From 2015 to 2017, the whole industry grew annually by 6.4 percent, nearly double the global economic growth (3.6 percent) (Global Wellness Institute, 2018). A general trend amongst Finnish consumers before the Corona-crisis has been the intention to change food consumption habits for health benefits (Latvala et al., 2012). Few consumers are ready to stop eating meat completely, but most plan to reduce their intake of certain meat products while increasing consumption of vegetables (Latvala et al., 2012; Archer, 2019). European consumers interest in vegan or vegetarian alternatives to meat products is more evident amongst younger consumers is also influenced by ethical and environmental issues in the food industry (Grunert et al. 2018; Archer, 2019).

Additionally, consumer interest for food and health can be seen in the attitudes towards artificial additives. The use of additives and preservatives in the food industry has gained the negative reputation of being unhealthy or unfamiliar. Consumers' interest for "clean labels" has led to increasing marketing strategies focusing on product labels such as organic, natural and free from additives (Asioli et al., 2017). Socio-demographic characteristics, such as education, gender and age have been shown to relate to consumers' perception of food additives (Wu et al., 2013). Women have shown lower acceptance of artificial food additives compared to men (Bearth et al., 2014), and younger people are less worried than older people about food safety (De Jonge et al., 2007).

Consumers' willingness to pay a premium price for a "natural" label has been found to be affected by knowledge of label information, and some labels have greater effect on consumers than others (Syrengelas et al., 2016). Similarly, consumers in the U.S. and Europe have been found to have greater preference for non-GM foods (Kemper et al., 2018; Soregaroli et al., 2003), and to value naturalness in foods as well as show increasing interest in organic and locally produced food and animal feed (Wägeli et al., 2015).

### *3.1.3 Convenience*

Lower diet quality and higher costs are associated with people who spend less time on food preparation. Reasons include the perception of time pressure and the lack of cooking skills (Monsivais et al., 2014). The number of meals eaten out-of-home or home-delivered meals compared to home-made, has increased rapidly during the last decades (Lachat et al., 2011). Frequency of eating-out is inconsistent between countries and has been linked to factors such as age, household size, income and education (Lund, Kjærnes & Holm, 2017). A rising number of households with both parents in the work force is one factor that has resulted in less time spent on food consumption and preparation (Mandemakers & Roeters, 2014). Attitudes towards the healthiness, value for money and time saving factors in convenience foods differ amongst consumers (Buckley et al., 2007). Consumption of convenience foods has also been found to be influenced by cooking skills, concern for naturalness and nutrition knowledge (Brunner et al., 2010). People who spend less time on food preparation tend to be working adults (Monsivais et al., 2014) and people who feel the most time pressure tend to appreciate the time saving aspect of convenience foods most (Mallinson et al., 2016).

### *3.1.4 Hypotheses*

With this background of previous research, this consumer survey aims to study consumer attitudes towards stock products and factors influencing purchase intention. The goal is to study how case specific socio-demographic variations can predict the user frequency of stock products and claims (information that could be used on labels) related to sustainability and animal welfare. Previous research suggests a strong preference for foods of domestic origin in Finland (Pouta et al., 2010). In the absence of more evidence, the hypothesis is that Finnish consumer also value domestic origin as one of the most important attributes in meat stock products. In the light of the previous evidence (section 4.1.2), the second hypothesis is that consumers have a strong preference for attributes related to naturalness (e.g. free from additives). Previous research suggests variations in socio-demographic variables, and the third hypothesis is therefore that older and female consumers value claims related to sustainability and animal welfare more, compared to men and younger people (Font-i-Furnols et al., 2011; Realini et al., 2013). Furthermore, keeping in mind that consumers seek convenience in food preparation (Brunner, Horst & Siegrist, 2010), the fourth hypothesis is therefore that attributes related to convenience are highly valued.

## **3.2 Methods**

### *3.2.1 Data collection*

584 Finnish consumers, between 20 and 70 years old participated in the online survey carried out by a professional market research company in February 2020. The key selection criteria for survey participants was placed on people who regularly prepare food, so only those who stated that they prepare food 2 – 3 days a week or more frequently were selected for survey participation. Additionally, respondents stating that they never use any kind of stock product were eliminated in all data analysis (N=33), causing the total number of observations to be reduced to 551.

### 3.2.2 *Survey questions*

The questionnaire was planned and developed in cooperation with the sponsoring company. Survey questions were created based on interests from sponsoring company and from literature. Stated preference models are commonly used in order to gather information on market response to new products and product attributes (Louviere et al., 2000). User frequency of stock products was investigated using a six-level ordinal scale (at least once a week, twice a month, once a month, once every three months or never), and the respondents could state their current use among four different stock products (stock-cube, fond, stock-gel and liquid-stock). Consumer preference for stock product brands was also investigated, using a stated choice method, by having consumers select which brand they mainly use, choosing from a list of common stock product brands found on the Finnish market. The purpose of using stock products was measured with a binary scale (yes or no) for four different purposes; soups, sauces, stews, for cooking rice/pasta/noodles and casseroles.

Consumers were also asked how much environmental and animal welfare attributes affect their purchase interest when choosing stock products. A five-level ordinal scale (not at all, very little, quite little, quite a lot, very much) was used to assess the effect of each factor. The factors studied were origin of raw materials, locality of raw materials (produced nearby/locally), environmental-friendly packaging (recyclability), environmental-friendly product (use of by-products) and animal welfare. A stated choice method was used to investigate the importance of different factors and product attributes influencing consumers' purchase interest. Participants were asked to choose the most important product-related factor/attribute when purchasing a stock product. A list of 16 choices, in randomized order, was presented to each participant and they were asked to choose the five most important factors/attributes when purchasing a stock product, 1 being most important and 5 fifth most important.

An Ordered Logit regression model (Min, 2013) was used to analyse the user frequency of stock products and the effects of sustainability and animal welfare factors on purchase intention. The data was analysed using STATA/MP statistics and data science software (version 15.1).



