FACULTY OF BIOSCIENCE ENGINEERING

Consumers' reactions towards the nutrition label Nutri-Score and the smartphone app Yuka

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This master's dissertation is the final piece of my Master of Bioscience Engineering: Food Science and Nutrition.

The realization of this master's dissertation was at times challenging. Especially because of the pandemic that was manifesting during the second semester. Aside from the covid-19 pandemic, it was at times confronting because of the freedom I was given to shape this dissertation in times that did not lend themselves perfectly for conducting research. Nevertheless, I was able to train myself in the field of consumer research and data processing, which will definitely be useful in my future career. Therefore, I am very grateful for all the useful skills and knowledge I have gained through the whole process of this study. In addition, I would also like to thank everyone who contributed to the successful completion of it.

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Last, I would like to thank my parents, my grandmother and friends who have continued to support and motivate me throughout the writing process.

Hélène Van der Stricht

PREAMBLE

This study was not precisely defined from the beginning but took shape during the first semester of the academic year. Subsequently, a survey was drawn up based on the concepts that could be interesting. These were in the first place the Nutri-Score label, Clean Label, and the Yuka app. It was later decided to partly leave out the section about Clean Label (i.e. mainly opinion about additives) and to partly incorporate found data under the section of the Yuka app. However, this was decided before the covid-19 pandemic. Also, data collection was completed before the fifteenth of March 2020 and the implementation of the covid-19 protective measures in the study countries.

As a result, it can be said that the data collection for this master's dissertation has not been hindered. We also believe it is quite unlikely that the upcoming covid-19 pandemic had an impact on the response behaviour of our survey participants.

In addition to the isolation at home, my close family (my mother) experienced sudden illness and was hospitalized, therefore I can say with certainty that finishing this master's dissertation was more difficult than it would have been under normal circumstances.

This preamble was drawn up in consultation between the student and the supervisor and approved by both.

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LIST OF ABBREVIATIONS

AA	Affective Attitudes
ANSES	*Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail*
App	Smartphone application
BEUC	Bureau Européen des Unions de Consommateurs
BMI	Body Mass Index
BOP	Back-Of-Pack
CA	Cluster Analysis
Df	Degrees of freedom
EC	European Commission
EFA	Exploratory Factor Analysis
EFSA	European Food Safety Authority
EU	European Union
EUFIC	European Food Information Council
FCQ	Food Choice Questionnaire
FSA	Food Safety Authority
FSA-NPS	Food Standard Agency Nutrient Profiling System
FOP	Front-Of-Pack
GBD	Global Burden of Disease
IA	Instrumental Attitudes
IARC	International Agency for Research on Cancer
KMO	Kaiser-Meyer-Olkin
MLR	Multiple Linear Regression
MTL	Multiple Traffic Light
NGO	Non-Governmental Organisation
NCD	Non-Communicable Disease
PBC	Perceived Behavioural Control
PNNS	Programme National Nutrition Santé
RIs	Reference Intakes
SD	Standard Deviation
SN	Subjective norms
SPSS	Statistical Package for Social Sciences
TPB	Theory of Planned Behaviour
VIF	Variance Inflation Factor
WHO	World Health Organisation

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ABSTRACT IN ENGLISH

Unhealthy diets are important influencing factors on the rising prevalence of diseases such as obesity and non-communicable diseases in Europe. Various tools were invented to encourage people to eat healthier. Examples are front-of-pack nutrition labels and nutritional smartphone apps. Recently developed and introduced in Belgium and France are the Nutri-Score label and the Yuka app. As a result, not much research has been done on these tools and especially not about consumers' thoughts about them. Therefore, this study aimed to get a better understanding of current reactions of Belgian and French consumers towards the Nutri-Score label and the Yuka app. Further, familiarity, current use, and intentions to use these tools were assessed. Finally, possible influencing variables on intentions to use the Nutri-Score label and the Yuka app during food shopping were determined. To assess all these aspects, a cross-sectional web-based survey was distributed in Belgium and France (n=1246). Results showed that 92% of Belgian and French consumers were familiar with the Nutri-Score label and 56% already used it. Also, 59% intended to use it in the future and from the tested influencing variables, only subjective norms, perceived behavioural control, instrumental attitudes, affective attitudes, education and reaction towards the Nutri-Score label did significantly influence intentions to use the Nutri-Score label. The results were less positive for the Yuka app as only 41% of the Belgian and French consumers were familiar with the app. Also, it is only used by 24% of the consumers during food shopping and 44% of intended to use the app. Significant influencing variables on these intentions were subjective norms, familiarity, reactions towards the Yuka app, avoidance of additives and food related app use. In conclusion, the Nutri-Score label is already positively perceived by Belgian and French consumers and therefore may serve as a preferred tool to help them make more informed food choices. The discussed recommendations in this study for policy makers and the food industry based on the results are likely to further improve reactions and use. Subsequently, the Yuka app is currently not very well known nor favoured by Belgian and French consumers. However, this app shows potential to complement the Nutri-Score label and help consumers make more informed choices. However, the app still needs to be sufficiently promoted based the results of this study.

Keywords: Nutri-Score label, Yuka app, consumers' reactions

ABSTRACT IN DUTCH

Ongezonde diëten zijn belangrijke invloed factoren op de toenemende prevalentie van ziekten zoals obesitas en niet-overdraagbare ziekten in Europa. Er zijn reeds verschillende hulpmiddelen uitgevonden om mensen aan te moedigen gezonder te eten. Voorbeelden hiervan zijn voedingsetiketten op de voorkant van de verpakking en voeding gerelateerde smartphone-apps. Recentelijk ontwikkeld en geïntroduceerd in België en Frankrijk zijn het Nutri-Score label en de Yuka app. Hierdoor is er nauwelijks onderzoek gedaan naar deze tools en vooral niet naar de mening van de consumenten over deze hulpmiddelen. Daarom heeft deze studie tot doel om een beter inzicht te krijgen in de huidige reacties van Belgische en Franse consumenten ten aanzien van het Nutri-Score label en de Yuka app. Verder werden bekendheid, huidig gebruik en intenties om deze tools te gebruiken geëvalueerd. Ten slotte werden mogelijke beïnvloedingsvariabelen op de intenties om het Nutri-Score label en de Yuka app te gebruiken tijdens de aankoop van voedingsmiddelen bepaald. Om al deze aspecten te beoordelen werd een transversale online survey verspreid in België en Frankrijk (n=1246). De resultaten toonden aan dat 92% van de Belgische en Franse consumenten vertrouwd waren met het Nutri-Score label en dat 56% het al gebruikte. Ook was 59% van plan om het in de toekomst te gebruiken en van de geteste beïnvloedende variabelen hebben alleen subjectieve normen, gepercipieerde gedragscontrole, instrumentele attitudes, affectieve attitudes, educatie en reacties ten aanzien van het Nutri-Score-label de intenties om het Nutri-Score-label te gebruiken significant beïnvloed. De resultaten waren minder positief voor de Yuka-app, aangezien slechts 41% van de Belgische en Franse consumenten bekend was met de app. Ook wordt de app slechts door 24% van de consumenten gebruikt tijdens de aankoop van voedingsmiddelen en 44% van de consumenten hadden de intentie om de app te gebruiken in de toekomst. Significante beïnvloedingsvariabelen op deze intenties waren subjectieve normen, bekendheid, reacties ten aanzien van de Yuka-app, het vermijden van additieven en voedsel gerelateerd app-gebruik. Concluderend kan worden gesteld dat het Nutri-Score label al positief wordt ervaren door Belgische en Franse consumenten en daarom kan dienen als een geprefereerd hulpmiddel om hen te helpen bij het maken van meer geïnformeerde voedingskeuzes. De besproken aanbevelingen in deze studie voor beleidsmakers en de voedingsindustrie gebaseerd op de resultaten zullen waarschijnlijk de reacties en het gebruik verder kunnen verbeteren. Vervolgens is de Yuka-app momenteel niet erg bekend en geliefd bij de Belgische en Franse consumenten. Deze app toont echter potentieel om het Nutri-Score label aan te vullen en consumenten te helpen om meer geïnformeerde keuzes te maken. De app moet echter nog voldoende worden gepromoot op basis van de resultaten van deze studie.

Sleutelwoorden: Nutri-Score label, Yuka app, consumentenreacties

1 INTRODUCTION

The prevalence of diseases such as obesity and non-communicable diseases has risen sharply throughout last decades in Europe (WHO, n.d.). Unhealthy diets are hereby an important influencing factor. Therefore, policy measures aiming to make diets healthier can be useful to address this problem. Food labelling, covering both front-of-pack and back-of-pack labels, is one of these policies. As nutrition information on back-of-pack labels can be difficult to interpret for consumers (Kelly et al., 2009), focus is nowadays more on improving and implementing front-of-pack labels. In the past, several studies have been conducted to determine the efficacy of several front-of-pack labels and to decide which one is best to make informed dietary choices (Ares et al., 2018; Ducrot et al., 2016; Nathan, Yaktine, Lichtenstein, & Wartella, 2012). Nevertheless, European countries currently use different front-of-pack labels with different objectives (WHO, 2018b) and no labelling system seems to be perfect (McGuire, 2012). Also, few studies have been done on consumer preference of front-of-pack labels.

The Nutri-Score label is a front-of-pack label recently introduced in Belgium and some time before in France. This label shows fives classes distinguished by a colour and a letter, going from dark green with an A to dark red with an E. In this way, it gives a straightforward evaluation of the nutritional quality of food products, making it easier for consumers to make more informed choices. In addition, the Nutri-Score label is outstanding due to the use of multiple colours and its presence on both healthy and unhealthy products. Also, it can be used to compare products within a product category based on their nutritional quality. Therefore, the Nutri-Score label could possibly be a better tool to make more informed food choices compared to other existing FOP labels. To our knowledge, only one study about the reactions of French consumers towards the Nutri-Score label has been performed (Ducrot, Nugier, & Serry, 2019). Furthermore, no studies were found about the reactions of Belgian consumers towards the label. Therefore, this study aims to determine current reactions of Belgian and French consumers towards the Nutri-Score label and influencing variables on the intention to use this label during food shopping. Based on the results, recommendations will be made to promote the Nutri-Score label as tool for making more informed choices .

As extension, nutritional smartphone applications were developed to make the interpretation of food labels easier. One of these is the Yuka application which was developed in France and also recently introduced in Belgium. By scanning the barcode of a product, the application provides the user with an overall quality score. If this score is low, better alternatives from the same food category are provided. As such, the Yuka application can, like the Nutri-Score label, serve as a tool to make more informed choices. In addition, the application can be seen as an extension of the label because, next to nutritional quality based on the Nutri-Score, it also takes additives and biological status into account when determining the overall quality scores. Since additives are now under attack by the 'Clean Label' trend, they are also slightly touched upon in this study. Last, this study will investigate consumers' current reactions towards the Yuka application, whether consumers already use it and what the influencing variables are on the intention to use the Yuka application during food shopping.

In this study, a modified version of the theory of planned behaviour will be used as framework to determine influencing variables on the intention to use the Nutri-Score label and the Yuka application during food shopping. According to our knowledge, this framework has already been used in two previous studies about food information usage (Lim, Kim, & Kim, 2015; Vijaykumar, Lwin, Chao, & Au, 2013). Following, with the help of cluster analysis, clusters will be made of consumers based on liking and current use of the Nutri-Score label. Last, recommendations will be given to increase the use of the Nutri-Score label in general and for the clusters separately. Only general recommendations will be made to increase the use of the Yuka application.

1.1 Objective of this study

The objective of this study is to determine current reactions of Belgian and French consumers towards the Nutri-Score label and the Yuka application as well as their intention to use these tools during food shopping. Possible differences in reactions and intention to use these tools between Belgian and French consumers are also examined. Subsequently, main influencing variables on the intention to use these during food shopping and their associated impact, will also be established. Last, based on the influencing variables and consumer segments identified, recommendations may be deduced to increase the use of the Nutri-Score label and the Yuka application during food shopping.

1.2 Research questions and hypotheses

7 research questions could be deduced from the objective mentioned above:

1. Is the evaluation of nutritional and overall quality scores given by consumers for certain food products comparable with the evaluation according to the Nutri-Score label and the Yuka application?

   Hypothesis 1: Consumers perceive most products healthier than they are independent of the food category. Therefore, they will give higher nutrition and overall quality scores compared to the Nutri-Score label and the Yuka application.

2. What are the current reactions of Belgian and French consumers towards the Nutri-Score label regarding liking, perceived usefulness, perceived credibility, attitude, and objective knowledge? Also, is there a difference between reactions of Belgian and French consumers towards the Nutri-Sore label?

   Hypothesis 2: Consumers' reactions towards the Nutri-Score label is neutral for all aspects as the label is not quite known by Belgian and French consumers. Also, it is expected that reactions of French consumers are better compared to those of Belgians consumers.

3. What are the current reactions of Belgian and French consumers towards the Yuka application regarding perceived credibility, perceived usefulness, and time consumption? Also, is there a difference between reactions of Belgian and French consumers towards the Yuka application?

   Hypothesis 3*:* Current reactions of consumers towards the Yuka application is in general somewhat negative. Still, reactions towards the Yuka application of French consumers are better compared to those of Belgian consumers.

4. What is the familiarity and current use of the Nutri-Score label and the Yuka app by Belgian and French consumers? Also, are there differences between Belgian and French consumers regarding familiarity and current use of these tools?

   Hypothesis 4*:* Familiarity and current use of the Nutri-Score label is average for both Belgian and French consumers but significantly higher for French than for Belgian consumers. For the Yuka application, familiarity and current use are low but higher for French than for Belgian consumers.

5. What is the intention of Belgian and French consumers to use the Nutri-Score label during food shopping? Also, is there a difference between Belgian and French consumers? Last, which influencing variables have a significant impact on the intention to use the Nutri-Score label during food shopping and is their associated impact positive or negative?

   Hypothesis 5: Intention to use the Nutri-Score label is low and French consumers are more willing to use it compared to Belgian consumers. The variables affective and instrumental attitudes, subjective norms, perceived behavioural control, sociodemographic and personal characteristics (i.e. country, gender, age, income, education, and BMI), familiarity, perceived usefulness, perceived credibility, objective knowledge and liking are supposed to influence intentions to use the Nutri-Score label.

6. What is the intention of Belgian and French consumers to use the Yuka application during food shopping? Also, is there a difference between Belgian and French consumers? Which variables have a significant impact on the intention to use the Yuka application during food shopping and is their associated impact positive or negative?

   Hypothesis 6: Intention to use the Yuka application is in general low but French consumers are more willing to use it compared to Belgian consumers. Also, following factors are suspected to influence the intention to use the Yuka application: affective and instrumental attitudes, subjective norms, perceived behavioural control, sociodemographic and personal characteristics (i.e. country, gender, age, income, education and BMI), familiarity, perceived usefulness, perceived credibility, technology adoption and avoidance of additives.

7. Can meaningful clusters of consumers be formed based on liking and current use of the Nutri-Score label?

   Hypothesis 7: It is possible to form three meaningful clusters based on liking and current use: consumers who like and already use the Nutri-Score label, consumers who like but not use the label yet and consumers who not like nor use the Nutri-Score label yet during food shopping.

2 LITERATURE STUDY

2.1 Impact of unhealthy diets on the burden of disease

Malnutrition is one of the major risk factors on the rising incidence of bad nutrition-related health conditions and Non-Communicable Diseases (NCDs) like cancer, diabetes and cardiovascular diseases (Branca et al., 2019). Trends to 2025 suggest that more than half of the adult population in the European Region, except in Tajikistan, will be overweight or obese. As a result, risk of related diseases will also increase (WHO, 2018a). In 2017, the Global Burden of Disease (GBD) ranked bad dietary behaviour as the most important risk factor, before smoking and alcohol use, for deaths and NCDs in Europe (European Commission, 2020).

Diets in high-income countries are often characterised by an excess intake of energy, saturated fats, sugar and salt through the consumption of highly processed, energy-dense foods and sugar-sweetened beverages (WHO, 2018a). A reduction of these nutrients is recommended (Viola, Bianchi, Croce, & Ceretti, 2016) as they are associated with increased risk of overweight, obesity and NCDs (Engelfriet et al., 2010; HPLE, 2017; Monteiro, 2009; Schulze & Hu, 2002). Still, these intakes are not totally under personal control as they are also influenced by political, cultural and environmental factors (Faria, 2019). In addition, the food industry is accountable for manufacturing and marketing foods containing (too) large amounts of fat, sugar, and salt, the so-called ultra-processed foods (Srour et al., 2019).

2.2 Promoting healthier diets

Healthy diets can help to protect against NCDs (Asioli et al., 2017; WHO, 2003). Therefore, government policies should encourage availability and accessibility of diverse and healthy diets. Different policy interventions can be used. Figure 1 displays commonly ones divided into those supporting more informed choice and those aimed at changing the market environment. The purpose of policies supporting more informed choice is to provide consumers with information and teach them how to use this information (e.g. advertising controls) (Brambila-Macias et al., 2011). In this way, they can influence people's preference towards healthier foods. On the other hand, there are the policies aiming to influence healthier eating by changing the market environment (e.g. by implementing taxes or subsidies). In this study, the focus is mainly on policies supporting more informed choice.

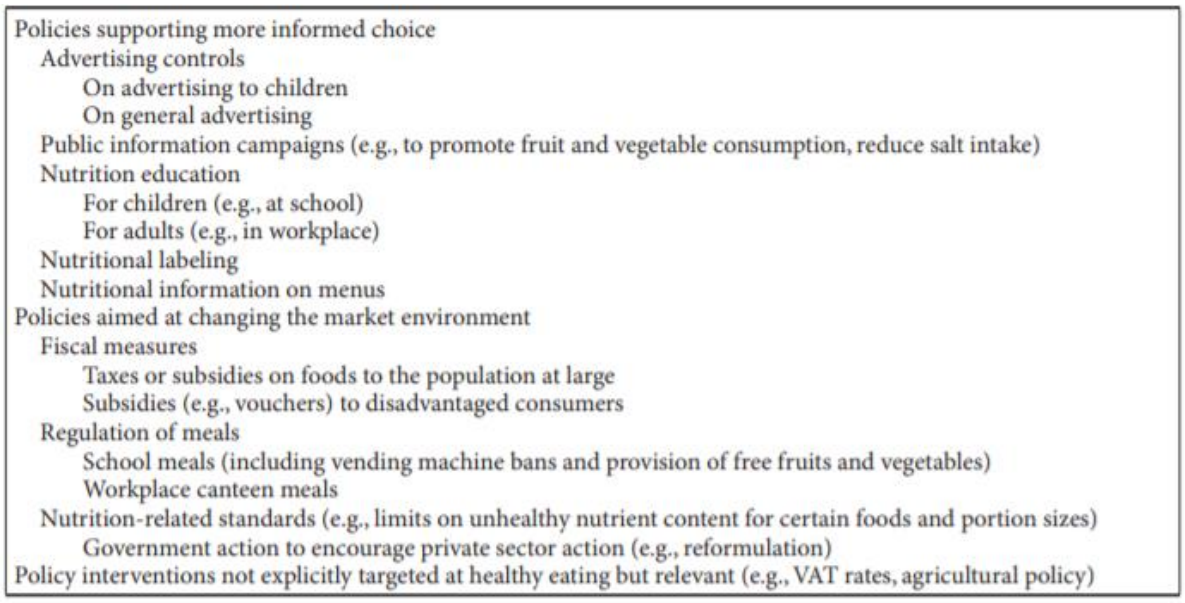


Figure 1: Policy interventions for promoting healthier diets (Brambila-Macias et al., 2011)

Influencing consumers' food purchasing behaviour, is important to guide consumers towards healthier diets. Consumers' food purchasing behaviour represents the decisions they make about which foods to purchase, to eat and how to prepare them (HPLE, 2017). This behaviour depends on individual characteristics and other factors like the food environment, community, culture, social class, etc. (De Brauw et al., 2019). These characteristics and factors should also be considered when trying to change consumer behaviour so they would make healthier food choices. As these influencing factors can vary a lot between consumers, it is sometimes difficult to use a uniform approach. Therefore, a combination of different policies should be used to achieve better results. For this purpose, the policies shown in Figure 1 can be combined. However, there are other possibilities besides these as well.