### 3.2.3 Data analysis

The ordered logit model is considered appropriate for a dependent categorical variable consisting of two or more categories in a meaningful order (Avanath & Kleinbaum, 1997; Pohlmann & Leitner, 2003). In this study the dependent variables used for user frequency and influencing factors consisted of six (at least once a week, twice a month, once a month, once every three months, more rarely and never), and five categories (not at all, very little, quite little, quite a lot, very much), respectively.

Min (2013) explains the ordered logit model as follows. The dependent variable  $Y$  is an ordinal variable with  $c$  categories.  $\Pr(Y \leq j)$  indicates the probability for a response on  $Y$  falling in category  $j$  or below, called a cumulative probability which equals the sum of probabilities in category  $j$  and below:

$$\Pr(Y \leq j) = \Pr(Y = 1) + \Pr(Y = 2) + \dots + \Pr(Y = j) \quad (1)$$

The dependent variable in the model has  $c$  cumulative probabilities:  $\Pr(Y \leq 1)$ ,  $\Pr(Y \leq 2)$ , ...,  $\Pr(Y \leq c)$ . The final cumulative probability uses the entire scale, therefore  $\Pr(Y \leq c) = 1$ , forming:

$$\Pr(Y \leq 1) \leq \Pr(Y \leq 2) \leq \dots \leq \Pr(Y \leq c) = 1 \quad (2)$$

In an ordered logit model, an underlying probability of an observation for being in the  $i$ th category is estimated as a linear function of the independent variables and a set of thresholds. The probability of a response being in category  $i$  is the same as the estimated linear function, plus random error, being within the range of the threshold estimated for that response.

$$\begin{aligned} \Pr(\text{Response Category for the } j\text{th Outcome} = i) = & \quad (3) \\ \Pr(k_{i-1} < b_1 X_{1j} + b_2 X_{2j} + \dots + b_k X_{kj} + u_j \leq k_i) & \end{aligned}$$

Estimating the coefficients  $b_1, b_2, \dots, b_k$  along with thresholds  $k_1, k_2, \dots, k_{i-1}$  is needed, where  $i$  is the number of possible categories in the dependent variable. These coefficients and thresholds are estimated using maximum likelihood procedures. Marginal effects then computed, which are immediate changes of the independent variable relating  $x_k$  to  $\Pr(y = m|x)$ ,

while holding all other variables constant. The equation for estimating the marginal effects for an ordered logit model can be presented as below (Long & Freese, 2006):

$$\frac{\partial \Pr(Y=m|X)}{\partial x_k} = \frac{\partial F(\tau_m - x\beta)}{\partial x_k} = \frac{\partial F(\tau_{m-1} - x\beta)}{\partial x_k} \quad (4)$$

### 3.3 Results

Descriptive statistics of the selected consumers by age, gender, education, province and number of single households are presented in Table 4. A comparison of the sample with the census population in Finland suggests over and under-representations of some of the groups in our samples. Summary statistics of data variables used in the regression analysis for usage frequency and factors influencing purchase interest are presented in Table 5.

Table 4. Summary statistics for survey population and the Finnish population (www.stat.fi 2018)

Variable	Census population	Survey population
Female (%)	51	59
Age (mean, years)	43	45
University degree - bachelor or higher (%)	22	24
Single person household (%)	44	30
Helsinki-Uusimaa (%)	31	40
Southern Finland (%)	21	20
Western Finland (%)	25	23
North- and Eastern Finland (%)	23	17

*Note.* The distribution of final sample data in percentage (N=551).

Table 5. Summary statistics of samples in the ordered regression analysis.

Variable	Unit	Mean	Std.
Age	Years	45	14.07
Gender	0 = male, 1 = female	0.60	0.49
Area	0 = rural, 1 = urban	0.82	0.38

*Note.* All explanatory variables were converted into a binary scale, except for age. Mean values and standard deviations are shown for variables.

### 3.3.1 *User frequency and purpose*

Consumers stating their user frequency of stock products and choice of brand gives information about the which product types and which stock product brands are most popular amongst Finnish consumers. According to the results there is a strong preference for stock cubes. Stock cubes are used by the majority (92%) of survey participants at least sometimes, and most stated using stock cubes at least once a week (26%) or twice a month (33%). The second most common stock product is stock gel, with 56 % of respondents stating that they use gels at least sometimes. About half of all respondents never use fonds (46%) and a great majority (82 %) stated that they never use liquid stock in their food preparation. Only 5 % of all respondents use liquid stock once every three months or more frequently and 14% use liquid stock more rarely. Those who use liquid stocks (N=107) prefer meat flavour over vegetable, chicken and fish (see Appendix B, Table 9). Results from respondent's choice of stock product brand show that most consumers mainly use one of two brands. Knorr (43 %) and Maggi (25 %) make together up for 64 % of stock product brands used, and the rest of the market share is spread out over several less popular brands (see Appendix B, Figure 8).

The purpose of using stock products is mainly when preparing four types of food; soups, sauces, stews, for cooking rice/pasta/noodles and casseroles. The most common food dish to use stock products for was soup (82 %). The second most common use is in sauces (60 %), about half (51 %) use stock products in stews, 38% when cooking rice/pasta/noodles and 28 % when making casseroles (see Appendix C Table 10). Only 3 % of respondents stated that they use stock products for other food dishes outside of these four types.

Table 7. Results from Ordered Logit model on usage frequency

Product	Variable	Coef.	Std. Err.	Six levels of user frequency					
				At least once a week	Twice a month	Once a month	Every three months	More rarely	Never
				Marginal effects					
Stock-cube	Age	-0.011	<b>(0.01)</b>	<b>0.002</b>	0.000	-0.000	-0.000	-0.001	-0.000
	Area	0.448	<b>(0.21)</b>	<b>-0.095</b>	-0.004	<b>0.022</b>	<b>0.020</b>	<b>0.049</b>	<b>0.008</b>
	Gender	0.253	(0.16)	-0.051	-0.007	0.012	0.011	0.030	0.005
Fond	Age	-0.019	<b>(0.01)</b>	<b>0.000</b>	<b>0.001</b>	<b>0.001</b>	<b>0.001</b>	<b>0.002</b>	<b>-0.005</b>
	Area	-0.221	(0.21)	0.005	0.012	0.006	0.010	0.023	-0.055
	Gender	0.213	(0.17)	-0.006	0.013	-0.006	-0.010	-0.020	0.053
Stock-gel	Age	-0.015	<b>(0.01)</b>	<b>0.001</b>	<b>0.001</b>	<b>0.001</b>	<b>0.001</b>	<b>0.001</b>	<b>-0.004</b>
	Area	0.119	(0.21)	-0.005	-0.010	-0.006	-0.004	-0.004	0.029
	Gender	0.102	(0.16)	-0.004	-0.009	-0.005	-0.004	-0.004	0.025
Liquid-stock	Age	-0.009	(0.01)	-	0.000	0.000	0.000	0.001	-0.001
	Area	-0.403	(0.30)	-	0.004	0.007	0.006	0.040	-0.057
	Gender	0.584	<b>(0.22)</b>	-	-0.006	<b>-0.012</b>	<b>-0.012</b>	<b>-0.063</b>	<b>0.093</b>
Log likelihood	=	Stock-cube	Fond	Stock-gel	Liquid-stock				
Number of obs	=	-842.79546	-707.2642	-806.39957	-806.39957				
LR chi2(3)	=	551	551	551	551				
Prob > chi2	=	12.58	14.62	8.34	11.25				
Pseudo R2	=	0.0056	0.0022	0.0394	0.0105				
		0.0074	0.0102	0.0051	0.0154				

Note. Significant p values (<0.05) are shown as bold.

Socio-demographic variables showing significant values for user frequency are reported in table 7. The estimated results from the ordered logit regression show significant differences found in three variables; age, gender and area. The significant and negative coefficient values of age indicate that consumers with higher age are more frequent users of stock-cubes, fonds and stock-gels (-0.124, -0.020 and -0.015). The results for area suggest that people in urban areas (area = 1) are less likely to be frequent users of stock-cubes (0.444). Results for liquid-stock suggest that females (gender = 1) are less likely to use liquid-stock than men (0.620).

### 3.3.2 Factors influencing product choice

Results from the analysis of sustainability and animal welfare attributes on purchase interest are presented in table 8. The results suggest that origin of raw materials, eco-friendly package (recyclability) and animal welfare are the most important factors affecting purchase interest for

stock products. About 34 % of consumers answered being affected by origin of raw materials quite a lot and 14 % very much. About 35 % stated they are affected by eco-friendly package quite a lot and 13 % very much, while about 32 % stated being affected by animal welfare quite a lot and 22 % very much (see Appendix C, Figure 10). No significant difference between socio-demographic variables for origin of raw materials was found.

Table 8. Results from Ordered Logit model on influencing factors.

Factor	Variable	Coef.	Std. Err.	Five levels of interest				
				Not at all	Very little	Quite little	Quite a lot	Really much
				Marginal effects				
CoO raw materials	Age	0.004	(0.01)	-0.000	-0.000	-0.000	0.001	0.000
	Area	-0.309	(0.21)	0.027	0.018	0.032	-0.036	-0.041
	Gender	0.154	(0.16)	-0.015	-0.009	-0.014	0.020	0.019
Local raw materials	Age	0.002	(0.01)	-0.000	-0.000	-0.000	0.000	0.000
	Area	-0.471	<b>(0.20)</b>	<b>0.046</b>	<b>0.037</b>	0.025	<b>-0.074</b>	<b>-0.034</b>
	Gender	0.174	(0.16)	-0.019	-0.014	-0.004	0.027	0.011
Environmental-friendly package	Age	-0.002	(0.01)	0.000	0.000	0.000	-0.000	-0.000
	Area	0.409	<b>(0.20)</b>	<b>-0.037</b>	<b>-0.035</b>	<b>-0.029</b>	<b>0.061</b>	<b>0.040</b>
	Gender	0.813	<b>(0.16)</b>	<b>-0.071</b>	<b>-0.068</b>	<b>-0.060</b>	<b>0.115</b>	<b>0.084</b>
Environmental-friendly product	Age	-0.005	(0.01)	0.001	0.000	0.000	-0.001	-0.000
	Area	0.160	(0.20)	-0.018	-0.013	-0.005	0.024	0.012
	Gender	0.610	<b>(0.16)</b>	<b>-0.070</b>	<b>-0.049</b>	<b>-0.019</b>	<b>0.092</b>	<b>0.047</b>
Animal welfare	Age	-0.008	(0.01)	0.000	0.001	0.001	-0.001	-0.001
	Area	-0.049	(0.19)	0.004	0.003	0.004	-0.004	-0.009
	Gender	0.478	<b>(0.16)</b>	<b>-0.045</b>	<b>-0.033</b>	<b>-0.041</b>	<b>0.038</b>	<b>0.080</b>
		CoO raw materials	Local raw materials	Environmental-friendly package	Environmental-friendly product	Animal welfare		
Log likelihood	=	-802.54758	-784.0047	-798.0147	-803.97273	-826.07746		
Number of obs	=	551	551	551	551	551		
LR chi2(3)	=	3.61	6.63	31.36	17.66	12.73		
Prob > chi2	=	0.3064	0.0846	0.0000	0.0005	0.0053		
Pseudo R2	=	0.0022	0.0042	0.0193	0.0109	0.0076		

Note. Significant p values (<0.05) are shown as bold.