This study focuses on one specific type, namely food labelling and in extension nutritional smartphone applications (apps). Food labelling can be defined as "the provision of information about the nutritional content of individual food products" (EUFIC, 2018). Food labels are mainly used on pre-packed food and beverages and can be divided in Front-Of-Pack (FOP) and Back-Of-Pack (BOP) labels (Mandle, Tugendhaft, Michalow, & Hofman, 2015). It was already shown that FOP labels can be a good tool to help consumers make more informed food choices by presenting comprehensible nutritional information and are therefore in the first place a policy supporting more informed choice. For example, they can be effective to reduce the intake of energy and fat, while increasing the intake of vegetables (Shangguan et al., 2018). However, it should be noted that previous studies indicated that FOP labels possibly only have a limited impact on final food choices and consumption behaviour (Borgmeier & Westenhoefer, 2009). Also, it was indicated that FOP-labels have a smaller effect compared to other policies on populations' overall health (Crosetto, Lacroix, Muller, & Ruffieux, 2018). Possible reasons for this are that FOP labels are often only recommended for pre-packaged foods (Cowburn & Stockley, 2005) and that they have to compete with other factors influencing the final decision of food purchase and consumption (Malam et al., 2009). Nevertheless, it has already been pointed out that they can be effective as tool to help consumers making more informed food choices and their effectiveness as health improvement tool can be increased through increasing awareness, understanding and use (Baltas, 2001).

Another advantage of FOP labels is that they are indirectly a policy aiming to change the market environment. This is because FOP labels also indirectly influence food manufacturers as for them the reactions of consumers towards their products, influenced by food labels, is important. Therefore, FOP labels encourage food manufacturers to develop new products or reformulate existing products towards healthier alternatives (Sassi, Cecchini, Lauer, & Chisholm, 2009). For example, Reformulation by the reduction of salt and saturated fat content in food products (Shangguan et al., 2018). The use of a FOP label (i.e. the Tick and Choices logo) on specific products has already proven successful in promoting reformulation (Vyth, Steenhuis, Roodenburg, Brug, & Seidell, 2010; Young & Swinburn, 2002).

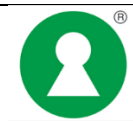
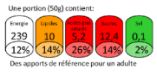
2.3 FOP labelling

FOP labels occur as symbols providing a simple indication of the nutritional value of food products (Mandle et al., 2015) and are therefore complementary to the more detailed information on BOP labels. The objective of FOP labels is to influence consumers and food manufacturers to promote healthier eating (Andrews, Lin, Levy, & Lo, 2014; Kanter, Vanderlee, & Vandevijvere, 2018). Therefore, FOP labels can serve as instruments to improve diets and thereby overall health of populations (Borgmeier & Westenhoefer, 2009; van Trijp, 2009). The World Health Organisation (WHO) agrees with this as they advise governments to implement FOP labels as part of their policy promoting healthier diets (Mendelson & Matsoso, 2015; WHO, 2019). A reason why FOP labels can be useful in promoting healthier diets is because they present nutrition information in a concise way on the front of the package. It has been indicated by Feunekes et al. (2008) that FOP labels are more noticeable than traditional BOP labels due to the combination of their simple format and presence on the front of the package. Following on this, Becker et al. (2015) found evidence that also due to the place on the package and the format of FOP labels, they are attended more often and earlier compared to BOP labels. In addition, BOP labels can sometimes be difficult to interpret by consumers (Kelly et al., 2009). Therefore, the focus of this study will be on FOP labels and BOP labels will not be further discussed as FOP labels appear to have certain characteristics which would make them a better tool in promoting healthier diets.

2.3.1 Overview of FOP labels in Europe and classification

An abundance of different FOP labels is currently used on food products. An overview of the most common ones used in the European Union (EU) nowadays is given Table 1. From these, the Nutri-Score label will be the main subject of this study and is discussed more in detail further on.

Table 1: Overview of four FOP labels that are currently used in Europe

Label	Name	Type	Developed by	Year of introduction	Countries in which it is used
	Nutri-Score	Summary	Nutritional Epidemiology Research Team (EREN)	2017	France, Belgium, Spain, Germany
	Nordic Keyhole	Summary	Swedish retailer group	1989	Sweden, Norway, Denmark, Iceland
	Reference Intakes (RIs)	Nutrient-specific label	FoodDrinkEurope	2014	Denmark, France, Greece, the Netherlands, Poland, …
	Multiple Traffic Light (MTL)	Hybrid	UKs FSA	2013	England, Italy, Portugal, Romania, Slovenia, Spain, …

Several classifications of these FOP labels exist. One possible way is based on the level of healthiness evaluation of foods Figure 2(Van Kleef & Dagevos, 2015). A more applicable version of the scheme of Van Kleef & Dagevos (2015) is shown in Figure 2. Hereby the FOP labelling systems are classified in nutrient-specific, hybrid and summary systems (Fatimah, Ruhaya, Fatimah, & Zainudin, 2019). Nutrient-specific systems (e.g. the RIs) do not need further interpretation as they give information about certain nutrients present in foods (Fatimah et al., 2019; Hersey, Wohlgenant, Arsenault, Kosa, & Muth, 2013). Therefore, they are simplified representations of BOP labels. On the contrary, summary labelling systems (e.g. the Nutri-Score) appoint a score to food products and therefore give evaluative information. The score is determined by a specific algorithm considering the overall nutritional quality. Last, some schemes are 'hybrid systems' (e.g. the MTL) because they display both nutrition and evaluative information (Talati, Pettigrew, Kelly, et al., 2016). Labels in different places of the continuum need different evaluation responses from consumers: summary labels need more trust-based evaluations as they show little information while very detailed evaluations are preferred for nutrient-specific labels as these show lots of information that needs to be evaluated (Van Kleef & Dagevos, 2015).

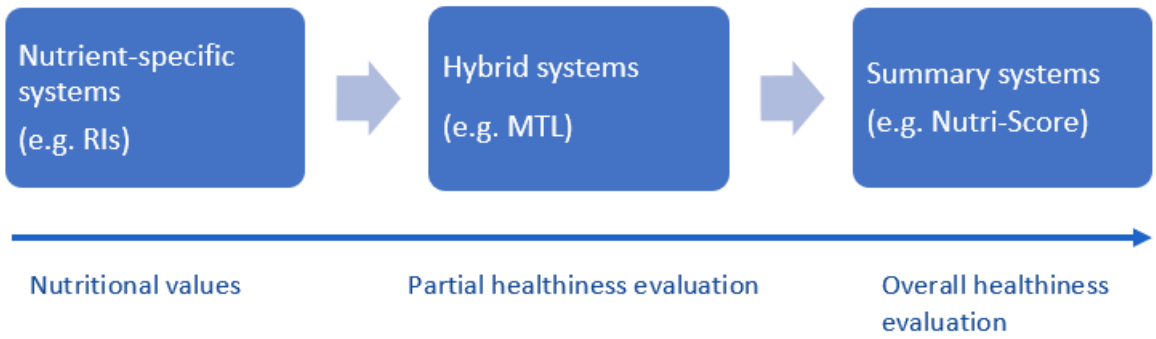


Figure 2: Classification of nutrition profiling schemes based on the level of healthiness evaluation of food products. This scheme is based on the classification of Van Kleef & Dagevos (2015)

Nevertheless, general preference of a type of FOP label is quite unclear. Some studies (Feunekes et al., 2008; Gorton, Mhurchu, Chen, & Dixon, 2009) suggest that nutrient-specific labels are preferred over summary labels while other studies (Grunert & Wills, 2007; Mandle et al., 2015; Möser, Hoefkens, Van Camp, & Verbeke, 2010; Talati, Pettigrew, Dixon, et al., 2016) concluded that consumers prefer simple and easy to understand labels, so those that are more in line with the definition of summary labels.

2.3.2 Influence of FOP labels on consumer behaviour

All FOP labels can influence food purchasing behaviour (Hersey et al., 2013). This will be explained further by the simplified scheme shown in Figure 3 based on the conceptual framework of Grunert, Wills, and Fernández-Celemín (2010).

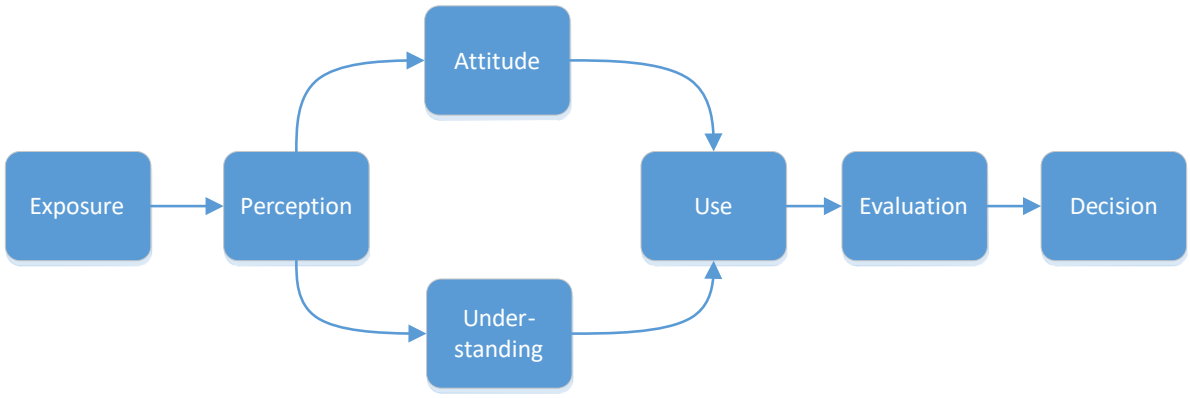


Figure 3: Simple scheme explaining the influence of FOP labels on consumer behaviour based on the theoretical framework of Grunert, Wills, & Fernández-Celemín (2010)

The first step in the process of influencing consumer behaviour is that consumers need to be exposed to FOP labels so they can catch consumers' attention (Peter, Olson, & Grunert, 1999). Attention to the label is influenced by type and position of the label (Bialkova & van Trijp, 2010), motivation for food choice (Verbeke, 2008) and time pressure. For FOP labels specific, attention can be increased by the use of pictures and symbolic elements (i.e. elements representing an abstract idea) (Viswanathan, Torelli, Xia, & Gau, 2009), bold text, colours, familiar words (Drichoutis, Lazaridis, & Nayga Jr, 2006; Schuldt, 2013) and consistency in place on the package, size and colour (Van Kleef & Dagevos, 2015). Once exposed to a FOP label, consumers can use their mind or senses to become aware of the FOP label. This step is also known as perception of the label. Influencing factors on perception are socio-economic factors and knowledge about nutrition as shown by Méjean et al. (2013) who also showed that perception varies across population subgroups. A concept closely related to perception is attitude, meaning consumers' actual feelings or way of thinking about a FOP label based on their perception. Attitudes towards FOP labels differ among consumers (Campos, Doxey, & Hammond, 2011) and can be influenced by educational level (Song et al., 2015) and socio-economic characteristics (Rimal, 2005). When perception and attitudes are formed, the effect of the FOP label will be influenced by consumers' understanding of the label. Understanding is important for information processing (Grunert, Fernández-Celemín, Wills, genannt Bonsmann, & Nureeva, 2010; Hoefkens, Veettil, Van Huylenbroeck, Van Camp, & Verbeke, 2012). A study in the UK showed that for some consumers (e.g. people over 65, with a lower educational level or from lower social classes), it is more difficult to correctly interpret FOP labels (Malam et al., 2009).

So, even though FOP labels are already easier to interpret compared to BOP labels, understanding is not self-evident (Van Kleef & Dagevos, 2015). Based on their understanding and attitude towards the label, consumers can use the FOP label and make interferences about the healthiness of food products (Grunert, Fernández-Celemín, et al., 2010). In other words, they can use the nutritional information on FOP labels to differentiate food products based on their nutritional healthiness which can together with other factors like price and sensory attributes, influence the evaluation of food products and eventually their buying decision. One more small note regarding influencing variables on this whole process of influencing consumer behaviour: these can be divided in internal factors of consumers (e.g. education level) and external factors. External factors can be further divided into FOP label specific (e.g. label type and position on the package) and other external factors (e.g. other information on the package or cost of the product) (Bommer, 2019; Malam et al., 2009).

2.3.3 The Nutri-Score label

The Nutri-Score label is a summary, graded, color-coded FOP food label that provides consumers with information about the overall nutritional quality of a food product (Figure 4). The underlying system classifies products in five mutually exclusive classes. The label displays all five classes making it easier for consumers to determine a products' relative nutritional quality (Julia & Hercberg, 2016; Ministère de l'Agriculture, 2017). The five categories provide a high degree of discrimination between food groups and the presence of a central category avoids dichotomous thinking (Julia & Hercberg, 2017a). This means that consumers will not see food products as good or bad, but in the case of the Nutri-Score label, that a certain food product has a better nutritional quality than another product from the same food category. The classes of the Nutri-Score label are distinguished by a colour ranging from dark green to dark red accompanied by a letter from A to E indicating respectively more and less healthy products (Crosetto et al., 2018). Therefore, the Nutri-Score label can be used to compare products and help in making more informed choices.

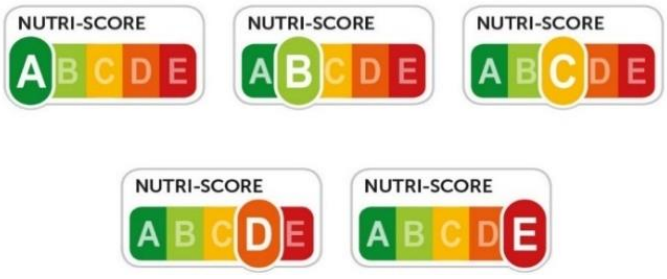


Figure 4: Graphical representation of the Nutri-Score label for the five different classes. The Nutri-Score of a certain product is shown larger than the other scores

Development, introduction, and use of the Nutri-Score

The Nutri-Score was developed in France within the *Programme National Nutrition Santé* (PNNS) (Chauliac & Hercberg, 2012), partly as response to Article 14 of the Modernisation Act of the French Health System (2016) stating that public authorities should recommend a simple and easy accessible food labelling system (Ministère de l'Agriculture, 2017).

The French Minister of Health, Marisol Touraine, appointed the Nutri-Score label as the official simplified voluntary FOP label of France (Deschasaux et al., 2018) as it was found the simplest, most influential and useful in obtaining healthier diets following French nutrition recommendations compared to other tested formats (Crosetto et al., 2018; Crosetto, Lacroix, Muller, & Ruffieux, 2019; Julia & Hercberg, 2017a). In August 2018, the Belgian Federal Minister of Public Health, Maggie de Block, announced the Nutri-Score label as supported voluntary FOP label in Belgium. A Royal Decree concerning the use of the Nutri-Score label, was published in the Belgian *Staatsblad* in April 2019 (Quaghebeur & Thijs, 2019). At the same time, the federal government launched a campaign to introduce the Nutri-Score to the Belgian population (FOD Volksgezondheid veiligheid van de voedselketen en leefmilieu, 2019). Next, the Nutri-Score label is since November 2018 recommended as a voluntary label in Spain (Michail, 2018) and the German Minister decided to introduce the Nutri-Score in Germany in September 2019 (Lebensmittel Praxis, 2019). Also, Luxembourg announced that it would introduce the Nutri-Score label on voluntary basis soon (RetailDetail, 2020). Lastly, the Nutri-Score label will be introduced in the Netherlands in 2021 (Consumentenbond, n.d.) and also in Switzerland the Nutri-Score label is slowly making its appearance (Lebensmittel Zeitung, 2019).

This shows that more and more European governments already support the Nutri-Score label. Nevertheless, there are still European countries such as Italy that do not want to introduce it. One of the main reasons for this is that according to them, the label contradicts the principles of the Mediterranean diet, which is high in fruits, nuts, vegetables, legumes, cereals, and olive oil. These products score poorly according to the Nutri-Score system (Morrison, 2020).

Determination of the Nutri-Score

The determination of the Nutri-Score is based on a modified version of the UK's Food Standards Agency Nutrient Profiling System (FSA-NPS) (Rayner, Scarborough, Boxer, & Stockley, 2005). The modified version is used as it gives better overall scores for cheeses, beverages and added fats compared to the original FSA-NPS (Haut Conseil de la Santé Publique, 2015). For the calculation of the nutritional quality score, the nutritional content per 100 g is used. Positive points (from 0 to 10) are assigned for energy, total sugar, saturated fatty acids, and sodium content (i.e. less healthy components) while negative points (from 0 to 5) are assigned for fruit, vegetables and nuts, fibre, and protein content (i.e. healthier components). This gives an overall value between -15 (best nutritional quality) and +40 (lowest nutritional quality) (Julia et al., 2014). Based on its nutritional quality score, a product is placed in one of the five categories of the Nutri-Score system as shown in Figure 5.

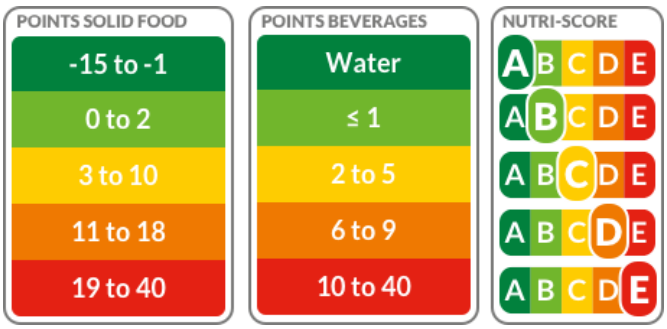


Figure 5: Attribution of a Nutri-Score per range of nutritional quality scores for solid foods and beverages (Colruyt Group, 2020)

Effectiveness of the Nutri-Score label and use in purchasing situations

The Nutri-Score label can be an effective tool to encourage customers to buy smaller portions of less healthy foods, to identify healthier products and to rank products according to their nutritional quality (de Edelenyi, Egnell, Galan, Druesne-Pecollo, et al., 2019). Therefore, due to its favourable perception and good performance among different categories of consumers, the Nutri-Score label can be a helpful tool to make more informed food choices (de Edelenyi, Egnell, Galan, Hercberg, & Julia, 2019; Ducrot et al., 2016; Ducrot et al., 2015b; Egnell, Ducrot, et al., 2018a; Julia et al., 2017), bearing in mind that the effectiveness probably depends on the healthiness of food products (Ares et al., 2018).

The label is understood by and can help consumers without or with little nutrition knowledge (Ducrot et al., 2016; Ducrot et al., 2015b), with poorer diets (Julia, Méjean, et al., 2016), at-risk of becoming obese (Ducrot et al., 2016; Egnell, Ducrot, et al., 2018a), buying the cheapest products (Julia & Hercberg, 2017b) and with the lowest income (Julia & Hercberg, 2017a). Therefore, the Nutri-Score label can reach a large part of the population (Ducrot et al., 2015a; Julia & Hercberg, 2017b). Sometimes contradictory results are found in terms of effectiveness: while a study in Colombia, were the introduction of the Nutri-Score is considered, showed that the label did not cause a reduction in calorie content of purchases (Mora-García, Tobar, & Young, 2019), another study found that the presence of a Nutri-Score label decreased the amount of calories, saturated fatty acids, sodium, fiber, while increasing the amount of protein, fruit and vegetables of food purchases (Egnell, Boutron, et al., 2019). Last, it was also shown that the Nutri-Score label has a higher impact on improving the nutritional quality of food purchases compared to other FOP labels like the MTL, Guidelines Daily Amounts and the Tick in several European countries (e.g. France, Denmark, Germany, Spain and the Netherlands) (Crosetto et al., 2019; Crosetto, Muller, & Ruffieux, 2016; de Edelenyi, Egnell, Galan, Hercberg, et al., 2019; Ducrot et al., 2016; Ducrot et al., 2015a; Egnell, Boutron, et al., 2019; Julia, Blanchet, et al., 2016; Julia & Hercberg, 2017c; Julia et al., 2015; Julia, Méjean, et al., 2016; Ruffieux & Muller, 2011).

Strengths & weaknesses of the Nutri-Score

A first strength of the Nutri-Score label is that it has characteristics of a good food label like the ability to attract consumers' attention, simplicity and a meaningful presentation of numeric nutritional information (Roberto & Khandpur, 2014). In addition, two studies conducted in Europe (Bialkova & van Trijp, 2010; Feunekes et al., 2008) found that consumers could faster interpret the simpler interpretive logos like the Nutri-Score compared to nutrient-specific FOP labels (e.g. the RIs). To elaborate further on the design of the Nutri-Score label, previous studies have shown that polychromatic labels (i.e. with a variety of colours) tend to be easier to understand, interpret and are better liked by consumers compared to monochromatic labels (i.e. labels with only one colour) (Jones & Richardson, 2007; Kelly et al., 2009). Last, Bialkova and van Trijp (2010) concluded that attention is captured faster when the label consumers search for is present on a food product. This can also be seen as a strength of the Nutri-Score label as it appears on both healthier and unhealthier products. This is for example not the case for the Nordic Keyhole which only appears on a product when it contains less and healthier fat, less sugar, less salt and more dietary fibre and wholegrain compared to other food products from the same food category (Sjolin, 2013).

Weaknesses mentioned by stakeholders are minimum testing in real conditions, not considering portions and that the Nutri-Score is not applicable for everyone (Haut Conseil de la Santé Publique, 2015). For example, it is not applicable for consumers with specific nutritional needs. Next, Dutch consumers mentioned difficulty to tell where the score is based on, absence of the entire calculation of the Nutri-Score on the label and also the fact that the score is not applicable for people with special dietary needs as limitations (Consumentenbond, 2018). Further, it does not always makes sense for consumers that traditional products sometimes get low scores (Boos, 2019) or that for example, chips get a higher score than salmon (Quaghebeur & Thijs, 2019). The main developer of the Nutri-Score, Serge Hercberg, sees this criticism as a possible consequence of a lack of knowledge about the label. For example, consumers complained that Roquefort, an artisanal product which is sometimes considered healthier, still gets a bad Nutri-Score. An explanation for this is that traditional products are not automatically healthier, and cheeses are given a Nutri-Score D or E because of their high fat content (Boos, 2019). Last, the middle of the scale should avoid dichotomous thinking. Nevertheless, this class can sometimes be difficult to interpret for consumers (Ares et al., 2018), meaning that they still tend to convert the scale into a binary evaluation between healthy or unhealthy (Hamlin & McNeill, 2016).

2.4 Nutritional smartphone app

As answer to some weaknesses of food labels, nutritional smartphone apps are developed which can help to make labels more understandable for consumers by decoding the nutritional information on the labels. These apps provide nutritional information and/or an evaluation of the overall quality when consumers scan a products' barcode. Barcode scanning technology was suggested as a good link between smartphones and a food databases (Elizabeth Dunford et al., 2014). As a result, these apps can help make more informed dietary choices and become an effective and low-cost instrument in larger public health promotion initiatives (Samoggia & Riedel, 2019).

Several smartphone apps to promote healthy diets were already developed and tested. Still, only a limited number of scientific articles on their effectiveness to make more informed food choices or about the reactions of consumers towards these apps exists. Found articles where mainly about app use in the context of food consumption and grocery shopping (Doub, Levin, Heath, & LeVangie, 2015; Flaherty, McCarthy, Collins, & McAuliffe, 2018; Gilliland et al., 2015) or about how nutritional apps can influence consumer's decision-making during grocery shopping (Okumus, Ali, Bilgihan, & Ozturk, 2018). A review demonstrated that apps can be effective in promoting healthier eating and that they can be a low-cost intervention for improving diets (Coughlin et al., 2015). Still, the design of existing apps should be improved to maximize effectiveness (Flaherty et al., 2018). A study about a fictive app giving personal recommendations based on the nutritional composition of a food product, received by scanning the barcode of the product, has shown that these apps can be effective for decreasing the perception of the barriers to healthy food eating and increasing the knowledge about healthy eating (Samoggia & Riedel, 2019). The El CoCo[1] and Yuka app are examples of commercially available nutritional apps that use barcode scanning technology. In this study, only the Yuka app will be discussed further.

[1] El CoCo: By scanning a barcode of a food product, the El CoCo app provides the user with an evaluation of the overall nutritional quality of a food product based on the Nutri-Score and NOVA (i.e. classification system classifying the products into 4 large groups depending on their degree of processing. The app can be downloaded for free.

2.4.1 The Yuka app

The nutritional app Yuka was launched in January 2017 in France. In the meantime, the Yuka app is also introduced in Switzerland, Belgium, Luxembourg, Spain, and the United Kingdom (Chadwick, 2019). Anno 2020, in France no less than 9 million citizens have installed the Yuka app, just as 250 000 Belgian citizens did. In Western Europe, it is the most common used nutritional app based on barcode scanning. The app can be downloaded for free although a paid version exists providing extra options like an offline mode and a search bar (Yuka, n.d.).

Functioning of the Yuka app

When consumers scan the barcode of a food product, the Yuka app generates a score between 0 and 100 representing the overall quality. 60% of the score is determined by the nutritional quality (based on the Nutri-Score), 30% by the presence of additives and the last 10% by the organic status of the food product. The higher the score, the better the overall quality. To make it more visual, the score is accompanied by a green dot representing good overall quality, an orange dot representing intermediate overall quality or a red dot representing bad overall quality. When consumers scan a product with a low (i.e. bad) score, the app provides healthier alternatives from the same food category (Figure 6).

Figure 6: Example of a recommendation of a product with a good overall quality for a product with a bad overall quality as also shown in the app

Food Additives

As mentioned before, the Yuka app also considers the presence of food additives. Food additives, natural or artificial, are added to preserve foods, improve flavour and/or appearance. They are assigned a specific E-number as identification. In the EU, only additives presented in the positive list included in Annex II of Regulation (EC) No 1333/2008 (2008) may be used in food products. Also, the Regulation (EU) No. 1169/2011 (2011) obliges that additives should be declared in the ingredient list of food products by their name and/or E-number and their function.

Consumers have been more concerned about additives in recent years, partly due to the 'Clean Label' trend whereby consumers ask for food products that do not contain chemical additives, have an easy-to-understand ingredient list and that are minimally processed (Song & Im, 2018; Van Gunst & Roodenburg, 2019). Additives are often considered as undesirable, harmful, unhealthy and artificial by consumers (Bearth, Cousin, & Siegrist, 2014; Cheung et al., 2016; Haen, 2014; Paans, Poortvliet, & Hartemink, 2013; Zugravu, Pogurschi, Pătrașcu, Iacob, & Nicolae, 2017).

Thereby, consumers are generally more sensitive to negative than positive information about additives (Zhong, Wu, Chen, Huang, & Hu, 2018). This shows that consumers concern about health impact of additives. These concerns are usually related to synthetic ones rather than to natural ones (Branen, Davidson, Salminen, & Thorngate, 2001; Dicks, 2007; Shim et al., 2011). Natural additives are perceived as safer (Koyratty, Aumjaud, & Neeliah, 2014) and are preferred compared to synthetics (Devcich, Pedersen, & Petrie, 2007). Some of consumers' concerns may be related to lack of general knowledge about additives (Dicks, 2007). Consumers often do not know their exact impact on health (van Dijk, van Kleef, Owen, & Frewer, 2012) or they are unaware that removing additives can lead to shorter shelve lives and reduced product quality (van Gunst & Roodenburg, 2019). A survey with Dutch consumers showed basic knowledge regarding food additives, but lacking knowledge regarding the relation between them and health conditions. Also, participants with a higher level of knowledge of additives avoided them less. This suggests that providing information could possibly decrease the avoidance of additives in foods (Paans et al., 2013). Also, the willingness to accept additives is higher for consumers who have a relatively high knowledge of additives (Zhong et al., 2018).

The Yuka app as extension of the Nutri-Score

As mentioned before, the Yuka app can be seen as an extension of the Nutri-Score label. First, they have the same objectives: they help consumers to find products that meet their requirements regarding nutritional quality and ingredients and encourage food manufacturers to improve the quality of existing food products by reformulating them or develop new products (Chapon, n.d.; Sherriff, 2019). As example, Intermarché, a French supermarket company, has announced to reformulate 900 of their food recipes, and hereby remove 140 additives (Chapon, n.d.) in order to get a better overall quality score by the Yuka app (Godart, 2019). The app provides information about the presence of additives and the biological status which are not considered in the calculation of the Nutri-Score. Therefore, the Yuka app can be considered as an extension of the Nutri-Score and makes it even easier to interpret the quality of food products correctly as it provides more information (i.e. about additives and biological status).

Effectiveness of the Yuka app as a tool to guide consumers during grocery shopping

Very little research has been done on the Yuka app. In a study conducted by the Paris-based firm Unknowns, consumers were accompanied to a grocery store where they were asked to use the Yuka app and to comment on their product choices. Results showed that the app simplified participants' grocery experience and helped to justify their choices. Therefore, the Yuka app can be effective in helping consumers during grocery shopping, particularly for advising against the presence of potentially harmful additives (Southey, 2019). However, this should be interpreted with caution as the experimental design only involved 18 consumers.

Also, the company behind the Yuka app conducted a survey with nearly 230 000 of its users. Results showed that 94% of the frequent users changed their buying behaviour (Chadwick, 2019; Vanlommel, 2019) and 92% of them put a product back when it got rated red by the app (Sherriff, 2019). However, these results were not published by the company itself and therefore should be interpreted with caution. So, although the goal of the Yuka app is "to improve consumers' health by helping them make sense of product labels and make better choices for their health" (Yuka, n.d.), no articles were found on this subject. Therefore, this study will examine current reactions of Belgian and French consumers towards the Yuka app.

2.5 Recommendations to increase the use of the Nutri-Score label and the Yuka app

During the literature study, several blind spots were found regarding the Nutri-Score label and the Yuka app. Collecting additional information (e.g. reasons why consumers do not like the Nutri-Score label), may lead to recommendations to improve reactions of consumers towards the label and subsequently increase its use. This paragraph elaborates on the missing information regarding the Nutri-Score label and the Yuka app and what will also be touched upon during this study.

2.5.1 Current reactions and reasons therefore towards the Nutri-Score label and the Yuka app

Previous studies mainly examined whether the Nutri-Score was able to discriminate amongst food products based on nutritional quality (de Edelenyi, Egnell, Galan, Druesne-Pecollo, et al., 2019; de Edelenyi, Egnell, Galan, Hercberg, et al., 2019) or whether consumers understood the label (Egnell, Ducrot, et al., 2018b; Egnell, Talati, Hercberg, Pettigrew, & Julia, 2018; Julia & Hercberg, 2017c). Only one study was found about the evolution of perception of French consumers regarding the Nutri-Score label (Ducrot et al., 2019). Their results showed that between 2018 and 2019 the number of consumers that had seen the Nutri-Score label increased, that in general consumers are quite positive about the Nutri-Score label and that 87% thought that the label should be mandatory on all products. Underlying reasons for liking, perceived credibility, and perceived usefulness, were not identified in previous studies.

In general, it may be possible to respond to current reactions of consumers, and underlying reasons, in order to increase liking, perceived credibility and perceived usefulness of these tools and following their use. Therefore, this study will in the first place examine current reactions towards the tools and also focus on reasons why Belgian and French consumers do not like, find the Nutri-Score label credible or useful and whether they would like to receive more information about the label. Based on this information, recommendations will be made to increase the use of the Nutri-Score label and the Yuka app during food shopping.

2.5.2 Trust in the developer and underlying calculation of both tools

A reliable source of information, transparency of who is responsible for the label (Grunert & Wills, 2007) and transparency of the underlying criteria (Van Kleef & Dagevos, 2015) can all contribute to the reliability of a FOP label. Related to the source of information, food manufacturers are considered less reliable because consumers think they use labels for their own sake (Van Kleef & Dagevos, 2015; Vyth et al., 2009). Third parties, like non-governmental organisations (NGOs) and official institutions, are identified as more reliable (Larceneux, 2003). Last, official authorisations or support by (inter)national organisations related to health and nutrition may increase the credibility of FOP labels (Feunekes et al., 2008; Mandle et al., 2015; Vyth et al., 2009).

These principles may be extended to nutritional apps as it was already shown in previous studies that trust is an important factor for adopting new technologies (Bahmanziari, Pearson, & Crosby, 2003; Bélanger & Carter, 2008) and for using QR code advertising on smartphones (Atkinson, 2013). As the Nutri-Score label has been developed by scientists and the Yuka app by an NGO, trust is expected to be quite high for both tools. However, consumers may not know who developed these tools or think the food industry uses these as marketing tricks to sell more. When this turns out to be the case, education regarding the developers can possibly increase their perceived credibility.

Where the underlying calculation of the Nutri-Score is fully transparent, this is not the case for the Yuka app. On the one hand, the calculation method and threshold values of the Nutri-Score are accessible for consumers allowing them to calculate Nutri-Scores themselves. As a result, transparency and reproducibility are ensured (Ministère de l'Agriculture, 2017). On the other hand, when contacting the company behind Yuka for further information about the determination of the overall quality score, reference was always made to the website where little can be found. However, since 2020 the developers of the Yuka app mention on their website that the evaluation of additives is based on scientific results and recommendations of the European Food Safety Authority (EFSA), *Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail* (ANSES), and the International Agency for Research on Cancer (IARC). One remark that needs to be made is that consumers probably need to know the underlying calculations before they can trust them. Therefore, this study examines the current objective knowledge of the Nutri-Score label and whether participants would like more information about it. If current objective knowledge turns out to be low, this may influence intentions to use the Nutri-Score label in a negative way. Education about the label may be a recommendation in this case to increase its use during food shopping.

2.5.3 Making the Nutri-Score label the standardized, mandatory FOP label in the EU

Despite current legislation (i.e. Regulation (EU) No. 1169/2011 determines the contours of FOP), implementation of the Nutri-Score label remains voluntary (Mandle et al., 2015). Therefore, its implementation relies on the willingness of food manufacturers and retailers to use it. Also, an international agreement on mandatory FOP labelling is still non-existing (Kanter et al., 2018). Discussions are ongoing about a standardized FOP label and guidelines on both global and European level (Codex Alimentarius Commission, 2016; EUFIC, 2018; Thow, Jones, Schneider, & Labonté, 2019). The opportunity for an international accepted FOP label exists despite some significant differences in effectiveness between EU countries (Feunekes et al., 2008).

Therefore, national and regional differences (Méjean et al., 2014; Möser et al., 2010), nutritional knowledge, eating habits (Grunert, Fernández-Celemín, et al., 2010) and consumer behaviour (Ares et al., 2018) for the different regions should be taken into account. Uncertainty exists about which type of FOP label is best. It is shown that nutrient-specific labels are better equipped to provide consumers with enough information (Hersey et al., 2013). However, consumers are often more eager to use simple summary labels (Bialkova & van Trijp, 2010; Feunekes et al., 2008) and these were also found easier to use, interpret, and a better guide in identifying healthier products or ranking products based on their healthiness (Bialkova & van Trijp, 2010; Crosetto et al., 2018, 2019; Egnell, Talati, et al., 2019; Feunekes et al., 2008; Hersey et al., 2013; Maubach, Hoek, & Mather, 2014).

In addition, consumers prefer standardisation (Campos et al., 2011; Kelly et al., 2009; Mandle et al., 2015) as it could reduce confusion due to an abundance of FOP labels (Draper et al., 2011; Möser et al., 2010). They are also more confident in food labels that are regulated (Gracia & de-Magistris, 2016; Hawley et al., 2013; Tonkin, Webb, Coveney, Meyer, & Wilson, 2016).

Organisations like the WHO and the *Vlaams Instituut Gezond Leven* have indicated that, based on scientific evidence, a standardized FOP label is important to improve diets and subsequently overall health (Kanter et al., 2018). Also, The *Bureau Européen des Unions de Consommateurs (*BEUC) recommends the Nutri-Score system as a minimum basis for a standardized FOP label in the EU (BEUC, 2019) and this is also supported by several European consumers' organisations (Cruz e Silva, 2019). Therefore, the Nutri-Score label may become the standardized mandatory FOP label in the EU (Julia & Hercberg, 2017b). Seven European consumer organisations have launched "PRO-NUTRISCORE", a European Citizens Initiative promoting healthier food intake (Cruz e Silva, 2019). The goal of this initiative is for the European Union to require the Nutri-Score label on all food products (Lees, 2019). The petition linked to this initiative requires one million signatures in order to demand the European Commission to address the Nutri-Score case (Test Aankoop, 2019). It was closed in April 2020 and received more than 100 000 signatures. Despite the fact that it did not reach the target, the Nutri-Score label will be further discussed by the EC (Consumentenbond, 2020). In addition, a coalition of consumer organisations, food companies, academics etc. has recently been formed which advocates to make the Nutri-Score mandatory on all food products in the EU (De Groote, 2020). In order to find out whether consumers would like the Nutri-Score label to become mandatory for all food products, their opinion about this was also asked, as well as on the "PRO-NUTRISCORE" petition. If these opinions are positive, making the Nutri-Score the only label in Europe could be (one of the) recommendations to increase its use.

3 METHODOLOGY

3.1 Theoretical framework

In this study, a framework based on the Theory of Planned Behaviour (TPB) will be used to examine influencing variables on the intentions to use the Nutri-Score label and the Yuka app during food shopping. Therefore, in the remaining of this paragraph, the general TPB is first discussed, followed by an explanation of the modified framework. Here, it is also explained what has already been found in the literature about the influencing variables on the use of food information to determine the healthiness of food products (i.e. the factors in the original TPB) and about the added variables.

3.1.1 Theory of Planned Behaviour

The TPB is one of the most widely used models for explaining human behaviour regarding health and food choices (Dean, Raats, & Shepherd, 2008). Therefore, it will form the basis for the adapted framework used in this study. The TPB-framework given in Figure 7: Theory of Planned BehaviourFigure 7 explains the human behaviour as a function of intention, its immediate antecedent. Intention is in turn influenced by attitude towards behaviour, subjective norms (SN), and perceived behavioural control (PBC) (Dean et al., 2008). Last mentioned factors can also affect each other but that is not considered in this study.

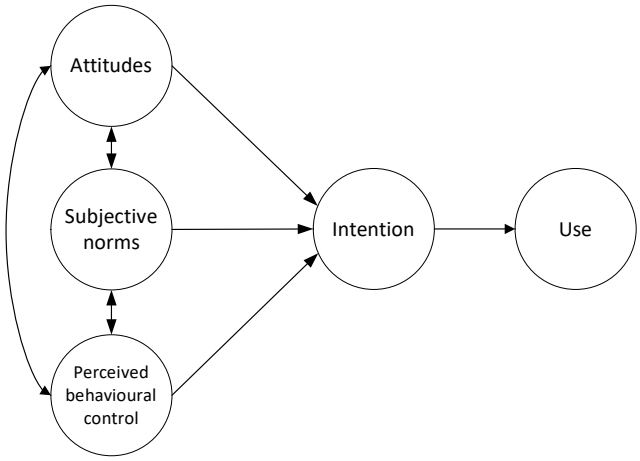


Figure 7: Theory of Planned Behaviour framework

Attitudes towards behaviour refers to how (un)favourable the evaluation of someone is towards a certain behaviour (Ajzen, 1991). Attitudes can be divided further in affective and instrumental attitudes. Affective attitudes (AA) refers to emotions and motivations that arise by the prospect of performing a certain behaviour. On the other side, instrumental attitudes (IA) refers to a more cognitive consideration of the extent to which consumers can benefit from performing a certain behaviour (Breckler & Wiggins, 1989). The next predecessor of intention is SN. This describes the expected evaluation of the behaviour by others and so the perceived social pressure to (not) preform a certain behaviour. Last, PBC is related to consumers' perceived ability to perform a behaviour. So, it refers to consumer's perception of the ease/difficulty of performing a certain behaviour and reflects past experiences and anticipated difficulties or facilitating conditions (Ajzen, 1991).

The original TPB framework is preserved to determine the influence of AA, IA, SN and PBC on the intention to use food information (i.e. food ingredients and nutrition information) to determine the healthiness of food products. Both the Nutri-Score label and the Yuka app are covered by using the term 'food information'. Two studies were found that already used the TPB in the context of the (intention to) use food information. A first study showed a higher relative importance of PBC compared to attitudes and SN as influencing variable on food label use in Singapore (Vijaykumar et al., 2013). Secondly, the study of Lim, Kim, and Kim (2015) used an adapted version of the TPB to determine influencing variables on food label use amongst female college students in Seoul. They found that especially control beliefs were important to explain label use among female college students. Control beliefs are beliefs regarding skills or opportunities for the behaviour and together with the perceived power of each control factor, they form the variable PBC.

The findings of both studies showed that the TPB is applicable for determining influencing variables on consumers' behaviour towards nutritional labelling. Nevertheless, their results should be interpreted with caution as research was performed outside Europe with samples not representing the whole population but specific groups (e.g. female students) and with consumers who live in a different culture compared to those in the EU.

3.1.2 Adapted framework

Next, additional factors specifically for the Nutri-Score label and the Yuka app were added to the original TPB. This results in the framework presented in Figure 8. Several variables are relevant for both the Nutri-Score label and the Yuka app while others are only applicable for one of both.