These results indicate that people residing in urban areas are less likely to perceive local raw materials as important factors (-0.475) compared to those in rural areas. Environmental-friendly package (recyclability) is more important to women (0.632) than to men and to people in urban areas (0.414) compared to people in rural areas. Women also tend to be more affected by the environmental friendliness of the product (using by-products) (0.632) and animal welfare (0.512) than men.

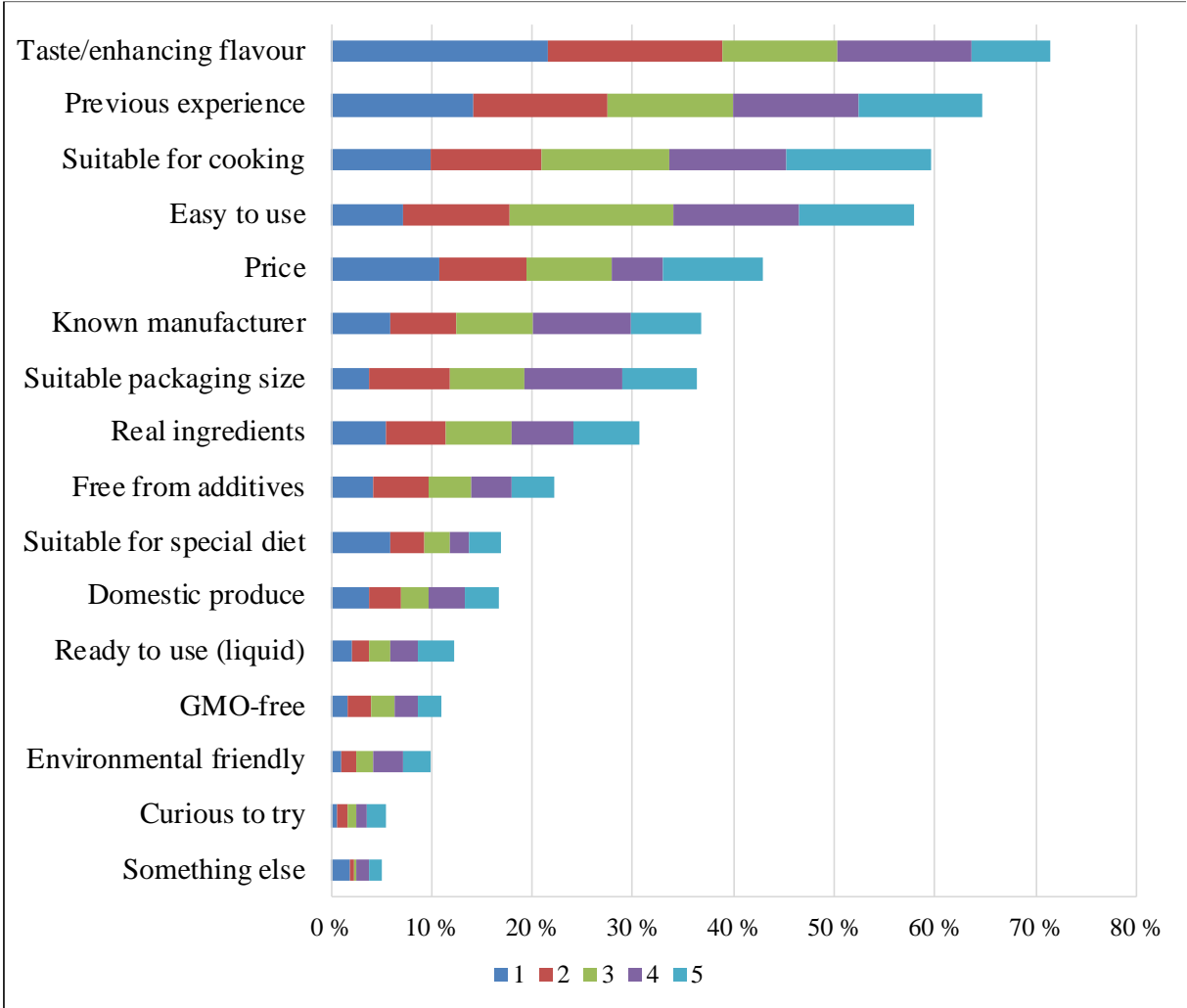


Figure 6. Consumers' ranking attributes of importance 1 (most important) – 5 (fifth most important). The number of observations differ for each ranking (1 to 5) since some respondents did not rank all five.

Factors most important when choosing a stock product are visualized in figure 6. Each bar colour indicates the frequency of an attribute being chosen as being first, second, third, fourth or fifth most important. Taste/enhancing flavour was thereby chosen most frequently as most important attribute (22 %) and the most common choice overall (72 %). Every factor was chosen at least once as most important, while the four most important factors, following taste

were previous experience (65 %), suitable for cooking (60 %), easy to use (58 %) and price (43 %). Flavour was also most frequently ranked as most important. Price was the fifth most chosen factor but more frequently chosen as most important compared to stocks being suitable for cooking and easy to use. Attributes related to health such as real ingredients (authenticity) (37 %) and free from additives (naturalness) (22 %) were moderately important while GMO-free (11 %) and environmental-friendly (10 %) were less important. Domestic produce was most important only to a few consumers and chosen overall in only 17 % of cases. However, we note that some of the survey respondents did not rank all five attributes, so the number of observations differs across attributes.

## **4 DISCUSSION**

### **4.1 Sensory analysis of meat stock**

In the sensory study the sensory characteristic of three newly developed meat stocks were investigated. Appearance, mouthfeel and flavour attributes in the test stocks were compared to two existing stocks in the marketplace used as reference. For this sensory evaluation, the use of different raw materials and the effect of roasting on flavour and colour development was of interest to explore the market potential for novel stock attributes.