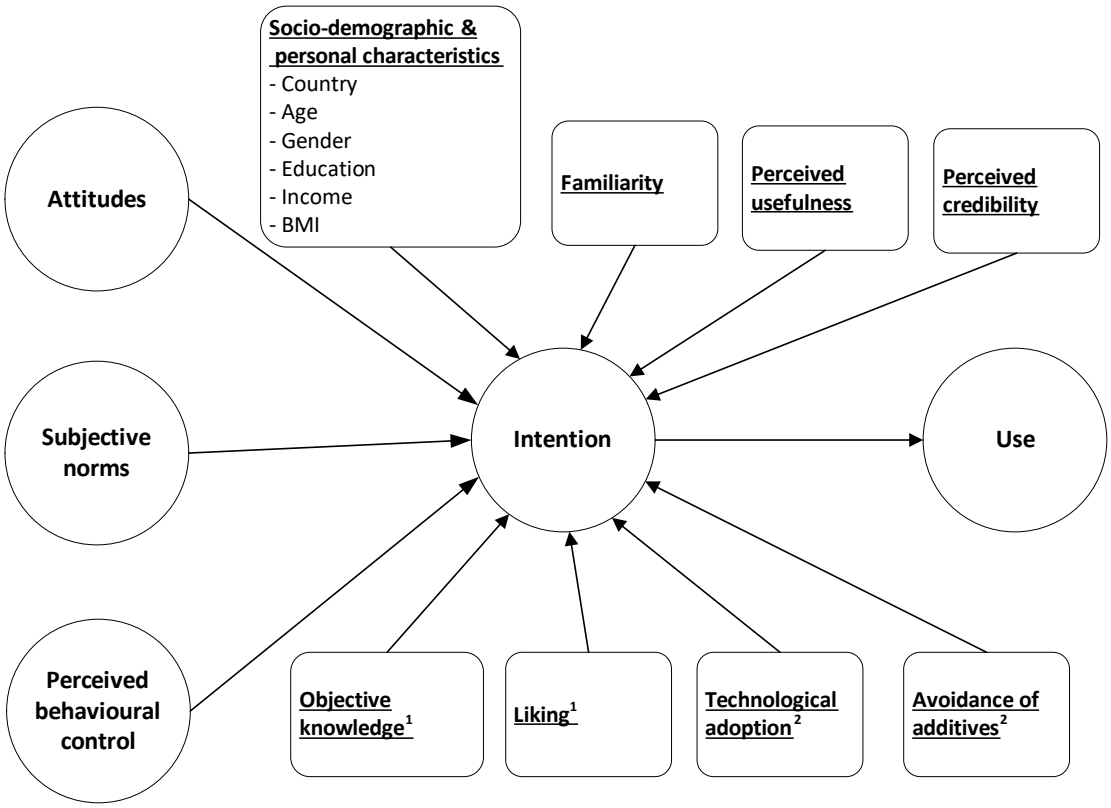


Figure 8: Adapted version of the TPB used in this study. [1]Variables only applicable for the Nutri-Score label; [2]Variables only applicable for the Yuka app

Influencing variables on the intention to use the Nutri-Score label

For the variables added in general and specific for the intention to use the Nutri-Score label, existing literature about the extension of the TPB for food labels was consulted (Drichoutis et al., 2006; Hess, Visschers, & Siegrist, 2012). However, influencing variables were mainly found for the actual use of food labels instead of for the intention to use it. Therefore, most of the added influencing variables are based on found literature related to the actual use of food labels during grocery shopping. Since the Nutri-Score label is introduced not long ago in Belgium and France, it would be difficult to study its actual use as not all consumers know this FOP label already. Azjen and Fishbein (2000) proposed that determining behavioural intention assumes predictive power for the future, with the focus on behavioural intention rather than actual behaviour. Also, in marketing, behavioural intention is a substitute indicator for actual behaviour (Fishbein & Ajzen, 1977). Therefore, it is assumed in this study that influencing variables on actual use of food labels also have an impact on intention to use them.

First socio-demographic and personal characteristics like gender, education, age, etc. were added. Although studies report inconsistent relations, overall it seems that women are more likely to report the use of food labels (Baltas, 2001; Cowburn & Stockley, 2005; Grunert & Wills, 2007). This is also the case for consumers with a higher income (Grunert & Wills, 2007). Then, consumers with higher education are more likely to read food labels and check the ingredient lists, while those with a lower educational level tend to only look at food labels (Bender & Derby, 1992; Drichoutis, Lazaridis, & Nayga, 2005). Furthermore, effect of age is not very clear (Drichoutis et al., 2006). Although some studies deduced that young and middle-aged adults are more likely to use food labels compared to elderly (Baltas, 2001; Campos et al., 2011; Cowburn & Stockley, 2005; Malam et al., 2009). Last, obese consumers (i.e. consumers with a Body Mass Index (BMI) higher than 25) are more likely to use food labels compared to consumers with a normal weight (Satia, Galanko, & Neuhouser, 2005).

Next, familiarity with a food label is a key factor in information processing (EUFIC, 2012; Moorman, 1990), can increase active searching (Grunert & Wills, 2007), accurate reading (Cowburn & Stockley, 2005) and influence the evaluation of a food label but probably not the choice of healthier products. It should be noted that findings about familiarity may not be generalized to other markets where they are familiar with another type of food label compared to the one examined in previous studies (van Herpen, Seiss, & van Trijp, 2012). In this study, familiarity is approached with whether participants have already heard about the Nutri-Score label.

High perceived usefulness has also shown to affect intention to use labels positively (Obayashi, Bianchi, & Song, 2003). Another study showed that perceived usefulness was associated with consumers' use of sustainability labels on apparel products (Ma, Gam, & Banning, 2017). As a result, it is assumed that when consumers think the Nutri-Score label is (very) useful, they also have a high intention to use it.

The following influencing variable is perceived credibility. Previous research has shown that a lack of credibility of the information on labels is negatively associated with label use (Obayashi et al., 2003). In order to be credible, labels need to be trusted by consumers regarding the information and the source providing this information (Grunert, 2002; Tonkin, Wilson, Coveney, Webb, & Meyer, 2015). Transparency about who is responsible for the label and about the underlying criteria is also important (Grunert & Wills, 2007; Van Kleef & Dagevos, 2015).

Food manufacturers are considered less reliable as consumers think they use labels for their own sake (Van Kleef & Dagevos, 2015; Vyth et al., 2009). On the other hand, third parties, like official institutions, are seen as more trustworthy (Bennett & McCrohan, 1993).

Grunert and Wills (2007) mentioned that liking a nutritional label can have an impact on the use of the label. This because when a label is liked, this can lead to a more positive assessment even when the label is not understood by consumers. Therefore, liking was also added in the adapted framework.

Last, several studies concluded that knowledge about nutrition can positively influence the use of food labels (Drichoutis et al., 2005; Grunert, Fernández-Celemín, et al., 2010; Misra, 2007; Petrovici, Fearne, Nayga Jr, & Drolias, 2012). Nevertheless, other studies showed no effect of knowledge about nutrition on food label use (Drichoutis, Lazaridis, Nayga, Kapsokefalou, & Chryssochoidis, 2008; Nayga Jr, 2000). The explanation was that these consumers already know enough and do not think looking at food labels is necessary anymore. Therefore, knowledge about nutrition was not considered in the framework. Objective knowledge (i.e. how much consumers actually know) of the Nutri-Score was included as understanding is important for information processing (Grunert, Fernández-Celemín, et al., 2010; Hoefkens et al., 2012). It is therefore expected that if consumers do not understand the label, they will use it less. Subjective knowledge (i.e. how much consumers think they know) about the Nutri-Score will not be taken up in the framework.

There are still variables (e.g. shopping habits, diet) that may influence intentions to use the Nutri-Score label. However, only the most important influencing variables who already showed to significantly influence the intention to use food labels in previous studies, were added in this study. For example, disease-related aspects seemed not that important in predicting label use in a study by Hess et al. (2012). Therefore, diet-related health conditions were not considered.

Influencing variables on the intention to use the Yuka app

As the Yuka app can be seen as an extension of the Nutri-Score label, it is assumed that sociodemographic and personal characteristics, familiarity, perceived usefulness, and perceived credibility can also influence intention to use the Yuka app. Their associated positive or negative effects are also assumed to be similar. Previous research regarding the use of food-related apps was mostly about general usage of apps related to health control (El-Gayar, Timsina, Nawar, & Eid, 2013; Higgins, 2016; Torous, Friedman, & Keshavan, 2014) and weight loss (Azar et al., 2013; Pellegrini, Pfammatter, Conroy, & Spring, 2015; Wharton, Johnston, Cunningham, & Sterner, 2014). One study showed that most of the participants strongly agreed that the diet-related and nutritional apps they used were easy to use, helpful and that they liked and enjoyed using them (West et al., 2017). This could indicate that perceived usefulness is positively related with app use. Nevertheless, no European studies were found about the use of apps during food shopping.

Compared to the framework that will be used for the Nutri-Score label, liking of the Yuka app was not considered as it is even more recently introduced compared to the Nutri-Score label. As a result, fewer people will know it and will not be able to judge correctly whether they like it or not. Two variables which are only applicable for the Yuka app are technological adoption and avoidance of additives.

The term technological adoption covers the process of acceptance, integration, and use of new technology. As nutritional apps are recently introduced to consumers, only limited research was found. The found studies were all about the development of this type of app (EK Dunford & Neal, 2017; Elizabeth Dunford et al., 2014; Henryks, Brimblecombe, & Bidstrup, 2017). Nevertheless, it is important to know whether consumers have positive reactions towards new technology to find a good way to promote the use of the Yuka app. In the continuation of this work, technology adoption is represented by the variable 'Food related app use'. Last, it is also important to know whether people avoid or seek additives since the Yuka app shows the additives present in food products and takes these into account in the calculation of the overall quality score. Therefore, when consumers try to avoid additives, this may be a reason for consumers to use the Yuka app.

3.2 Study design

3.2.1 Pre-testing and study setup

Data was collected in Belgium and France by means of a survey (Appendix A) drawn up in the online survey programme Qualtrics. The survey was designed in English and translated to Dutch and French. An initial version of the survey was pretested in a sample of researchers and university students for comprehensibility, terminology, and length of the survey. Following, the survey was adapted based on received comments. Ethics approval for this study was granted by the Belgian Ethics Committee of Ghent University Hospital in March 2020 (Reference No. B670202042998) and can be found in Appendix B. All collected data was coded in a non-identifiable format and processed anonymously. For this study, a collaboration was made with *Test Aankoop*. They cofounded the project together with Ghent University and revised the survey during its development.

3.2.2 Data collection

Data was obtained by means of probabilistic sampling from the online access proprietary panel of the contracted market research agency Kantar in both Belgium and France. Data collection was completed at the fifteenth of March 2020. In order to obtain representative data for both countries, quotas provided by Kantar were used to obtain the correct ratios for gender, age category and region (Appendix C). These quota percentages were applied to 600 consumers for both countries each (Table C1). Data collection was closely monitored to ensure that all quotas were met. Nevertheless, there were some deviations from the original quotas in the final dataset due to problems with the online survey program. As a consequence, quotas were increased by 5% to ensure that original quotas were met (Table C2). Still, the original quotas were well approached.

Qualtrics offers the possibility to screen out consumers when they do not meet the requirements. In this way, consumers who did not agree with the five questions regarding the informed consent form, who did not meet the quota, who were never responsible for the purchase of food products and those who stopped filling in the survey early, were screened out.

3.2.3 Survey design

The total survey can be found in Appendix A. It starts with an informed consent. This is followed by 4 screening questions for gender, age, region, and responsibility for food purchases to determine whether consumers meet the quotas. The question about responsibility for food purchases is adapted from previous studies (FSAI, 2009; TNS BMRB Research, 2016). These questions were followed by the actual content questions.

Product evaluation

First, consumers were asked to evaluate four food products. They are presented one randomly allocated product from each of the four following categories: dairy and dairy substitutes; vegetarian, meat, and fish products; sweet and salty snacks, and beverages. The four categories were chosen based on two criteria: (1) commonly available in Belgian and French supermarkets, and (2) contain products with a wide variability in nutritional quality. All categories contain five food products with different Nutri-Scores. It was ensured that the chosen products are known by most of Belgian and French consumers and are available in both countries.

Product selection was done online, mainly via the website of Delhaize. Then, their Nutri-Scores were checked with the calculation sheets available on the website of the federal public service of health, food chain safety and environment of Belgium. These calculations can be found in Table E1 to Table E4. Table 2 shows all 20 products and in Appendix 0 these products are described more in detail. Here, the list of ingredients, nutritional values, overall quality scores given by the Yuka app and, if applicable, additives and alternatives proposed by the Yuka app can be found.

Table 2: Overview of the 20 products used in the product evaluation question. Every category contains five products with different Nutri-Scores

Nutri-Score	Dairy & dairy subsitutes	Meat, Fish & vegetarian products	Sweet & salty snacks	Beverages
A	Danone – Skimmed yoghurt	Garden gourmet – Vegetable burger	Nestlé - Fitness - Breakfast cereals	Alpro – Soy drink
B	Alpro – Vanilla & Almond Dessert	Saupiquet – Canned tuna	Lu - Cracotte – Multicereal crackers	Coca-Cola – Coke zero
C	Galbani - Mozzarella	Herta - Superieur natuur - Cooked ham	Lays - Salted chips	Tropicana – Orange juice without pulp
D	La rustique - Camembert	Labeyrie - Le Tradition - smoked salmon	Lu - Pim's orange	Lipton – Ice Tea
E	Président – Soft butter	Justin Bridou - Le Batôn de Berger - Dried sausage	Côte d'Or - Milk chocolate	Coca-Cola – Regular coke

Products are evaluated based on nutritional value, health, price-quality ratio, naturalness (i.e. presence of additives) and taste on a scale from 1 to 5. In addition, a general quality score, based on only nutritional quality and the presence of additives, will be requested for the product on a scale from 0 to 100. For these two questions, consumers are shown a picture of the products' packaging accompanied by the list of ingredients and nutritional values like in the example for Lays' Salted chips shown in Figure 9.

Lays - Salted chips

Ingredient list: Potatoes, vegetable oils (sunflower, rapeseed, corn, in varying amounts), salt.
Nutritional value (per 100 g) Energy 2305 kJ / 551 kcal Fat 34 g of which Saturates 4,2 g Carbohydrate 53 g of which Sugars 0,5 g Fibre 4,2 g Protein 6,3 g Salt 1,1 g.

Figure 9: Example of how food products were displayed in the product evaluation question

Food purchasing behaviour

Next, consumers get three questions regarding their food purchasing habits. They are asked about both their three most visited types of shops and supermarkets. In addition, importance of aspects (e.g. price, health, presence of a food label, etc.) during food purchases was assessed on 5-point Likert scales ranging from 'Not at all important' (1) to 'Extremely important' (5). Aspects were chosen based on the Food Choice Questionnaire (FCQ) and previous research (Fotopoulos, Krystallis, Vassallo, & Pagiaslis, 2009; Januszewska, Pieniak, & Verbeke, 2011; Sonnenberg et al., 2013; Steptoe, Pollard, & Wardle, 1995).

Use of food information to determine the healthiness of foods

The following block contains two questions about consumers' reactions towards the use of food information (i.e. food ingredient and nutritional information) to determine the healthiness of foods. This was examined based on the elements of the original TPB.

The first question contains three statements measuring SN (e.g. "People who are important to me think that I should use food information to determine the healthiness of foods.") and 4 statements measuring PBC (e.g. 'It is easy to use food information to determine the healthiness of foods.') obtained from previous research (Kraft, Rise, Sutton, & Røysamb, 2005; Leach, Hennessy, & Fishbein, 2001; Menozzi, Halawany-Darson, Mora, & Giraud, 2015; Spence, Stancu, Elliott, & Dean, 2018) and are assessed on 5-points Likert scales from 'Strongly disagree' (1) to 'Strongly agree' (1).

The second question assesses attitudes towards the use of food information which was measured by 6 statements on 5-point bipolar scales[1]. AA (e.g. from 'Unenjoyable' (1) to 'Enjoyable' (5)) and IA (e.g. from 'Useless' (1) to 'Useful' (5)) were both estimated by 3 items based on the research of Rhodes and Courneya (2003).

[1] Bipolar scales contain opposite endpoints and a centre point. With this type of scale, it is possible to measure both the direction as the intensity of the participant's opinion about the asked concept ("Encyclopedia of Survey Research Methods," 2008).

The Nutri-Score label

The block about the Nutri-Score label contains questions determining consumers' reactions towards the label. First, a picture of the Nutri-Score label is shown accompanied by an explanation. Subsequently, familiarity and current use were assessed. The reasons for using or not using the label were also investigated. Next, intention to use the Nutri-Score label is assessed by six statements (e.g. 'I will use the Nutri-Score label the next time I go food shopping.'), liking with four statements (e.g. 'I like the Nutri-Score label'), perceived credibility by three statements (e.g. 'I think the Nutri-Score label is a trustworthy source of nutritional information.') and perceived usefulness by three statements (e.g. 'The Nutri-Score label is useful.').

The next question contained four statements assessing attitude towards the Nutri-Score label (e.g. 'A Nutri-Score label on all food products in the EU should be mandatory.'). All statements were selected based on previous research (Consumentenbond, 2018; Crosetto et al., 2019; Egnell, Talati, et al., 2019; Emrich, Qi, Cohen, Lou, & L'Abbe, 2015; Fatimah et al., 2019; Fenko, Kersten, & Bialkova, 2016; Feunekes et al., 2008; Menozzi et al., 2015; Spence et al., 2018; Teo & Lee, 2010) and are rated on 5-point Likert scales from 'Strongly disagree' (1) to 'Strongly agree' (5). When 'Strongly disagree' or 'Strongly' disagree' on all statements regarding liking, perceived credibility, or perceived usefulness, reason(s) for this were asked.

Last question in this block asked about consumers' objective knowledge of the Nutri-Score label based on ten true/false statements (e.g. 'On a Nutri-Score label, dark green with a letter A stands for the best Nutri-Score, red with a letter E stands for the worst Nutri-Score'). The option 'I do not know' was also provided.

The Yuka app

To introduce the block about the Yuka app, consumers were asked about their urge to avoid/look for certain ingredients (e.g. sweeteners) during food shopping on 5-point scales from 'I avoid this ingredient' (1) to 'I seek this ingredient' (5). Also, their objective knowledge of additives was assessed by three true/false (e.g. 'Approved additives are regularly re-tested for their safety'). Last, consumers' smartphone use during food shopping, as indication for technological adoption, was assessed by five statements (e.g. "I use more than one smartphone app during food shopping.") on 5-point Likert scales from 'Never' (1) to 'Always' (5) (Doub et al., 2015).

Before the actual questions about the Yuka app, a short explanation of the app was given. Questions about familiarity, current use, intention, perceived credibility, and perceived usefulness of the Yuka app were similar to those for the Nutri-Score label. Statements were slightly modified to make them applicable to Yuka and a statement about perceived time consumption of the Yuka app was added.

Final questions

To end the survey, subjective knowledge about nutrition, the Nutri-Score label and the Yuka app was assessed on 5-points Likert scales from 'Very poor' (1) to 'Excellent' (5). Last, nine questions regarding socio-demographic and personal characteristics (e.g. highest obtained degree, financial situation, etc.) were included.

3.3 Data Analysis

3.3.1 Data cleaning, recoding, and creating new variables

Statistical analyses were carried out with IBM® SPSS® Statistics 26. Data was first cleaned up by removing answers from those who did not filled in the last question with forced response (i.e. "How many people are there in your household?") and the consumers who completed in 40% or less than 40% of the median time taken by the overall sample. Also, too many females filled in the Belgian survey. Based on the quota for age, random females were deleted to approach the quotas. For France, this problem did not arise.

Next, some of the variables were recoded, or computed into new variables. For example, the variable 'age' was recoded in a new variable with six age categories. Also, monthly income was converted from a 5-point scale with actual incomes and the option 'Prefer not to answer' to four groups: 'Low income', 'Average income' and 'High income' and 'Prefer not to answer'. BMI was calculated with following formula: BMI=weight (kg)/(length (m) x length (m)) and consumers were categorised into four groups suggested by the *Vlaams Instituut Gezond Leven*. Those who did not filled in their length or weight were put in an extra group 'Prefer not to answer' for the variable BMI. Next, overall objective knowledge scores were calculated for both the Nutri-Score label and additives. This was done by appointing one point when a statement was answered correctly and no point when it was answered wrong or 'I do not know' was indicated. Then the points were added up to obtain an overall knowledge score for the Nutri-Score label on a scale of ten and for additives on a scale of three.

For variables constructed by taking the mean score for different statements, internal reliability was examined to verify whether the statements measure the same subject. Cronbach's alpha (α) is used as it is an effective way of checking internal reliability. For all variables, Cronbach's alpha was higher than 0.7 (Table 3), meaning that the statements are internal reliable (Bell, Bryman, & Harley, 2018).

Table 3: Results of the reliability analyses for variables constructed by taking the mean of several statements shown by Cronbach's alpha (α) for the overall sample (n=1246)

Subject	**α**
Intention to use the Nutri-Score label	0.96
Liking of the Nutri-Score label	0.89
Perceived credibility of the Nutri-Score label	0.90
Perceived usefulness of the Nutri-Score label	0.84
Avoidance of additives	0.72
Food-related app use	0.93
Intention to use the Yuka app	0.97
Perceived credibility of the Yuka app	0.95
Perceived usefulness of the Yuka app	0.88

Following, in order to compare actual Nutri-Scores with the evaluation of the nutritional quality estimated by consumers in the product evaluation question, actual Nutri-Scores were converted to a 5-points scale from 'Low nutritional quality' (1) to 'High nutritional quality' (5). Therefore, Nutri-Score A was converted to five, B to four, etc. (Table 4). Next, overall quality scores given by the Yuka app were compared with those given by consumers. As none of the evaluated products was organic, the Yuka score was recalculated so that the 10% determined by organic status was no longer taken into account but that the overall score was still on a scale of 0 to 100 (Table 4).

Table 4: Values for the Nutri-Score as used in this study and overall quality score given by the Yuka app recalculated whereby organic status was not considered on a scale of 0 to 100

Product	Nutri-Score	Yuka score
Dairy and dairy substitutes		
Danone - Skimmed yoghurt	5	93
Alpro - Vanilla & Almond Dessert	4	53
Galbani - Mozzarella	3	53
La rustique - Camembert	2	38
La Président - Soft butter	1	39
Meat, Fish & vegetarian products		
Garden gourmet - Vegetable burger	5	100
Saupiquet - Canned tuna	4	83
Herta - Superieur natuur - Cooked ham	3	43
Labeyrie - Le Tradition - Smoked salmon	2	38
Justin Bridou - Le Batôn de Berger - Dried sausage	1	0
Sweet & salty snacks		
Nestlé - Fitness - Breakfast cereals	5	70
Lu - Cracotte - Multicereal	4	93
Lays - Salted chips	3	53
Lu - Pim's orange	2	6
Côte d'Or - Milk chocolate	1	17
Beverages		
Alpro - Soy drink	5	54
Coca-Cola - Cola zero	4	43
Tropicana - Orange juice without pulp	3	71
Lipton - Ice Tea	2	37
Coca-Cola - Regular coke	1	0

3.3.2 Statistical analysis

Results were considered significant when p-values were lower or equal to 0.05. Descriptive analyses were used to determine mean values. For comparison of mean values between two variables, Mann-Whitney U Tests were used while for means between more variables Kruskal-Wallis Tests were used unless stated otherwise.

Product evaluation

Spearman's correlation was first checked between the attributes (i.e. nutritional value, healthiness, quality-price ratio, naturalness, and taste) to see whether there are significant associations between them. Following, comparisons between evaluations of nutritional quality by the Nutri-Score and by consumers as well as the comparison between the (recalculated) overall quality score by the Yuka app and by consumers were conducted with One-Sample Wilcoxon Signed Rank Tests.

Exploratory factor analysis

Exploratory factor analyses (EFA) were performed in the first place to reduce the number of predicting variables on the intentions to use both tools. In addition, they were also performed to make sure assumptions for performing multivariate linear regressions (MLRs) were satisfied. EFAs were done separately for the predicting variables in the original TPB, Liking of the Nutri-Score, perceived usefulness, perceived credibility, avoidance of additives and food related app use. The Kaiser-Meyer-Olkin (KMO) measure was used to verify the sampling adequacy for the analyses. No individual KMO-value should be <0.5. Also, Bartlett's Test of Sphericity was used to see whether correlations between factors were high enough to perform EFAs. Last, cross-loadings should be below 0.4 (Hair, Anderson, Babin, & Black, 2010).

Resulting from the EFAs, eight new latent variables were created: 'Subjective norms', 'Perceived Behavioural control', 'Affective attitudes', 'Instrumental attitudes', 'Reactions towards the Nutri-Score label', 'Avoidance of additives', 'Food related app use' and 'Reactions towards the Yuka app'. Internal reliability was for all new variables larger than 0.7. Therefore, all new formed latent variables have good internal reliability, and they will be used as predicting variables in the MLRs. Also, the new variables will merge some previously mentioned variables discussed in the adapted framework (Paragraph 3.1.2). Table 5 shows the results of the different EFAs.

Table 5: Statements used in the EFAs and the newly created latent variables made with the different EFAs (n=1246). Every block gives the results of a different EFA

Constructs and items	Factor loadings	Cronbach's α	Variance extracted
Subjective norms		0.87	0.22
People who are important to me (e.g. family and friends) think that I should use food information to determine the healthiness of foods.	0.79		
People who are important to me use food information to determine the healthiness of foods.	0.69		
People who are important to me advise to use food information to determine the healthiness of foods.	0.86		
Perceived behavioural control		0.78	0.16
It is easy to use food information to determine the healthiness of foods.	0.63		
I am confident when using food information to determine the healthiness of foods.	0.62		
I am able to use food information to determine the healthiness of foods.	0.68		

Table 5: Statements used in the EFAs and the newly created latent variables made with the different EFAs (n=1246). Every block gives the results of a different EFA (continued)

Constructs and items	Factor loadings	Cronbach's α	Variance extracted
Affective attitudes		0.80	0.15
Using food ingredients and nutrition information to determine the healthiness of foods is unenjoyable vs. enjoyable	0.57		
Using food ingredients and nutrition information to determine the healthiness of foods is stressful vs. easy	0.77		
Instrumental attitudes		0.75	0.12
Using food ingredients and nutrition information to determine the healthiness of foods is foolish vs. wise	0.78		
Using food ingredients and nutrition information to determine the healthiness of foods is harmful vs. beneficial	0.75		
Reactions towards the Nutri-Score label		0.95	0.68
The Nutri-Score label gives confidence to choose the product with this label.	0.86		
The Nutri-Score label is useful.	0.85		
I think the Nutri-Score label is a trustworthy source of nutritional information.	0.84		
I want to see the Nutri-Score label on more food products.	0.83		
I like the Nutri-Score label.	0.83		
I can trust the Nutri-Score label.	0.82		
The Nutri-Score label can help you choose healthier products.	0.81		
I would choose food products based on the Nutri-Score label.	0.81		
The Nutri-Score label helps understand the nutritional quality of a product	0.78		
I would choose the product with a Nutri-Score label even at a higher price.	0.68		
The Nutri-Score label gives enough information, so I do not need to look at the information on the back of the food package anymore.	0.60		
Avoidance of additives		0.81	0.59
Sweeteners	0.77		
Colourings	0.86		
Flavourings	0.67		
Food related app use		0.93	0.73
I use more than one smartphone app during food shopping.	0.89		
I use a smartphone app during food shopping.	0.89		
I look actively for the next great food related smartphone app.	0.88		
I scan QR codes on food products or advertisements that interest me.	0.87		
I research information about products that I am thinking of purchasing during food shopping.	0.74		

Table 5: Statements used in the EFAs and the newly created latent variables made with the different EFAs (n=1246). Every block gives the results of a different EFA (continued)

Constructs and items	Factor loadings	Cronbach's α	Variance extracted
Reactions towards the Yuka app		0.93	0.77
I think Yuka is a trustworthy source of nutritional information.	0.91		
Yuka gives confidence to choose the product with a higher score.	0.92		
I can trust Yuka.	0.90		
I think Yuka is generally trustworthy.	0.91		
Yuka is useful.	0.88		
Yuka can be helpful in choosing healthier products.	0.88		
Yuka gives enough information, so I do not need to refer at the information on the food package.	0.75		

Multivariate linear regressions

MLRs were conducted separately for intentions to use the Nutri-Score label and the Yuka app during food shopping. The variables 'Intention to use the Nutri-Score label during food shopping' and 'Intention to use the Yuka app during food shopping' served as dependant variables in separate MLRs. Independent variables measured on Likert-scales (e.g. original TPB variables, reactions towards the Nutri-Score label and the Yuka app, etc.), were seen as scale variables. These variables were chosen based on the adapted frameworks discussed in Paragraph 3.1.2 and on the EFAs discussed in Paragraph 3.3.2. For the categorical variables (i.e. gender, age, BMI, income, education, and familiarity), dummies were created. Baseline groups for these variables are shown in Table 6. These were chosen because they contained the largest number of consumers. Consumers who preferred not to answer on the questions regarding their length, weight or income were seen as missing in the MLRs.

Table 6: Baseline groups for the dummy variables used in the MLRs

Variable	Baseline category
Gender	Female
Country	France
Age	18-29 year olds
BMI	Normal weight
Income	Average income
Education	Secondary school
Familiarity Nutri-Score label	Yes
Familiarity Yuka app	No

In Figure 11Figure 13**Error! Reference source not found.** the model used in the MLR for predicting significant influencing variables on intentions to use the Nutri-Score label during food shopping is shown. In addition, Figure 10 displays the model used in the MLR for determining influencing variables on intention to use the Yuka app during food shopping. First, preliminary analyses were performed with all influencing variables, based on the adapted framework from Paragraph 3.1.2 and the results of the EFAs.

$$
\begin{aligned}
&Intention\ to\ use\ the\ Nutri-Score\ label\ during\ food\ shopping_i \\
&= \beta_0 + \beta_1 * Belgium + \beta_2 * Male + \beta_3 * Age{:}\ 30-39\ years + \beta_4 * Age{:}\ 40-49\ years \\
&+ \beta_5 * Age{:}\ 50-59\ years + \beta_6 * Age{:}\ 60-65\ years + \beta_7 * 66-75\ years + \beta_8 \\
&* Underweight + \beta_9 * Overweight + \beta_{10} * Obese + \beta_{11} * no\ education/primary\ school \\
&+ \beta_{12} * Bachelor + \beta_{13} * Master + \beta_{14} * PhD + \beta_{15} * No\ familiarity + \beta_{16} \\
&* Subjective\ norms + \beta_{17} * Perceived\ behavioural\ control + \beta_{18} \\
&* Instrumental\ attitudes + \beta_{19} * Affective\ attitudes + \beta_{20} * Reaction\ toward\ the\ Nutri \\
&- Score\ label + \beta_{21} * Objective\ knowledge\ of\ the\ Nutri-Score
\end{aligned}
$$

Figure 11: Model with possible influencing variables on the intention to use the Nutri-Score label during food shopping

$$
\begin{aligned}
&Intention\ to\ use\ the\ Yuka\ app\ during\ food\ shopping_i \\
&= \beta_0 + \beta_1 * Belgium + \beta_2 * Male + \beta_3 * Age{:}\ 30-39\ years + \beta_4 * Age{:}\ 40-49\ years \\
&+ \beta_5 * Age{:}\ 50-59\ years + \beta_6 * Age{:}\ 60-65\ years + \beta_7 * 66-75\ years + \beta_8 \\
&* Underweight + \beta_9 * Overweight + \beta_{10} * Obese + \beta_{11} * no\ education/primary\ school \\
&+ \beta_{12} * Bachelor + \beta_{13} * Master + \beta_{14} * PhD + \beta_{15} * Familiarity + \beta_{16} \\
&* Subjective\ norms + \beta_{17} * Perceived\ behavioural\ control + \beta_{18} \\
&* Instrumental\ attitudes + \beta_{19} * Affective\ attitudes + \beta_{20} \\
&* Reaction\ toward\ the\ Yuka\ app + \beta_{21} * Avoidance\ of\ additives + \beta_{22} \\
&* Food\ related\ app\ use
\end{aligned}
$$

Figure 10: Model with possible influencing variables on the intention to use the Yuka app during food shopping

A bootstrapping method was used to provide more robust statics and in this way to account for possible issues with assumption violation (i.e. heteroscedasticity). All major assumptions for performing MLRs were checked. First, there was no issue of multicollinearity for both models. Collinearity diagnostics showed: no correlation between two predictive variables in both models above 0.5, no values of variance inflation factor (VIF) larger than 10, no average VIF-values substantially larger than 2 (the largest VIF value was 1.695 for the Nutri-Score label and 1.693 for the Yuka app), no tolerance value below 0.2 (smallest tolerance value was 0.590 for the Nutri-Score label and 0.591 for the Yuka app). Next, histograms and the normal P–P plots of normally distributed residuals showed that the data is normally distributed for both models. Last, the plot of standardized residuals against standardized predicted values showed a slight tendency of funnelling out but no real curve formation. This indicates that there could be heteroscedasticity in the data. Also, more than 5% of the cases were outliers so MLR was redone without these values. Still, the assumption of linearity has been fulfilled. In general, results of the assumption tests showed that MLR is a good statistical method to analyse the data in this study.

Cluster analysis

Lastly, a cluster analysis (CA) was conducted to segment consumers based on their liking and current use of the Nutri-Score label. Three clusters were created based on the agglomeration coefficient: consumers who like and already use the Nutri-Score label, consumers who like but not yet use it and consumers who do not like nor use it. To characterize these clusters, Pearson's Chi-Square and Kruskal-Wallis Tests were used to characterize these clusters.

Next, no CA was performed based on liking and current use For the Yuka app because liking of the Yuka app was not assessed in the survey. In addition, the combination of reactions towards the Yuka app and its current use did not result in good clusters.

4 RESULTS

4.1 Socio-demographic and personal characteristics of the sample

The final sample consists of 1246 consumers, 50% females and 50% males. 49% of the overall sample were Belgian and the other 51% were French. The absolute values for socio-demographic and personal characteristics can be found in Table 7. The age of the consumers was between 18 and 75. For the total sample, 19% belonged to the category of 18-29 years old, 18% to the category of 30- 39 years old, 20% to the category of 40-49 years old, 19% to the category of 50-59 years old, 10% to the category of 60-65 years old and the last 13% of them belonged to the category of 66-75 years old. About half of the consumers (48%) have as highest degree secondary school, followed by consumers who have a master's degree (24%). Most of the consumers have an average income (42%). However, it should be noted here that 13% of the consumers did not want to answer this question. Last, about half of the overall sample (49%) had a normal weight, followed by people who were obese (29%). Comparison between the characteristics of Belgian and French consumers and the quotas provided by Kantar for gender, age and living area, shows that this sample is representative for Belgian and French consumers.

Table 7: Socio-demographic and personal characteristics of the total sample (n= 1246) divided into Belgian (n=612) and French (n=634) consumers

	Belgium	France
Gender		
Female	306	318
Male	306	316
Age category		
18-29	125	116
30-39	111	109
40-49	117	130
50-59	118	123
60-65	62	68
66-75	79	88
Highest obtained degree		
No education/primary school	16	23
Secondary school	277	320
Bachelor	222	71
Master	92	208
PhD	5	12
Monthly income		
Low	176	185
Average	229	293
High	85	122
Prefer not to answer	122	34
BMI		
Underweight	24	31
Normal weight	288	322
Overweight	184	176
Obese	78	74
Prefer not to answer	38	31

Differences in socio-demographic and personal characteristics between Belgian and French consumers were determined with Chi²-Tests. Only a significant association between living country and education of consumers was found (Table 8). Despite the significant difference, the magnitude of the difference is small, and it can be assumed that both samples are quite similar in composition.

Table 8: Association between the country where consumers live and several sociodemographic and personal characteristics

	χ2	df	p
Gender	0.003	1	0.96
Age	1.52	5	0.91
BMI	2.36	3	0.50
Income	3.62	2	0.16
Education	8.92*	3	0.03

**Significant value on a 0.05-level; [a]Bachelor's- and master's degree taken together.*

4.2 Product evaluation

First, Spearman correlation factors showed positive significant correlations for the variables "Nutritional value", "Healthiness", "Quality-price ratio", "Naturalness" and "Taste" for all 20 products (Table E5). This means that the variables evolve in the same direction, i.e. when one variable rises or decreases, the others will do the same. Still, correlation factors varied between 0.58 and 0.81. From this, it can be concluded that correlations were moderate to strong (Weir, 2016). Nevertheless, none of them were too high to not look at associations between consumers' evaluations of nutritional and overall quality scores of food products and the evaluation by the Nutri-Score label/Yuka app. A possible reason for these results is that Belgian and French consumers in general do not attach more importance to a specific factor during food shopping compared to the other factors.

Subsequently, it was determined whether there were significant differences between consumers' evaluation of the nutritional quality of the food products and the score given by the Nutri-Score. The zero hypothesis could be rejected for all products, meaning that consumers' evaluations of the nutritional quality is in general significantly different compared to the evaluation by the Nutri-Score label (Table 9).

A general trend for all products could not be observed. However, it is notable that consumers rated the nutritional quality of the products around average as their scores ranged from two to four on a scale from one to five. As a result, the nutritional quality of products with a better Nutri-Score is often assessed lower by consumers in general. This is the case for skimmed yoghurt, vanilla & almond dessert, vegetable burger, breakfast cereals, multicereal crackers, salted chips, soy drink and coke zero. The opposite is observed for products with a less positive Nutri-Score (i.e. camembert, soft butter, cooked ham, smoked salmon, dried sausage, milk chocolate, orange juice and regular coke): consumers assessed their nutritional quality better than the Nutri-Score does.

As a result, consumers maybe had both good and bad assessments, but that these were averaged out by aggregating the results for the overall sample. Another possible explanation is that consumers were not familiar with the food products and therefore could not correctly assess the nutritional quality of the products.

Table 9: Comparison between the nutritional quality score estimated by consumers and according to the Nutri-Score (n=1246)

Product	n	Nutri-Score	Median	Z
Dairy and dairy substitutes				
Danone - Skimmed yoghurt	249	5^b	4^a	878.12
Alpro - Vanilla & Almond Dessert	243	4^b	3^a	632.20
Galbani - Mozzarella	250	3^a	3^b	461.96
La rustique - Camembert	252	2^a	3^b	908.31
La Président - Soft butter	252	1^a	3^b	1034.92
Meat, Fish & vegetarian products				
Garden gourmet - Vegetable burger	251	5^b	3^a	949.27
Saupiquet - Canned tuna	249	4^a	4^b	485.61
Herta - Superieur natuur - Cooked ham	250	3^a	4^b	502.95
Labeyrie - Le Tradition - Smoked salmon	246	2^a	4^b	925.52
Justin Bridou - Le Batôn de Berger - Dried sausage	250	1^a	2.5^b	820.55
Sweet & salty snacks				
Nestlé - Fitness - Breakfast cereals	244	5^b	3^a	959.60
Lu - Cracotte - Multicereal	255	4^b	3^a	664.93
Lays - Salted chips	250	3^b	2^a	762.56
Lu - Pim's orange	252	2^a	2^b	523.04
Côte d'Or - Milk chocolate	245	1^a	3^b	990.95
Beverages				
Alpro - Soy drink	254	5^b	3^a	949.39
Coca-Cola - Cola zero	243	4^b	2^a	971.60
Tropicana - Orange juice without pulp	242	3^a	4^b	596.10
Lipton - Ice Tea	257	2^a	2^b	623.57
Coca-Cola - Regular coke	250	1^a	2^b	465.52

n = the number of participants that evaluated a certain food product based on the nutritional quality; Median = the median value for the nutritional quality given by N participants for a certain product. The superscripts a,b indicate significantly different values (across rows) at the 0.05-level (2-tailed) in ascending order.

Next, overall quality scores given by consumers compared with overall quality scores from the Yuka app were significant for all food products, except for fruit juice without pulp. So, in general, consumers' evaluations of the overall quality of food products used in this study did not correspond with the evaluations of the Yuka app, except for orange juice (Table 10).

Table 10: Comparison between the overall quality score given by consumers and the overall quality score given by the Yuka app which was recalculated so the organic aspect was not taken into account (n=1246)

Product	n	Yuka score	Median	Z
Dairy and dairy substitutes				
Danone - Skimmed yoghurt	249	93[b]	71[a]	1130.64
Alpro - Vanilla & Almond Dessert	243	53[a]	61[b]	1089.90
Galbani - Mozzarella	250	53[a]	57[b]	1130.58
La rustique - Camembert	252	38[a]	71[b]	1144.35
La Président - Soft butter	252	39[a]	65.5[b]	1137.41
Meat, Fish & vegetarian products				
Garden gourmet - Vegetable burger	251	100[b]	61[a]	1110.28
Saupiquet - Canned tuna	249	83[b]	72[a]	1089.78
Herta - Superieur natuur - Cooked ham	250	43[a]	60[b]	11444.34
Labeyrie - Le Tradition - Smoked salmon	246	38[a]	71[b]	1110.29
Justin Bridou - Le Batôn de Berger - Dried sausage	250	0[a]	50[b]	1049.82
Sweet & salty snacks				
Nestlé - Fitness - Breakfast cereals	244	70[b]	56.5[a]	1056.37
Lu - Cracotte - Multicereal	255	93[b]	62[a]	1158.10
Lays - Salted chips	250	53[b]	50[a]	1137.43
Lu - Pim's orange	252	6[a]	51[b]	1151.25
Côte d'Or - Milk chocolate	245	17[a]	60[b]	1110.26
Beverages				
Alpro - Soy drink	254	54[a]	62[b]	1144.31
Coca-Cola - Cola zero	243	43[b]	30[a]	1095.96
Tropicana - Orange juice without pulp	242	71[a]	71[a]	1016.46
Lipton - Ice Tea	257	37[a]	50[b]	1192.56
Coca-Cola - Regular coke	250	0[a]	31[b]	900.46

n = the number of participants gave an overall quality score of a certain food product; Median = the median value for the overall quality score given by n participants for a certain product. The superscripts [a,b] indicate significantly different values (across rows) at the 0.05-level (2-tailed) in ascending order.