The two reference stock samples were evaluated as darker, having stronger flavour of roasted root vegetables and stronger overall flavour. These results are in line with expectations. The Maillard reaction, or non-enzymatic browning as it is often referred to occurring in the roasting process is known to affect meat flavour and colour development (Cambero et al, 2000; Shahidi et al., 2014). This could explain the significant difference in ‘colour’, ‘flavour strength’ and ‘taste of roasted root vegetables’. However, the ‘fried meat’ attribute did not differ significantly between samples and the perception of fried meat was even lower in one of the reference samples (KLL) than in the test samples. This might indicate that the ‘fried meat’ attribute was difficult to distinguish or that the difference in flavour strength mostly came from the using more vegetables, rather than from the roasting process. The duration of aftertaste was also dominant for the SPLL reference sample which could be related to the overall flavour strength. The reference stocks were also evaluated as sweeter, especially the KLL reference sample. Natural sweetness in carrots and onions used when making these could explain this difference

(McGee, 2004). The reference stocks were both more bitter and had a stronger rancid flavour, compared to test samples made with beef (Beef 1 and Beef 2). Possible off-flavours seem to be developing either from the roasting process or by using certain ingredients. Evaluation of viscosity and oiliness show that all samples were similar in attributes related to mouthfeel.

All samples were mainly similar in both sessions except for one interaction between sample and session for clarity. The same products were used in both sessions but came from separate packages, so inconsistency between product packages is possible. Differences between sessions was found to be significant for the colour attribute. Performing an independent t-test showed a higher mean in the second session (4.30) compared to the first (3.80), indicating that colours were evaluated as darker in the second session. Colour might have been difficult to evaluate or there might have been external factors influencing the evaluation. The stocks were presented in two different cups and appeared having a darker colour in the white styrofoam cups than in the plastic see-through cups. A clear stock may appear lighter in colour and a cloudy stock may appear darker. Mean comparison using an independent t-test show higher mean value (6.08), indicating that the stocks were evaluated as clearer in the first session, compared to the second (5.56). Differences in clarity might therefore have an effect on the perception of colour.

There is a range of chemical reactions occurring during cooking which can have great effects on the perception of food (Barham, 2000). Cooking temperature has been found to directly affect the flavour in meat stocks (Cambero et al., 2000; Krasnow et al., 2011), but the cooking temperature used when making the reference stocks were unknown so no comparison could be made. Differences in cooking time and temperatures, and the effect of roasting could be studied for stocks with identical raw materials in order to study the effect of each factor on the final result. Test stock sample Beef 1 got the highest score for 'pleasantness' but the difference was only significant to the Pork sample. However, even though this result can give some indication on over all liking, the small number of panellists (N=10) suggests that the results need to be interpreted with caution.

## **4.2 Consumer survey study**

The findings from the consumer survey suggest that the user frequency of liquid stock in food preparation is low amongst Finnish consumer. As a reminder, this sample data consists of people who regularly cook and is therefore not representative for the whole Finnish population.



Stock cubes were the most common choice for the majority of consumers, and fond and stock-gels were also more popular than liquid stock. Two stock product brands, Knorr and Maggi are clearly the most popular brands and widely used amongst Finnish consumers.

The results also suggest that the preference for product attributes, when choosing stock products, varies. This is in line with previous research showing that the importance of different attributes is not the same for everyone (Caputo et al., 2017; Botelho et al., 2017; Anselmsson et al., 2014; Michel et al., 2011). Results from the statistical analysis on user frequency of stock products suggest that using stock products is more common for older than younger people, and women are less likely to use liquid stock compared to men. Lund et al. (2017) found that eating out is more common for younger people, which could explain that older people prepare food more frequent and therefore also use more stock products. The study also found that eating out is more common in the inner city of capital cities. This relates to these results that people in urban areas are less likely to use stock-cubes as frequently as people in rural areas. The results on the effect of sustainability and animal welfare attributes on purchase interest suggest, as previous studies, that women are more receptive to these attributes than men (Pouta et al., 2010). Animal welfare, environmental-friendly product and packaging were all affecting purchase interest of women more than men.

Taste, or flavour enhancing, was the most important factor to consumers when purchasing stock products, chosen most often in total, and also ranked most frequently as the most important attribute. This is in line with previous research, suggesting that taste plays a key role in peoples' food preferences (Garcia-Bailo et al., 2009). Furthermore, consumers seem to rely greatly on familiar products and brands they recognize. 'Previous experience' was the second most chosen factor, 'known manufacturer' was the sixth most common while 'curious to try' was chosen rarely. This indicate that most are used to purchasing a brand they recognize, but it doesn't exclude consumers' willingness to try new products if being presented to them. The preference for using stock-cubes over other stock product types and factors such as 'known manufacturer' may be related. Stock-cubes were commercialized by Maggi in 1908 and other brands such as Knorr soon followed. The product and the two brands have a long history and have become popular on the global market (Fatima, 2013). Brands allow consumer to draw on their previous experience and product familiarity is a strong factor influencing consumers' food choice (Hoek et al., 2017).

Consumers were hypothesised to show high interest for attributes related to convenience and the results confirm this expectation. ‘Suitable for cooking’, ‘easy to use’ and ‘suitable package size’ were important factors for many consumers. This supports the hypotheses that convenience is sought after in food preparation (Monsivais et al., 2014), and suggest that consumers expect stock products to make food preparation easier. ‘Price’ was the fifth most chosen attribute and most frequently ranked as most important. Previous research has also found price to be most important to some and less important to others (Realini et al., 2013; Baines et al., 2001). Some studies have even reported contradictory results of the importance of price for the same type of product (du Plessis & du Rand, 2012; Font-i-Furnols et al., 2011). The frequent choice of price as most important suggest that price was very important to some consumers, ranking it as number one, while not so important to others who rather choose other attributes ahead of price.