The overall trends showed first that products with better overall quality scores by the Yuka app, consumers estimated the overall quality lower. This was the case for skimmed yoghurt, vegetable burger, canned tuna, breakfast cereals, multicereal crackers, salted chips, and soy drink. Furthermore, products with lower overall quality scores from the Yuka app get a better evaluation by consumers. This was the case for vanilla & almond dessert, mozzarella, camembert, soft butter, cooked ham, smoked salmon, dried sausage, pim's orange, milk chocolate, coke zero, ice-tea, and regular coke. So, more products are scored better by consumers then by the Yuka app. The most remarkable differences were for products with lowest Nutri-Scores: consumers rated these products 26 to 50 points more compared to the Yuka score app.

Possible explanations are in the first place the same as for the comparison between evaluations of nutritional quality by consumers and by the Nutri-Score. Consumers may not have known the food products used in the survey and therefore could not correctly assess overall quality. On top of this, the Yuka app takes into account the presence of additives. In Figure 12, percentages of consumers who obtained certain objective knowledge scores of additives are shown. These results show that the majority of the overall sample (70%) scored 0 on 3. This general low level of objective knowledge about additives may also be a possible explanation for the incorrect estimation of the overall quality of food products.

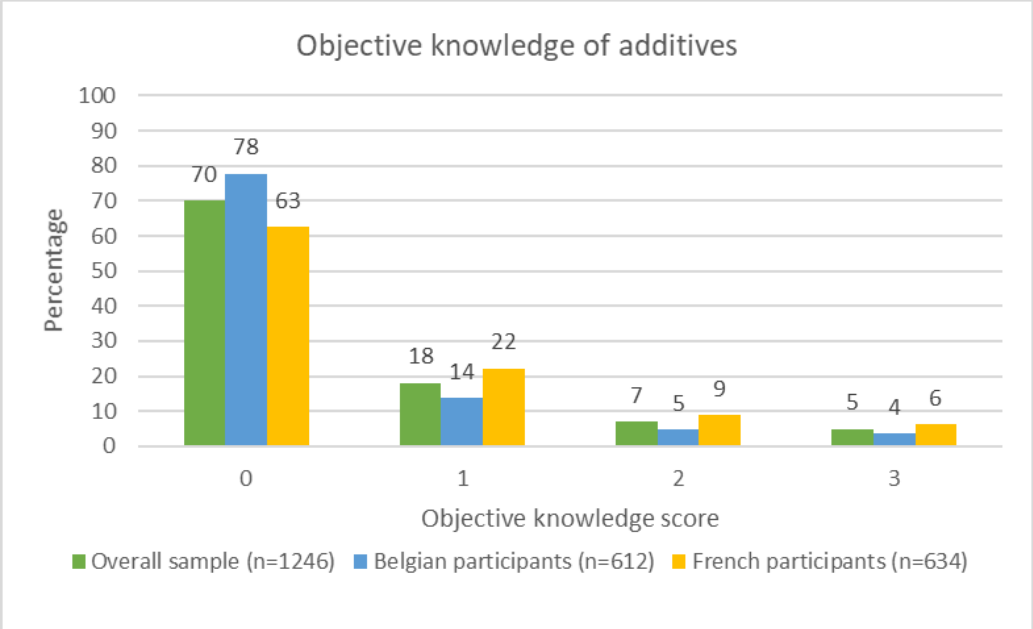


Figure 12: Percentages of consumers who obtained a different objective knowledge score about additives on a scale from 0 to 3. Results are given for the overall sample (n=1246), Belgian (n=612) and French (n= 634) consumers separately

4.3 Current consumers' reactions towards the Nutri-Score label

In order to get a better insight into current consumers' reactions towards the Nutri-Score label, descriptive results concerning consumers' reactions (i.e. an item constructed with EFA based on liking, perceived credibility, and perceived usefulness), attitude and objective knowledge will be discussed in this paragraph. Table 11 gives an overview of the mean scores for Belgian and French consumers.

Table 11: Current reactions of Belgian (n=612) and French (n=634) consumers towards the Nutri-Score label in terms of liking, perceived usefulness and perceived credibility, attitude toward the label and objective knowledge

	Mean ± SD				
	Belgium	**France**	**U**	**z**	**r**
Reactions towards the Nutri-Score label	3.27[a] ± 0.84	3.44[b] ± 0.80	171670	-3.52	-0.10
Liking of the Nutri-Score label	3.14[a] ± 0.93	3.38[b] ± 0.89	166412	-4.37	-1.12
Perceived usefulness of the Nutri-Score label	3.35[a] ± 0.85	3.47[a] ± 0.80	183362	-1.69	-0.48
Perceived credibility of the Nutri-Score label	3.33[a] ± 0.88	3.50[b] ± 0.85	175556	-2.96	-0.08

[a,b] *Different letters indicate a significant difference on a 0.05-level (across rows) in ascending order.*

Table 11: Current reactions of Belgian (n=612) and French (n=634) consumers towards the Nutri-Score label in terms of liking, perceived usefulness and perceived credibility, attitude toward the label and objective knowledge (continued)

	Mean ± SD				
	Belgium	**France**	**U**	**z**	**r**
Attitude towards the Nutri-Score label					
Voluntary Nutri-Score labelling implementation is sufficient. (n=1117)	3.06[a] ± 1.01	3.10[a] ± 1.17	152487	-0.67	-0.02
A Nutri-Score label on all food products in the EU should be mandatory. (n=1169)	3.68[a] ± 1.18	4.07[b] ± 1.04	139093	-5.76	-0.17
A Nutri-Score label should appear on all products regardless of their healthiness. (n=1163)	3.72[a] ± 1.18	4.06[b] ± 1.05	141209	-5.10	-0.15
All food manufacturers and supermarkets should put a Nutri-Score label on their food products. (n=1174)	3.72[a] ± 1.20	4.04[b] ± 1.03	141209	-4.59	-0.13
Objective knowledge score for the Nutri-Score label	4.17[b] ± 2.54	3.92[a] ± 2.31	181531	-1.98	-0.06

[a,b] *Different letters indicate a significant difference on a 0.05-level (across rows) in ascending order.*

4.3.1 Liking, perceived usefulness and perceived credibility

First, in Table 11 can be seen that mean overall reactions of French consumers is significantly more positive compared to the reactions of Belgian consumers. A possible reason for these is that French consumers are already more familiar with the Nutri-Score label compared to Belgian consumers. Also, French consumers (Mean = 3.19) find the presence of food labels more important during food shopping compared to Belgian consumers (Mean = 2.80), U = 159320, $p < 0.001$.

Next, Perceived usefulness of the Nutri-Score label was not significantly different between Belgian and French consumers. Also, results show that both liking and perceived credibility of the Nutri-Score label is on average higher for French than for Belgian consumers. A reason for this can be that French consumers are already more familiar with the Nutri-Score label compared to Belgian consumers (Paragraph 4.5.1) and therefore have been able to form better opinions of the label. A footnote here is that the mean scores for both countries are between 3 and 4 meaning that in general, consumers did not agree nor disagree to slightly agree with the statements regarding liking, perceived usefulness, and perceived credibility.

When consumers (strongly) disagreed with all statements measuring either liking, perceived usefulness, or perceived credibility, they were asked for underlying reason(s). Frequencies by which provided reasons were indicated, can be found in Table 12. Other reasons given by consumers themselves can be found in Table E6. First, when looking at reasons for not liking the Nutri-Score label, the main one is that they thought it is a marketing trick. This was indicated by 56% of the consumers who did not like the label (n=94). As it was indicated by 34% of those who did not like the Nutri-Score label, the second most indicated reason was that consumers did not find the Nutri-Score label interesting. Lastly, the third reason, still indicated by 29% was that they did not find the Nutri-Score label credible.

Regarding reasons for not thinking the Nutri-Score label is useful, the first and most significant one, indicated by 74% of the 70 consumers who did not think the Nutri-Score is useful, was that they think the label is a marketing trick. Secondly, 'The Nutri-Scores are not meaningful.' was indicated by 63%. 'The meaning of the Nutri-Scores is not clear.' was indicated by 37%, making it the third most indicated reason.

Last, reasons why consumers did not find the Nutri-Score label credible were examined. 75% of the 102 consumers that do not find the Nutri-Score label credible, indicated 'the Nutri-Score label is a marketing trick' as a reason for this. The second most indicated reason is that they do not find the Nutri-Score label transparent (28%). Finally, a quarter of them did not find the Nutri-Score label clear, making this the third most indicated reason.

Table 12: Reasons why consumers did not like or think the Nutri-Score label is credible or useful and the percentages of consumers who indicated these

	Belgium (%)	France (%)	Overall sample (%)
Reasons for not liking the Nutri-Score label [a]			
The Nutri-Score label is not interesting.	29	44	34
The meaning of the Nutri-Scores are not clear.	19	25	21
It is difficult to understand the Nutri-Scores.	15	16	15
The letters on the Nutri-Score label are too small.	3	9	5
The look and feel of the Nutri-Score label are not appealing.	3	13	6
The Nutri-Score label is not trustworthy.	29	28	29
The Nutri-Score labelling system is not transparent.	27	19	24
The Nutri-Scores are not correctly in line with the public health guidelines.	10	9	10
The Nutri-Score label is a marketing trick.	58	53	56
Other	15	6	12
Reasons for not thinking the Nutri-Score label is useful [b]			
The meaning of the Nutri-Scores is not clear.	35	42	37
It is difficult to understand the Nutri-Scores.	11	21	14
The letters on the Nutri-Score label are too small.	4	4	4
It is time-consuming to use the Nutri-Score label.	7	13	9
The Nutri-Scores are not correctly in line with the public health guidelines.	13	29	19
The Nutri-Scores are not meaningful.	61	67	63
The Nutri-Score label is a marketing trick.	67	88	74
Other	9	13	10
Reasons for not thinking the Nutri-Score label is credible [c]			
The meaning of the Nutri-Scores is not clear.	27	20	25
It is difficult to understand the Nutri-Scores.	15	20	17
The letters on the Nutri-Score label are too small.	3	0	2
The Nutri-Score labelling system is not transparent.	31	25	28
The Nutri-Scores are not correctly in line with the public health guidelines.	27	15	23
The Nutri-Score label is a marketing trick.	76	73	75
Other	10	10	10

Multiple answers were possible; [a] Asked at 92 consumers: 62 from Belgium and 32 from France; [b] Asked at 70 consumers: 46 from Belgium and 24 from France; [c] Asked at 102 consumers: 62 from Belgium and 40 from France.

This mainly showed that 'The Nutri-Score label is a marketing trick' was the most important reason for negative consumers' reactions towards the Nutri-Score label. This is possibly because these questions have been asked to all consumers, including those who are less familiar with the Nutri-Score label and those that thought it has been developed by the food industry. In addition, many articles can be found warning consumers that food labels may be marketing tricks (Lemond Nutrition, n.d.; Prominent, 2020) that may also influence consumers' thoughts.

4.3.2 Attitudes towards the Nutri-Score label

Next, mean values for consumers' attitudes towards the Nutri-Score label are shown in Table 11. In general, answers on the statements measuring attitude showed that French consumers have a more positive attitude towards the Nutri-Score label as they agree on a significantly higher degree with the statements about mandatory presence of the Nutri-Score label on all food products in the EU, the appearance of the label on all products independently of their healthiness and the fact that all food manufacturers and supermarkets should put a Nutri-Score label on their products. Only for 'Voluntary Nutri-Score labelling implementation is sufficient', no significant difference in mean answers between Belgian and French consumers was found.

To assess consumers' thoughts about making the Nutri-Score label mandatory, they were asked whether they already heard about the 'PRO-NUTRISCORE'-petition. Results are shown for the overall sample in Figure 13 as answers were not significantly different between Belgian and French consumers, $\chi 2$ (5, 1246) = 8.67, p = 0.12. Therefore, results show that 37% was indifferent to signing the petition and that only 39% already signed it or were willing to sign it. On the other hand, 23% was not willing to sign the petition. A possible reason for these low results is that consumers are not necessarily against making the Nutri-Score label mandatory in the EU, but rather against petitions. This could be deduced from self-given reasons shown in Table E7.

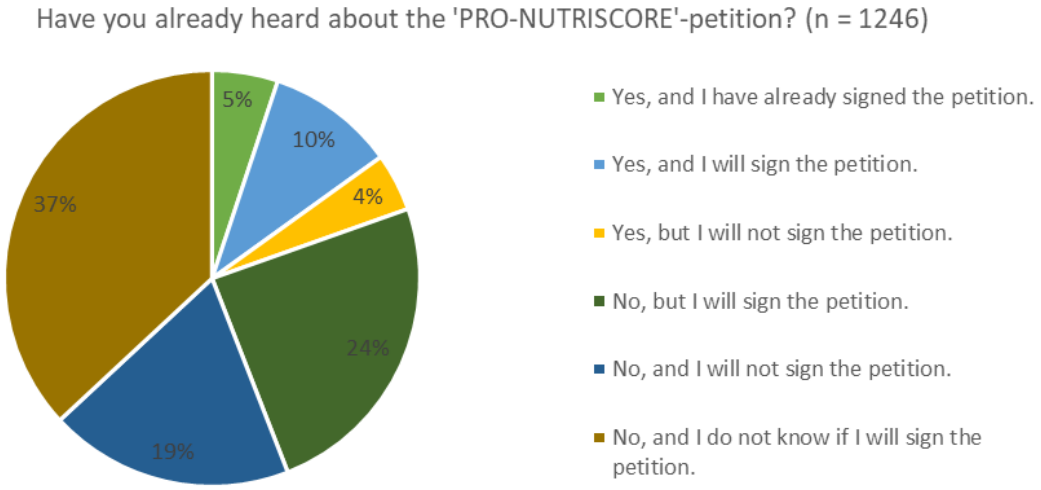


Figure 13: Familiarity with the 'PRO-NUTRISCORE'-petition for the overall sample (n=1246)

Those who were not willing to sign the petition (n=293) were asked for their reason(s) behind this. The three most indicated reasons were 'I am not interested in the Nutri-Score label' (39%), 'I do not trust the Nutri-Score label' (24%) and 'I do not find the Nutri-Score label useful' (20%). Like previous results, these also underline the importance of increasing perceived credibility and usefulness of the Nutri-Score label.

4.3.3 Objective knowledge about the Nutri-Score label

First, percentages of Belgian and French consumers who answered wrongly, correctly or did not know the answers for statements measuring objective knowledge about the Nutri-Score label are shown in Table 13. From these results, it can be deduced that between 22% and 50% of the total sample could not respond correctly on the statements. In addition, the statement 'On a Nutri-Score label, dark green with a letter A stands for the best Nutri-Score, red with a letter E stands for the worst Nutri-Score.', was most correctly answered (i.e. by 71% of the overall sample). 'The Nutri-Score label was proposed by the food industry or retailers.' was the statement for which 80% answered incorrectly or for which they did not know the answer, making this the worst-assessed statement.

Table 13: Percentages of Belgian (n=612) and French (n=634) consumers who responded correctly, wrongly or did not know the answer on the statements measuring objective knowledge of the Nutri-Score label

	Belgium			France		
	Wrong (%)	Correct (%)	I do not know (%)	Wrong (%)	Correct (%)	I do not know (%)
The Nutri-Score label is mandatory on foods in Belgium.	22	36	42	34	31	35
On a Nutri-Score label, dark green with a letter A stands for the best Nutri-Score, red with a letter E stands for the worst Nutri-Score.	7	70	23	7	73	20
A diet coke has a better Nutri-Score than a regular coke.	19	32	49	27	26	47
The content of fibre, fruit and vegetables in the food product partially determines the colour and letter of the Nutri-Score label.	9	55	36	15	48	37
The calorie content alone determines the colour and letter of the Nutri-Score label.	19	44	38	26	38	35
The Nutri-Score label is only a nutritional information label, not an overarching score on food quality.	14	45	41	23	42	36
The higher the content of energy, sugars, saturated fat, sodium of the food products, the better the Nutri-Score.	13	59	28	20	54	27
The Nutri-Score label was proposed by the food industry or retailers.	29	17	54	31	23	46
Nutri-Score labels should not be used to compare food products across different categories.	20	32	47	28	32	39
The Nutri-Score label enables the comparison between food categories such as olive oil and frozen pizza.	36	27	37	39	25	36

These results indicate the importance of education about the Nutri-Score label. For example, 30% of the overall sample currently thinks that the Nutri-Score label was proposed by the food industry or retailers.

Secondly, objective knowledge of consumers was determined. Obtained objective knowledge scores are shown in Figure 14 for the overall sample and Belgian and French consumers separately. From these results can be deduced that Belgian consumers have in general significantly higher objective knowledge of the Nutri-Score label compared to French consumers although the difference is small (Table 11). This was already confirmed by consumers' answers to the statements measuring objective knowledge (Table 13). In general, objective knowledge of the Nutri-Score label showed to be rather low. This is another indication that consumers need to be better informed about the Nutri-Score if increase in its use is desired.

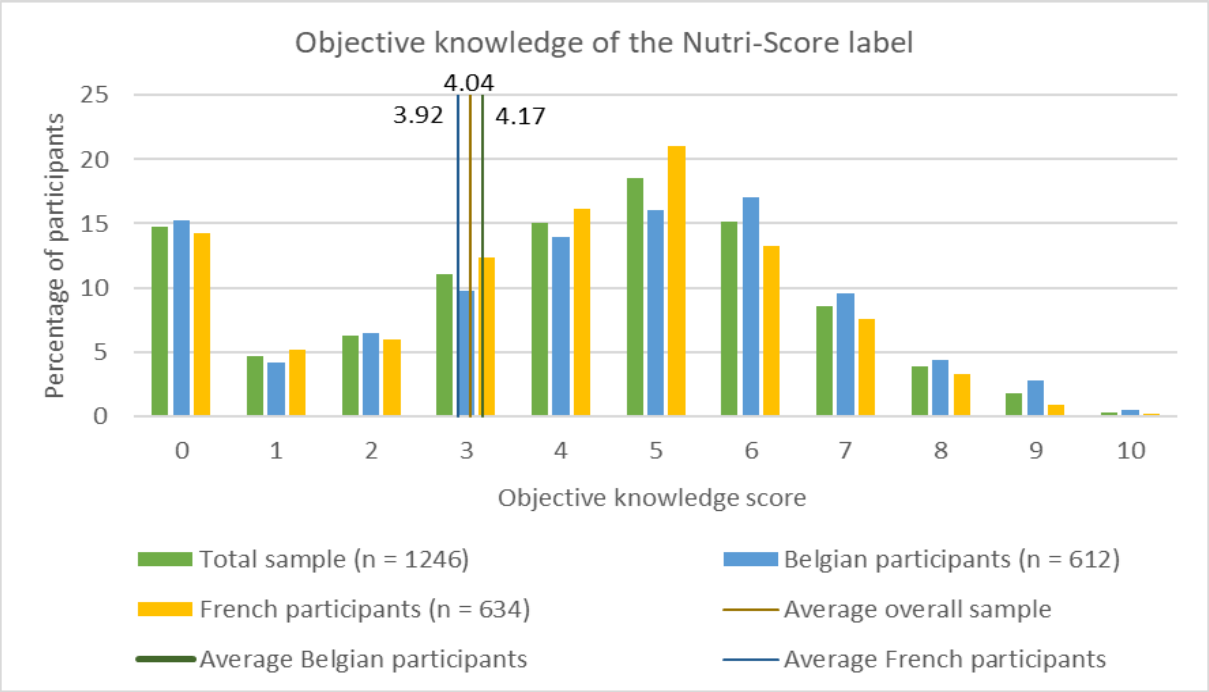


Figure 14: Percentages of consumers in the total sample (n=1246) and for Belgian (n=612) and French (n=634) separately against their obtained objective knowledge scores for the Nutri-Score label on a scale from 0 to 10. Averages for both countries and the overall sample are shown as vertical lines

The last part of the survey regarding the Nutri-Score label was about whether consumers would like extra information about the label. No less than 41% of the overall sample indicated that they would like to receive more information. From them, 74% would like to know more about how the Nutri-Score is determined (i.e. which nutrients and ingredients are used in the determination) and 71% would like to know how the Nutri-Score is calculated. The most desired medium from which they would like this additional information was the packaging of food products, indicated by 50% of those who wanted additional information. So, despite the fact that current objective knowledge of the Nutri-Score label was on the low side, consumers were in general interested in receiving additional information about the label.

4.4 Current consumers' reactions towards the Yuka app

Current consumers' reactions towards the Yuka app were assessed by asking them to rate several statements measuring perceived credibility and perceived usefulness. In addition, they were asked about perceived time consumption of the Yuka app. From the results in Table 14, it can firstly be concluded that mean reactions towards the Yuka app from French consumers were significantly more positive compared to those of Belgian consumers. Further, underlying aspects, perceived usefulness, and perceived credibility were also rated significantly better by French than by Belgian consumers.

A first reason for these results may be that the Yuka app was introduced in France some time before it was introduced in Belgium and that French are therefore more familiar with the Yuka app and had more time to form a justified opinion. Secondly, mean food related app use of French consumers is significantly higher compared to food related app use of Belgian consumers (Table 14). However, it should be noted that Belgian consumers tried to avoid additives significantly more compared to French consumers (Table 14). Normally, this may have led to higher use of the Yuka app by Belgian consumers to find additives present in food products compared to French consumers.

Table 14: Current reactions of Belgian (n=612) and French (n=634) consumers towards the Yuka app explained in terms of reactions, time consumption and influencing variables on the use

	Mean ± SD				
	Belgium	**France**	**U**	**z**	**r**
Reactions towards the Yuka app	$3.26^{a} \pm 0.88$	$3.40^{b} \pm 0.91$	17357	-3.30	-0.09
Perceived usefulness of the Yuka app	$3.29^{a} \pm 0.91$	$3.43^{b} \pm 0.92$	175365.5	-2.99	-0.85
Perceived credibility of the Yuka app	$3.23^{a} \pm 0.90$	$3.39^{b} \pm 0.95$	362943.5	-3.52	-0.10
Time consumption of the Yuka app	$3.18^{a} \pm 1.00$	$3.03^{a} \pm 1.06$	76913	-1.93	-0.05
Influencing variables on the use					
Avoidance of additives	$2.08^{a} \pm 0.56$	$2.66^{b} \pm 0.64$	162359	-5.08	-0.14
Food related app use	$1.62^{a} \pm 0.89$	$1.91^{b} \pm 1.03$	161995	-5.23	-0.15

^{a,b} *Different letters indicate a significant difference on a 0.05-level (across rows) in ascending order.*

Also, there is no significant difference between the mean score for time consumption of the Yuka app between Belgian and French consumers (Table 14). In general, they did not agree nor disagree with the statement that the Yuka app is time-consuming. This is potentially due to the fact that most consumers were not familiar with the app and were therefore unable to estimate how much time it takes to use it. Therefore, they estimated time consumption average since there was no option 'I do not know'.

4.5 Familiarity and current use of the Nutri-Score label and the Yuka app

Both familiarity with the Nutri-Score label and the Yuka app and current use of these tools during food shopping were examined (Table 15).

Table 15: Association between living country and familiarity and current use of the Nutri-Score label and the Yuka app. Counts are compared between Belgian (n=612) and French (n=634) consumers

	Percentages		χ2	df
	Belgium	**France**		
Nutri-Score label				
Familiarity (Have heard of or seen)	92[a]	91[a]	0.53	1
Current usage	52[a]	60[b]	9.04	1
Yuka app				
Familiarity (Have heard of)	23[a]	59[b]	161.48	1
Current usage	14[a]	33[b]	62.86	1

[a,b] *Different letters indicate a significant difference on a 0.05-level (across rows) in ascending order..*

4.5.1 The Nutri-Score label

Familiarity and current use of the Nutri-Score label during food shopping are shown in Figure 15. The most remarkable difference is that more Belgian consumers (40%) have never heard of or used the Nutri-Score label before compared to French consumers (31%).

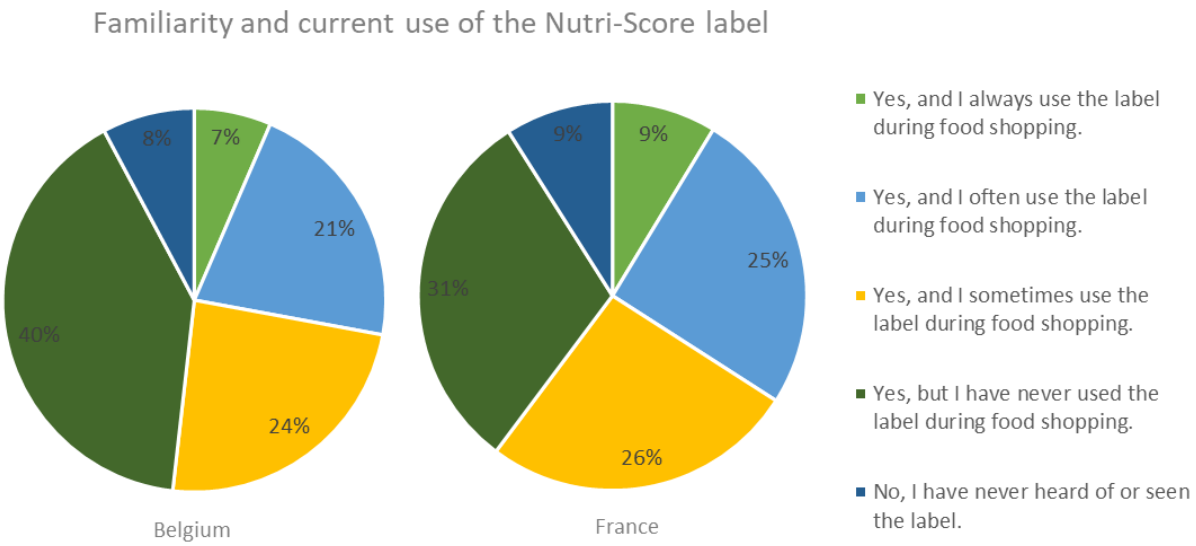


Figure 15: Familiarity and current use of the Nutri-Score label by Belgian (n=612) and French (n=634) consumers

Still, in Table 15 can be seen that familiarity is not significantly different between Belgian (92%) and French (91%) consumers. However, current use of the Nutri-Score label during food shopping is significantly higher for French (60%) than for Belgian (52%) consumers (Figure 15). A possible explanation for these results is that the Nutri-Score label has been introduced in France two years before it was introduced in Belgium. Also, the label appears already on more products in France than in Belgium.

The odds that French consumers already used the Nutri-Score label during food shopping compared to Belgian consumers was calculated with following formula:

$$Odds\ ratio = \frac{\left(\frac{\%\ of\ French\ consumers\ who\ already\ used\ the\ Nutri-Score\ label\ during\ food\ shopping}{\%\ of\ French\ consumers\ who\ have\ never\ used\ the\ Nutri-Score\ label\ during\ food\ shopping}\right)}{\left(\frac{\%\ of\ Belgian\ consumers\ who\ already\ used\ the\ Nutri-Score\ label\ during\ food\ shopping}{\%\ of\ Belgian\ consumers\ who\ have\ never\ used\ the\ Nutri-Score\ label\ during\ food\ shopping}\right)}$$

From this calculation, it was obtained that French consumers were 1.41 times more likely to have used the Nutri-Score label already during food shopping compared to Belgian consumers. It should be noted here that this difference in current use is small.

Subsequently, reasons why consumers (did not) use Nutri-Score labels during food shopping were examined (Table 16). Other reasons given by consumers themselves, translated from Dutch or French to English, are shown in Table E8. The top three most indicated reasons for not using the Nutri-Score label started with 'To find healthy products' indicated by 51% of the consumers that already use the Nutri-Score label during food shopping (n=699). The second reason 'To avoid unhealthy products' was marked by 50% and the third reason 'To get informed about the nutritional value of the products', was indicated by 46%.

Maybe more important are reasons why consumers did not use the label during food shopping. The most indicated reason was 'I am not interested in the nutritional value of food products.', marked by 34% of those who did not use the Nutri-Score label during food shopping in the past (n=442). The second reason was 'I do not trust the Nutri-Score label.', indicated by 21%. The third most important reason, 'I do not find the Nutri-Score label useful.', was marked by 20%. Only one study about reasons for not using food labels was found (Klopp & MacDonald, 1981). However, this study examined reasons for not using food labels in general. This makes it difficult to compare their results with ours. Nevertheless, some of the self-given reasons were similar to those of the study of Klopp and MacDonald (1981). Examples are 'I trust my ability to select nutritious foods without using the label information', 'I do not have the time to read the food label when I'm shopping' and 'The price of the food product is more important'.

Table 16: Percentages of Belgian and French consumers who indicated certain reasons for (not) using the Nutri-Score label during food shopping

	Belgium	France
Reasons for using the Nutri-Score[a]		
To get informed about the nutritional value of the products	42	50
To compare the same type of products of different brands	15	30
To compare different types of products	27	33
To avoid unhealthy products	47	52
To find healthy products	52	50
To purchase the same type of products with a better Nutri-Score among the different brands	22	32
To purchase different types of products with a better Nutri-Score	27	28
Other reason	3	0

Multiple answers were possible; [a] Asked at 699 consumers: 317 from Belgium and 382 from France; [b] Asked at 442 consumers: 247 from Belgium and 195 from France.

Table 16: Percentages of Belgian and French consumers who indicated certain reasons for (not) use the Nutri-Score label during food shopping (continued)

	Belgium	France
Reasons for not using the Nutri-Score[b]		
I do not like the Nutri-Score label.	9	7
I do not trust the Nutri-Score label.	46	46
I do not understand the Nutri-Score label.	34	25
I do not agree with the Nutri-Score.	32	17
I do not find the Nutri-Score label useful.	47	40
I am not interested in the nutritional value of food products.	86	66
Other reason	47	34

Multiple answers were possible; [a]Asked at 699 consumers: 317 from Belgium and 382 from France; [b]Asked at 442 consumers: 247 from Belgium and 195 from France.

Consumers who were familiar with the Nutri-Score label were asked where they heard about or have seen the label (Table 17). The same top three can be noticed for both Belgian and French consumers. First, 63% of those who were familiar with the Nutri-Score label indicated that they saw it on the packaging of food products. As a result, this is the main source of which the label is known. This may be because more and more products in supermarkets display a Nutri-Score label. Therefore, this is the source where consumers are most likely to come across Nutri-Score labels accidentally.

Table 17: Sources of which consumers know the Nutri-Score label. Percentages are shown for Belgian (n=564) and French (n=577) consumers who indicated that they were familiar with the Nutri-Score label

Source	Belgium	France
Packaging of food products	67	60
Advertisement leaflet, poster, or billboard of supermarket	33	14
Television/radio food producers	39	51
Social media from consumer organization	9	11
Information materials from the government	13	14
Other	3	4

Multiple answers were possible

Next, second most indicated source was 'television and radio spots of food manufacturers', s indicated by 45%. The third most indicated source were advertisement leaflets, posters, or billboards of supermarkets. Remarkable, this reason was indicated by a lot more Belgian (33%) than French (14%) consumers.

More detailed consideration was given to Belgian consumers who replied they knew the Nutri-Score label from advertising material of supermarkets. From those 188 consumers, 119 indicated Delhaize as one of the three supermarkets where they purchase most frequently food products. Over the past year, Delhaize has put a lot of effort into promoting nutrition with a good Nutri-Score and gave 20% discount on food products with a Nutri-Score A or B from September 2019 to December 2019. This can be an explanation why Belgian consumers know the Nutri-Score label more from advertising from supermarkets compared to French consumers.

4.5.2 The Yuka app

Familiarity and current use of the Yuka app during food shopping are shown in Figure 16. The most remarkable difference was that more French consumers (33%) already used the Yuka app during food shopping compared to Belgian consumers (14%). This may also be the reason for the big difference between Belgian (58%) and French (29%) consumers who indicated that they do not use the Yuka app yet but would like to download it. More in detail, in Table 15 can be seen that familiarity with the Yuka app was significantly higher for French (59%) than for Belgian (23%) consumers. Also, current use of the Yuka app was significantly higher for French (33%) than for Belgian (14%) consumers.

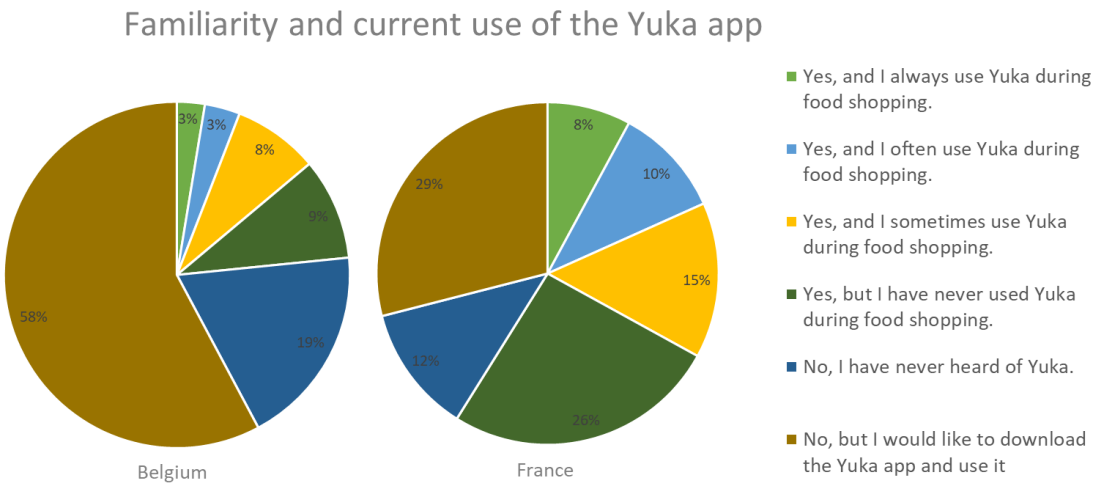


Figure 16: Familiarity and current use of the Yuka app of Belgian (n=612) and French (n=634) consumers

Based on the odds ratio (calculated with a similar formula as for current use of the Nutri-Score label), French consumers were 4.69 times more likely to be familiar with the Yuka app compared to Belgian consumers. Similar, French consumers were 3.05 times more likely to already use the Nutri-Score label compared to Belgian consumers. The most logic reason for this is that the Yuka app was introduced in France some time before it was introduced in Belgium. This means that French consumers had more time to get to know the Yuka app. Subsequently, reasons why consumers (do not) use the Yuka app during food shopping were examined. An overview and the percentages who indicated these reasons is shown in Table 18. Other reasons given by consumers themselves were translated and are shown in Table E9.

Table 18: Percentages of Belgian and French consumers who indicated certain reasons for (not) using the Yuka app during food shopping

	Belgium	France
Reasons for using Yuka[a]		
To get informed about the nutritional value of the products	18	24
To get informed about the presence of additives in the products	15	31
To compare the same type of products of different brands	15	19
To compare different types of products	15	25
To avoid unhealthy products	20	39
To find healthy products	22	35
To purchase the products with a better score suggested by Yuka	18	24
Other reason	1	1

Multiple answers were possible; [a]Asked at 832 consumers: 439 from Belgium and 393 from France; [b]Asked at 442 consumers: 58 from Belgium and 164 from France.

Table 18: Percentages of Belgian and French consumers who indicated certain reasons for (not) using the Yuka app during food shopping (continued)

	Belgium	France
Reasons for not using Yuka[b]		
I do not like Yuka.	2	5
I do not trust Yuka.	14	12
I do not understand the Yuka score.	7	5
I do not agree with the Yuka score.	17	7
I do not find Yuka useful.	9	11
I find using Yuka time-consuming.	26	34
I am not interested in the nutritional quality and presence of additives.	7	15
I am interested but do not want to install the app.	14	19
Other reason	26	16

Multiple answers were possible; [a]Asked at 832 consumers: 439 from Belgium and 393 from France; [b]Asked at 442 consumers: 58 from Belgium and 164 from France.

The top three most indicated reasons for using the Yuka app starts with 'To avoid unhealthy products', indicated by 29%. The second reason 'To find healthy products' was marked by 28% and the third 'To get informed about the presence of additives in the products' by 23% of the consumers that already used the Yuka app during food shopping (n=832). Maybe more important are reasons why consumers did not already used the Yuka app (yet). The top three reasons starts with 'I find using Yuka time-consuming.' indicated by 32%, 'Other reasons' by 26% and 'I am interested but do not want to install the app.' was indicated by 18% of the consumers that do not use the Yuka app during food shopping (n=222). Other reasons given by themselves included 'I do not have a smartphone', 'I have not downloaded it yet' and 'I do not have enough memory on my smartphone to download the app' (Table E9).

4.6 Intention to use the Nutri Score label and the Yuka app

Last tested aspects were intentions to use the Nutri-Score label and the Yuka app. First, 59% of all consumers (strongly) agreed that they intended to use the Nutri-Score label during food shopping. Also, mean intentions were higher for French (3.38) than for Belgian (3.18) consumers although the difference is small (Table 19). This was also demonstrated by the fact that 58% of Belgian consumers had the attention to use the label while this was the case for 60% of the French consumers.

Table 19: Intention to use the Nutri-Score label and the Yuka app for Belgian (n=612) and French (n=634) consumers

	Mean ± SD				
	Belgium	France	U	z	r
Intention to use the Nutri-Score label	3.18[a] ± 1.01	3.38[b] ± 0.97	1733234	-3.27	-0.09
Intention to use the Yuka app	2.83[a] ± 1.11	2.99[b] ± 1.16	176734	-2.75	-0.08

[a,b] Different letters indicate significant differences on a 0.05-level (across rows) in ascending order.

Secondly, consumers were less positive about the Yuka app as only 44% of all consumers had the intention to use the Yuka app during food shopping. In addition, mean intention of French consumers was significantly higher than mean intention of Belgian consumers. Here, the difference was bigger than for the Nutri-Score label as 47% of French consumers indicated that they had the intention to use the Yuka app while this was only the case for 40% of the Belgian consumers.

Also, mean intentions were higher for French (2.99) than for Belgian (2.83) consumers although the difference is small (Table 19).

Next, MLRs were conducted to determine influencing variables and their impact on intentions to use the Nutri-Score label and the Yuka app during food shopping. The results of these regressions will be discussed separately in following paragraphs.

4.6.1 Intention to use the Nutri-Score label during food shopping

Table 20 shows the results of the MLR exploring possible influencing variables on the intention to use the Nutri-Score label during food shopping. Results of the ANOVA-analysis showed that this MLR was significant, $F(23,962)=84.44$, $p < 0.001$. The adjusted R^2 of this model was 0.661 meaning that the influencing variables accounted for 66.1% of the variance. Therefore, it was concluded that the proposed model had explanatory value.

Table 20: Results of a multivariate linear regression testing the effect of several variables on the intention to use the Nutri-Score label during food shopping (n=986)

Variables entered	B	SE	β	BCa 95% CI	
				Lower	Upper
Constant	3.30*	0.07	-	-	3.43
France	-0.05	0.04	-0.02	-0.17	0.07
Male	-0.06	0.04	-0.03	-0.14	0.03
Age: 30-39	2.91*	0.06	-0.02	-0.19	0.06
Age: 40-49	0.03	0.05	0.01	-0.09	0.16
Age: 50-59	0.12	0.06	0.05	0.02	0.21
Age 60-65	0.02	0.06	0.01	-0.13	0.19
Age: 66-75	-0.05	0.07	-0.02	-0.20	0.15
Underweight	-0.10	0.09	-0.02	-0.26	0.03
Overweight	0.01	0.04	0.01	-0.05	0.06
Obese	0.03	0.05	0.01	-0.05	0.06
No education/ primary school	0.17*	0.08	0.03	0.04	0.26
Bachelor	0.05	0.05	0.02	-0.05	0.15
Master	0.07	0.05	0.03	-0.03	0.16
PhD	0.11	0.14	0.01	-0.15	0.36
Low income	-0.06	0.04	-0.03	-0.17	0.09
High income	0.03	0.05	0.01	-0.06	0.10
No familiarity	0.09	0.06	0.02	-0.03	0.19
Reactions	0.24*	0.03	0.24	0.20	0.28
Subjective norms	0.14*	0.02	0.14	0.10	0.16
Perceived behavioural control	-0.12*	0.02	0.08	0.03	0.14
Instrumental attitudes	0.13*	0.02	0.06	0.02	0.07
Affective attitudes	0.62*	0.03	0.61	0.55	0.70
Objective knowledge	-0.002	0.01	-0.004	-0.02	0.02

** Significant on a 0.05-level (2-tailed); based on robust method with 1000 bootstrap samples; B: unstandardized coefficient estimate; SE: standard error; β: standardized coefficient estimate; BCA 95% CI: bootstrapped 95% confidence-interval based on bias-corrected and accelerated method; Model goodness-of-fit: R^2adj = 66.1%. Baseline groups for the dummy variables used in the MLRs are described in Table 6.*

Only the variables 'No education/primary school' compared to 'Secondary school', 'Reactions towards the Nutri-Score label', 'SN', 'PBC', 'IA' and 'AA' had a significant influence on intentions to use the Nutri-Score label during food shopping.