Attributes related to natural ingredients were expected to be important factors for product choice. “Free from” labels, such as GMO-free have a tendency to be perceived as healthier compared to similar products without such label (Hartmann et al., 2018). In this study ‘real ingredients’ was the 8<sup>th</sup> most common choice and was the most common factor relating to naturalness, followed by ‘free from additives’ and lastly ‘GMO-free’. Labels might convince consumers to choose one product over another, but this study suggests that there is not a lot of concern for additives in relation to stock products. Stock products being used as condiments rather than the main part of a meal may explain the low interest for health-related factors.

Surprisingly, ‘domestically produced’ was not as important to respondents as hypothesised. Previous research has shown a high preference for domestic food products (Font-i-Furnols, 2011; Realini et al., 2013) and Finnish consumers have been found to follow a similar trend (Pouta et al., 2010). However, the low preference for domestic produce in this study could be explained by the different effect of origin on different product types. Balcombe et al (2016) reported that the importance of origin is stronger for fresh meat and weaker for processed meat products. This suggests that consumers may view stock products as highly processed products and origin is therefore not as important.

Most consumers in this study stated as having an interest in factors related to sustainability, especially for ‘origin of raw materials’, eco-friendly package and animal welfare. However, ‘environmental-friendly’ being the third least important attribute when purchasing stock

products suggests that most consumers value other attributes more. This could also be related to high brand trust, since ‘previous experience’ and ‘known manufacturer’ were popular choices and consumer thereby trust the manufacturers enough to not question sustainability attributes.

### **4.3 Marketing implications**

Bringing a new product to a mature market is challenging, considering that the majority of new products fail within a year (Dijksterhuis, 2016). There are numerous reasons to why products fail, one being the misinterpretation of consumer demand. The increasing importance of consumer-led product development has therefore been reported in several studies and is frequently used in food companies (Linnemann et al., 2006; Dijksterhuis, 2016; Horvat et al., 2019).

For the food processors seeking novel inroads with stock products, the addition of a roasting step in the production process or adding more vegetables seems to enhance the flavour strength but does not add a stronger flavour of fried meat. However, even though it increases overall flavour, the results here suggest that it might lead to developing off-flavours. To gain further insights into the role of other intrinsic and extrinsic attributes for consumer purchase intentions, the consumer survey study results suggest that flavour, previous experience, convenience and price are the most appreciated factors when choosing stock products. As this study also suggests in line with many previous works, product attributes are not valued equally by all consumers (Liesionis & Pileliené, 2007). This requires food companies to determine prior to product launches which attributes are to be focused on in their product developing and marketing. Furthermore, customers are known to identify, at least on some level, with a producing company brand. Nevertheless, the identification does not have to be with the company brand but also with the company values and social responsibility (Bhattacharya & Sen, 2003). Product attributes should therefore match the values and mission of the company. The results from this thesis suggest that the use of fresh, domestic raw materials and real ingredients, and product attributes related to convenience, sustainability and animal welfare are valuable features that could be used to differentiate liquid stocks from other stock products in the marketplace. Future marketing strategies focusing on these features could increase brand value and thereby build consumer trust, adding perceived value for future products (Alhaddad, 2015).

#### **4.4 Limitations and further extensions**

There are limitations in this study which should be taken into consideration in future research. Regarding the setup of the sensory study, it is known that samples size and the evaluation environment can affect the results. Lawless and Heymann (2010) suggest using individual booths for each panellist in the evaluation session, since evaluations free from disturbances increase the likelihood of success. This was not possible in this study due to limited space, although the sensory evaluations were performed in rather neutral setting in the manufacturer's premises. Furthermore, it is well known that in-depth training is necessary and the use of well-trained panellists that are consistent over time is beneficial for more reliable results (Lawless & Heymann, 2010). However, in this study, only two training sessions were held due to limited time. Insignificant differences between samples for several attributes and high standard deviations indicate that some attributes were not appropriate to study the differences between samples and that attributes were difficult for the panellists to evaluate. More suitable attributes could have been found with more time spent on training and developing the vocabulary. In particular, further testing could be done to study how roasting directly influence perceived meat stock flavour. Umami, a typical taste found in meat stocks (Cambero et al., 2000) was not used as an attribute in this study since umami is difficult to evaluate and would have required more time on panellists training (Checchini et al., 2019).

Furthermore, as for the sensory study, differences in cooking time and temperatures and the effect of roasting could be studied for stocks with identical raw materials in order to study the effect of each factor. Also, a larger-scale testing of stock-attributes with regular (untrained) consumers under conditions of regular meal-intake could be of interest, i.e. when the stock products tested would be employed as part of a full meal, considering that stock products are mostly used as flavour enhancers in food dishes. Further research could therefore also combine a study of sensory attributes of stock products as part of food dishes, jointly with a consumer survey analysis assessing consumer preference for foods made with these stocks.

The analysis of consumer preferences from the consumer survey could be extended in multiple ways. For a more detailed understanding of consumer preferences, further data analysis could be performed that studies the relationship between the choice of most important attributes when choosing stock products and socio-demographic variables. Furthermore, case-specific variables like consumer knowledge about stock products could be further investigated. In particular, consumer knowledge about stock manufacturers' focus on environmental sustainability and

animal welfare were not investigated, and further research could be done to study under which circumstances consumers would be willing to switch to another brand of stock products based on these factors.

Additionally, as for the ordered regression analysis, it is important to keep in mind that the ranking of the five most important attributes provides no information on each attributes' degree of importance, only information on its order importance relative to other attributes investigated. One clear limitation of the consumer survey study is that the stated preferences analysed are not entirely in line with actual (revealed) purchase behaviour, due to the underlying hypothetical and other cognitive biases (Louviere et al., 2000). Furthermore, the stated-preferences nature of the survey questionnaire naturally also abstracts from other factors that are known to influence purchase decisions at the point of sales, when consumers are confronted with a number of other factors, such as products and store design. Nevertheless, keeping in mind the above limitations, this study could be used as a base to develop market strategies by providing guidelines on consumer interests and attitudes towards intrinsic and extrinsic stock product attributes.

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## 7 Appendix A

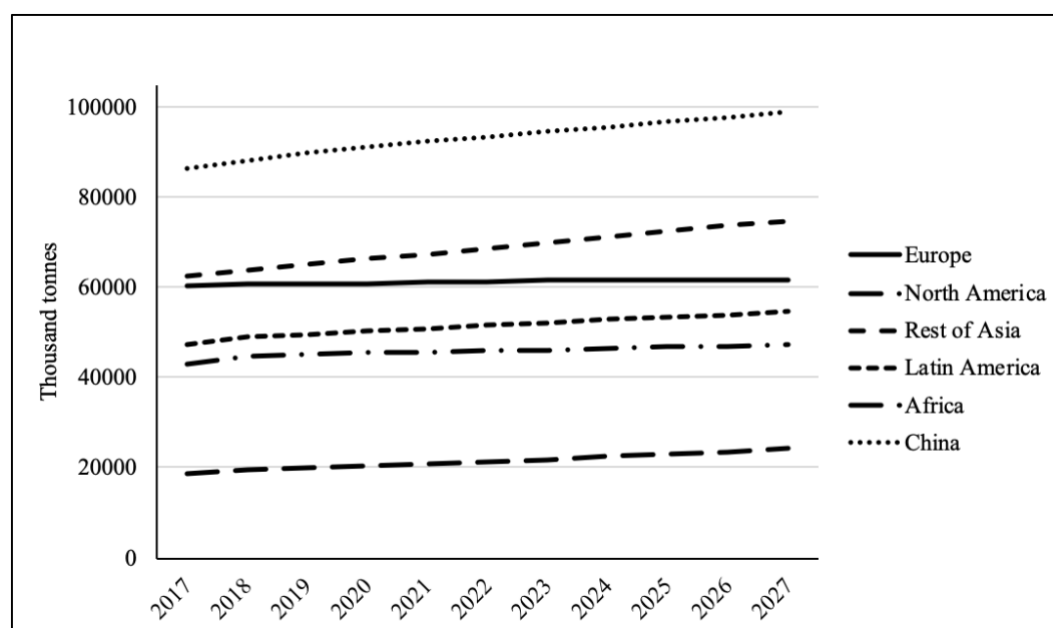


Figure 7. Estimated yearly consumption of meat (thousand tonnes) in different regions (2017 – 2027) (www.data.oecd.org).

Table 9.

User frequency of stock products in proportion of consumers % (N=551)

How often do you use the following stockproducts? (meat, fish, chicken or vegetable)				
	Cube	Fond	Gel	Stock
At least once a week (%)	28	3	4	-
Twice a month (%)	35	7	10	1
Once a month (%)	11	3	8	2
Once every three months (%)	8	7	8	2
More rarely (%)	15	34	27	14
Never (%)	2	46	44	81

Note. proportions may not end up to 100% due to rounding.

## 8 Appendix B

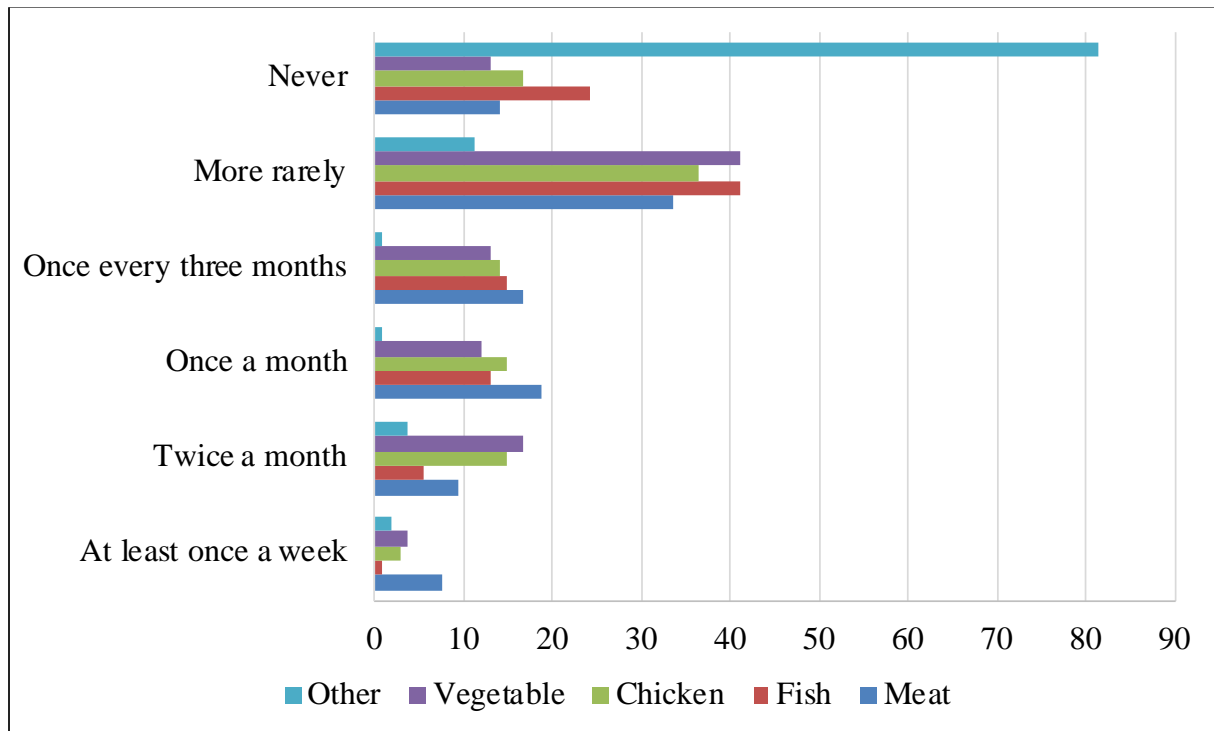


Figure 9. User frequency of flavour for liquid stock (N=107).

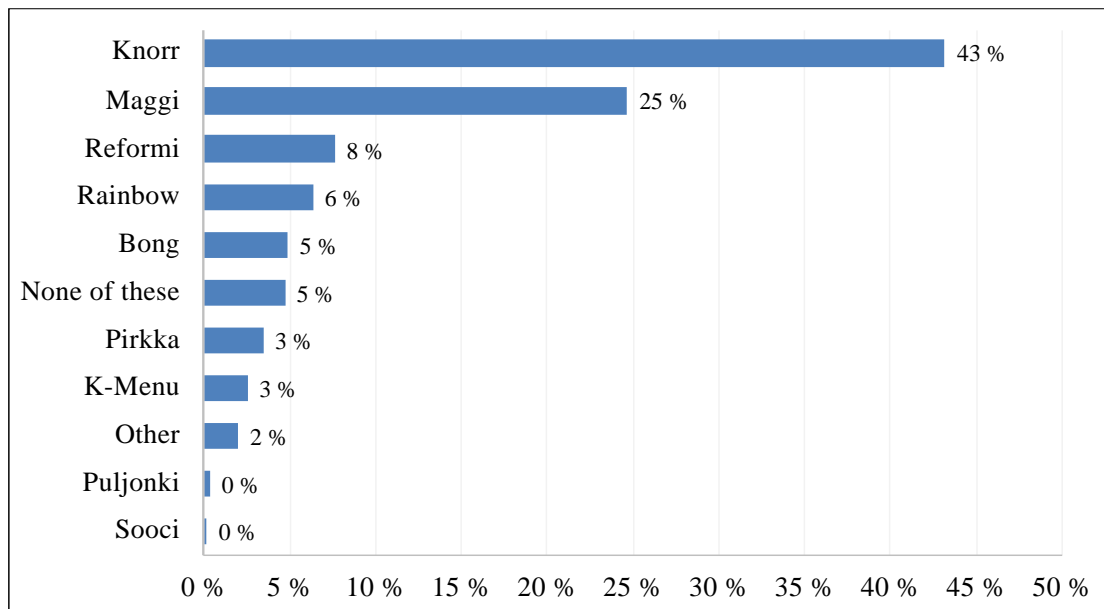


Figure 8. Respondents choice of stock product brand mainly used.

## 9 Appendix C

Table 10. Purpose for using stock products

	<u>Yes</u>		<u>No</u>	
	Frequency	Percent	Frequency	Percent
	Soups	453	82 %	98
Sauces	330	60 %	221	40 %
Stews	281	51 %	270	49 %
To cook rice/pasta/noodles	211	38 %	340	62 %
Casseroles	156	28 %	395	72 %
Other	15	3 %	536	97 %

*Note.* Distribution of respondents' purpose of using stock products (N=551).

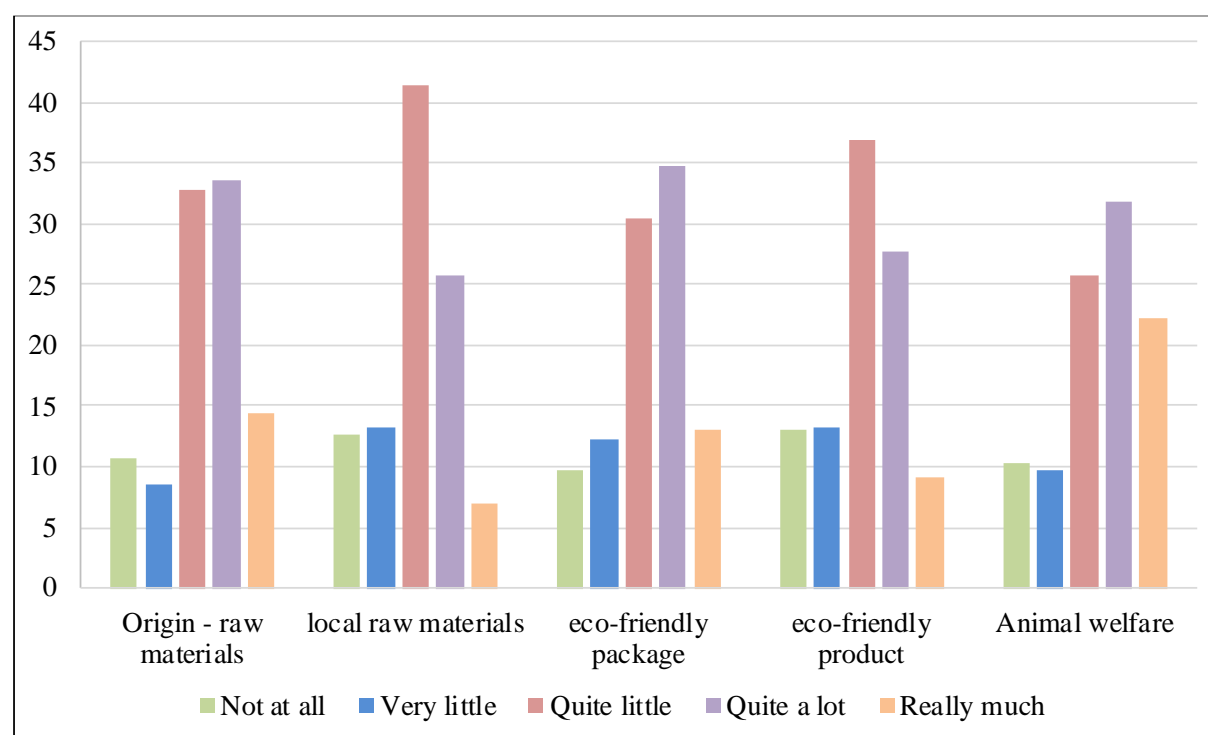


Figure 10. Factors affecting purchase interest of stock products on an ordinal scale. (N=551)