The variable with the strongest positive effect on intention was AA. This means that when consumers felt more positive about using food information, they had a higher intention to use it. This is followed (in decreasing order of importance) by reactions towards the Nutri-Score label, SN, PBC and IA, which all had positive influences on intentions. Therefore, when reactions towards the Nutri-Score label were more positive, when using food information is perceived more positive by others, when perceived ability to use food information is higher or, when consumers think they can benefit from using food information, intentions to use the Nutri-Score label were higher.

Next, the variable 'Objective knowledge' did not had a significant influence on intention to use the label. Also, familiarity with the label did not significantly influence intentions. Following, intention of consumers with as highest education level secondary school was lower compared to these of consumers who did not went to school or had as highest education level primary school. For the other comparisons between consumers with a secondary schools degree and those with other highest obtained degrees, no significant differences in intention to use the Nutri-Score label were found. Last, for the other socio-demographic and personal characteristics (i.e. country, gender, age, BMI, and income), no significant differences in intention to use the Nutri-Score label between the reference group and the other groups were noticed.

4.6.2 Intention to use the Yuka app during food shopping

Table 21 shows the results of the MLR exploring possible influencing variables on the intention to use the Yuka app. Results of the ANOVA-analysis showed that this MLR was significant, $F(24,965) = 60.45$, $p < 0.001$. The adjusted R^2 of this model is 0.591 meaning that the influencing variables account for 59.1% of the variance in intention to use the Nutri-Score label during food shopping. Therefore, it was concluded that the proposed model had explanatory value.

Table 21: Results of a multivariate linear regression testing the effect of several variables on the intention to use the Yuka app during food shopping (n=986)

Variables entered	B	SE	β	BCa 95% CI	
				Lower	Upper
Constant	2.91*	0.08	-	2.74	3.15
France	0.06	0.05	0.03	-0.01	0.09
Male	-0.03	0.05	-0.01	-0.12	0.05
Age: 30-39	0.04	0.08	0.01	-0.12	0.23
Age: 40-49	0.05	0.07	0.02	-0.08	0.14
Age: 50-59	0.03	0.07	0.01	-0.09	0.13
Age 60-65	-0.09	0.09	-0.02	-0.25	0.06
Age: 66-75	0.08	0.09	0.02	-0.08	0.23
Underweight	-0.17	0.12	-0.03	-0.41	0.18
Overweight	0.04	0.05	0.02	-0.07	0.17
Obese	0.04	0.08	0.01	-0.14	0.29

** Significant on a 0.05-level (2-tailed); based on robust method with 1000 bootstrap samples; B: unstandardized coefficient estimate; SE: standard error; β: standardized coefficient estimate; BCA 95% CI: bootstrapped 95% confidence-interval based on bias-corrected and accelerated method; BCA 95% CI: bootstrapped 95% confidence-interval based on bias-corrected and accelerated method; Model goodness-of-fit: R^2adj = 59.1%. Baseline groups for the dummy variables used in the MLRs are described in Table 6.*

Table 21: Results of a multivariate linear regression testing the effect of several variables on the intention to use the Yuka app during food shopping (n=986) (continued)

Variables entered	B	SE	β	BCa 95% CI	
				Lower	Upper
No education/primary school	0.05	0.16	0.01	-0.26	0.35
Bachelor	-0.03	0.06	-0.01	-0.15	0.10
Master	0.001	0.06	0.0002	-0.10	0.09
PhD	0.13	0.18	0.01	-0.23	0.46
Low income	-0.02	0.05	-0.01	-0.13	0.07
High income	0.07	0.06	0.02	-0.04	0.18
Familiarity	-0.12*	0.06	-0.05	-0.21	-0.09
Subjective norms	0.13*	0.03	0.11	0.06	0.23
Perceived behavioural control	0.03	0.03	0.02	-0.02	0.05
Instrumental attitudes	-0.002	0.02	-0.002	-	-
Affective attitudes	0.03	0.03	0.02	-0.01	0.04
Reactions	0.70*	0.03	0.60	0.66	0.73
Avoidance of additives	-0.07*	0.02	-0.06	-0.12	-0.02
Food related app use	0.31*	0.03	0.27	0.23	0.39

** Significant on a 0.05-level (2-tailed); based on robust method with 1000 bootstrap samples; B: unstandardized coefficient estimate; SE: standard error; β: standardized coefficient estimate; BCA 95% CI: bootstrapped 95% confidence-interval based on bias-corrected and accelerated method; BCA 95% CI: bootstrapped 95% confidence-interval based on bias-corrected and accelerated method; Model goodness-of-fit: R^2adj=59.1%. Baseline groups for the dummy variables used in the MLRs are described in Table 6.*

The variable with the strongest, positive, effect on intentions to use the Yuka app during food shopping is the reactions towards the Yuka app. This means that when reactions of consumers towards the Yuka app increased, their intentions to use it during food shopping increased as well. The next variable with a positive effect on intentions to use the Yuka app is food related apps use. Therefore, when consumers were more eager to use food related apps, their intentions to use the Yuka app was also higher.

Next, the only factor from the TPB framework which had a significant influence on the intention to use the app is SN. When reactions of others in their surroundings (e.g. friends, family) towards using food information increased, intentions of consumers to use the Nutri-Score label did too. Following, familiarity with the Yuka app and avoidance of additives had a negative relation with intentions to use the Yuka app. So, when consumers already heard about the Yuka app, their intentions to use it were lower compared to intentions of consumers who were not familiar with the app. Also, intentions to use the Yuka app of consumers who try to avoid additives was higher compared to those who did not tried to avoid additives. However, it should be noted that the effect is rather small. Regarding socio-demographic characteristics, no significant differences in intentions to use the Yuka app were observed based on country, gender, age, BMI, education and income between baseline groups and the tested groups.

4.7 Cluster analysis and recommendations to increase the use of the Nutri-Score label

Based on their liking and current use of the Nutri-Score label, consumers were divided into three clusters by means of a CA. The size and scores for liking and current use are shown in Table 22. Cluster 1 consisted of 19% of the overall sample who did not like nor used the Nutri-Score label already. The largest part of the consumers (i.e. 49%) were grouped into cluster 2. These consumers liked the Nutri-Score label but did not used it yet. Lastly, cluster 3 contained 31% of the consumers. These were grouped because of their liking of the label and often usage. All clusters ad their mean scores for liking and current use of the Nutri-Score label are shown in Table 22 and Figure 17.

Table 22: Size and means for liking and current use of the three formed clusters (n=1246)

Clusters	n	Mean ± SD	
		Liking*	Current use **
Total sample	1246	3.26 ± 0.92	3.14 ± 1.10
1. Not liking and not using the Nutri-Score label	242	1.85^{a} ± 0.58	4.06^{c} ± 0.45
2. Liking but not using the Nutri-Score label	615	3.42^{b} ± 0.53	3.64^{b} ± 0.68
3. Liking and often using the Nutri-Score label	389	3.89^{c} ± 0.30	1.76^{c} ± 0.44

**Liking of the Nutri-Score label on a scale from 1: 'Not like it at all' to 5: 'Like it a lot'; **Current use on a scale from 1: 'I always use the label during food shopping' to 5 'I have never head of the label'; n=number of participants; SD=Standard deviation; ^{a,b} indicate significant differences at the 0.05-level across columns in ascending order.*

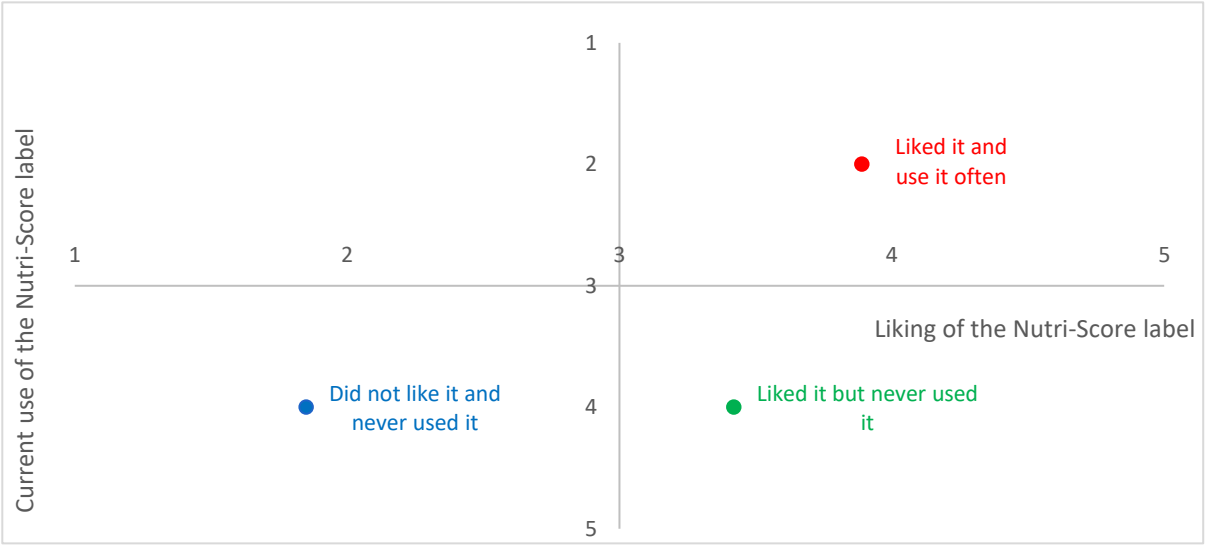


Figure 17: Positioning of the 3 clusters based on their current use and liking of the Nutri-Score label (n=1246)

The three clusters did not significantly differ in terms of gender and BMI (Table 23). Meanwhile, number of Belgian and French consumers is both significantly lower for the cluster that did not like nor use the Nutri-Score label is significantly lower for both the Belgium and France consumers. Regarding age difference between the three clusters, only the amount of 30 to 39 year olds for the last cluster is significantly different from the amount of this age category from the other clusters. When looking at the difference between highest obtained degree (i.e. education), there are only significant differences between the number of consumers with a bachelor's degree or a PhD.

The number of consumers with a bachelor's degree is significantly different between cluster 2 and 3 and between these clusters and cluster 1. Lastly, the number of consumers with a high income is significantly lower for cluster one compared to cluster 2 or 3 and also between cluster 2 and 3 there is a signicant difference as the number of consumers who like the Nutri-Score label but not use it, is higher than the number of consumers with a high income who like the label and use it.

Table 23: cluster profiles based on socio-demographic and personal characteristics for the overall sample (n=1246)

Socio-Demographics		Clusters (number of consumers)			P
		NL, NU (242)	L, NU (615)	L, U (389)	
Country	Belgium	142[a]	298[b]	172[b]	0.002
	France	100[a]	317[b]	217[b]	
Gender	Female	118	300	206	0.392
	Male	124	315	183	
Age category	18-29	42[a]	116[a]	83[a]	0.006
	30-39	28[a]	103[a]	89[b]	
	40-49	57[a]	116[a]	74[a]	
	50-59	59[a]	116[a]	66[a]	
	60-65	24[a]	69[a]	37[a]	
	66-75	32[a]	95[a]	40[a]	
Highest obtained degree	No education/primary school	8[a]	22[a]	9[a]	0.007
	Secondary school	103[a]	315[a]	179[a]	
	Bachelor	73[a]	122[b]	98[a,b]	
	Master	54[a]	153[a]	93[a]	
	PhD	4[a,b]	3[a]	10[b]	
Monthly income (n=1090)	Low	72[a]	192[a]	97[a]	0.023
	Average	101[a]	262[a]	159[a]	
	High	38[a,b]	86[b]	83[a]	
BMI (n=1177)	Underweight	11	26	18	0.089
	Normal weight	115	278	217	
	Overweight	110	189	101	
	Obese	30	85	37	

Clusters are mentioned in an abbreviated form, NL, NU: Not liking and not using the Nutri-Score label; L, NU: Liking but not using the Nutri-Score label; L, U: Liking and already using the Nutri-Score label; The superscripts [a,b,c] indicate significantly different proportion across the three clusters (across rows) at the 0.05-level in ascending order.

4.7.1 Characteristics of the clusters

Other characteristics of the clusters are shown in Table 24 and Table 25. Regarding important factors during food shopping, only for 'Convenience', there was no significant difference between the clusters. In addition, the importance of the factors 'Health', 'Natural content', 'Presence of a nutrition or health claim' and 'Presence of a FOP label' increased significantly when looking from the cluster with consumers who do not like nor use the label, like but not use it and like and use it (i.e. from left to right in Table 24).

The importance of the factor 'Sensory appeal' was only significant between the first two clusters and the third cluster while for the factor 'Price', the difference between the first cluster (i.e. consumers who do not like nor use it) and the other two (i.e. consumers who like the Nutri-Score label) was significant.

Next, trust in food information sources increased going from the clusters NL, NU to L, NU to L, U (i.e. from left to right in Table 24). Also, intentions to use the Nutri-Score label increased in the same direction. These are logical results as consumers who did not like nor used the label are less eager to use the label compared to those who already liked and used it. The same trend was also observed for objective knowledge, perceived credibility, and perceived usefulness of the Nutri-Score label as these are highest for consumers who like the Nutri-Score label compared to those who do not like it.

Attitudes towards the Nutri-Score label differed the most between consumers who liked the Nutri-Score label (cluster 1) and those who did not like it (clusters 2 and 3). The last examined characteristic is subjective healthiness of their diet. Results showed that consumers who liked and used the Nutri-Score label thought that their diets were healthier compared to those who did not use it.

Table 24: Characteristics of the 3 clusters formed based on their liking and current use of the Nutri-Score label

Characteristics		Clusters (number of consumers)			P
		NL, NU (242)	L, NU (615)	L, U (389)	
Importance of factors during food shopping	Health	$3.06^{a} \pm 1.18$	$3.59^{b} \pm 0.92$	$3.90^{c} \pm 0.88$	< 0.001
	Sensory appeal	$3.52^{a} \pm 1.09$	$3.54^{a} \pm 0.91$	$3.76^{b} \pm 0.84$	0.001
	Natural content	$3.16^{a} \pm 1.28$	$3.54^{b} \pm 0.95$	$3.89^{c} \pm 0.88$	< 0.001
	Convenience	3.11 ± 1.13	3.25 ± 0.94	3.33 ± 1.01	0.067
	Price	$3.84^{b} \pm 1.00$	$3.69^{a} \pm 0.90$	$3.72^{a} \pm 0.89$	0.021
	Presence of nutrition or health claim	$2.07^{a} \pm 1.06$	$2.91^{b} \pm 1.04$	$3.28^{c} \pm 1.12$	< 0.001
	Presence of FOP label	$1.95^{a} \pm 1.02$	$2.98^{b} \pm 1.00$	$3.69^{c} \pm 0.93$	< 0.001
Trustworthiness of food information sources	Food manufacturer	$2.61^{a} \pm 1.03$	$2.97^{b} \pm 0.89$	$3.19^{c} \pm 1.03$	< 0.001
	Retailer/supermarket	$2.55^{a} \pm 0.90$	$2.86^{b} \pm 0.80$	$3.01^{c} \pm 1.00$	< 0.001
	Scientist	$3.05^{a} \pm 1.03$	$3.39^{b} \pm 0.87$	$3.61^{c} \pm 0.93$	< 0.001
	Food safety authority	$3.10^{a} \pm 1.10$	$3.39^{b} \pm 0.89$	$3.68^{c} \pm 0.92$	< 0.001
	Consumer organisation	$3.07^{a} \pm 1.07$	$3.40^{b} \pm 0.92$	$3.64^{c} \pm 0.91$	< 0.001
	Government	$2.28^{a} \pm 1.10$	$2.70^{b} \pm 0.98$	$3.02^{c} \pm 1.08$	< 0.001
	Blogger/influencer	$1.69^{a} \pm 0.85$	$2.22^{b} \pm 0.98$	$2.45^{c} \pm 1.20$	< 0.001
	Celebrity chef	$2.51^{a} \pm 1.00$	$2.97^{b} \pm 0.92$	$3.15^{c} \pm 1.05$	< 0.001

Clusters are mentioned in an abbreviated form, NL, NU: Not liking and not using the Nutri-Score label; L,NU: Liking but not using the Nutri-Score label; L, U: Liking and already using the Nutri-Score label; The superscripts ^{a,b,c} indicate significantly different proportion across the three clusters (across rows) at the 0.05-level in ascending order.

Table 24: Characteristics of the 3 clusters formed based on their liking and current use of the Nutri-Score label (continued)

Characteristics		Clusters (number of consumers)			P
		NL, NU (242)	L, NU (615)	L, U (389)	
Intention to use the Nutri-Score label		$1.91^{a} \pm 0.82$	$3.38^{b} \pm 0.66$	$3.98^{c} \pm 0.60$	< 0.001
Objective knowledge		$3.91^{b} \pm 2.62$	$3.64^{a} \pm 2.52$	$4.75^{c} \pm 1.97$	< 0.001
Credibility		$2.38^{a} \pm 0.91$	$3.52^{b} \pm 0.61$	$3.90^{c} \pm 0.62$	< 0.001
Usefulness		$2.42^{a} \pm 0.90$	$3.52^{b} \pm 0.55$	$3.86^{c} \pm 0.60$	< 0.001
Attitude towards the Nutri-Score label	Voluntary Nutri-Score labelling implementation is sufficient. (n=1117)	$2.89^{a} \pm 1.16$	$3.05^{a} \pm 1.07$	$3.23^{b} \pm 1.20$	0.004
	A Nutri-Score label on all food products in the EU should be mandatory. (n= 1169)	$2.70^{a} \pm 1.29$	$3.99^{b} \pm 0.89$	$4.41^{c} \pm 0.82$	< 0.001
	A Nutri-Score label should appear on all products regardless of their healthiness. (n=1163)	$2.74^{a} \pm 1.30$	$4.01^{b} \pm 0.90$	$4.42^{c} \pm 0.79$	< 0.001
	All food manufacturers and supermarkets should put a Nutri-Score label on their food products. (n=1174)	$2.68^{a} \pm 1.30$	$4.00^{b} \pm 0.87$	$4.44^{c} \pm 0.76$	< 0.001
Subjective knowledge	Nutrition	$3.05^{a} \pm 1.12$	$3.19^{a} \pm 0.88$	$3.65^{b} \pm 0.78$	< 0.001
	Nutri-Score	$2.50^{a} \pm 1.07$	$2.91^{b} \pm 0.90$	$3.71^{c} \pm 0.77$	< 0.001
Subjective healthiness of diet		$3.30^{a} \pm 0.74$	$3.31^{a} \pm 0.66$	$3.43^{b} \pm 0.85$	0.001

Clusters are mentioned in an abbreviated form, NL, NU: Not liking and not using the Nutri-Score label; L,NU: Liking but not using the Nutri-Score label; L, U: Liking and already using the Nutri-Score label; The superscripts a,b,c indicate significantly different proportion across the three clusters (across rows) at the 0.05-level in ascending order.

In Table 25, the wish for additional information about the Nutri-Score label is displayed for the three clusters. From these results can be concluded that 60% of the consumers who did not like nor use the label, did not want extra information because they were not interested. Regarding the other clusters: 43% of the consumers who liked but not used the label wanted to receive additional information and this was also the case for 56% of those who liked and used the Nutri-Score label.

Table 25: Number of consumers who want more information about the Nutri-Score label and consumers who are on a diet given for every cluster

Characteristics		Clusters (number of consumers)			p
		NL, NU (242)	L, NU (615)	L, U (389)	
Extra information	Yes	37^{a}	264^{b}	216^{c}	< 0.001
	No, I know enough	59^{a}	229^{b}	156^{b}	
	No, not interested	146^{c}	122^{b}	17^{a}	

Clusters are mentioned in an abbreviated form, NL, NU: Not liking and not using the Nutri-Score label; L,NU: Liking but not using the Nutri-Score label; L, U: Liking and already using the Nutri-Score label; The superscripts a-c indicate significantly different proportion across the three clusters (across rows) at the 0.05-level in ascending order..

The first cluster (n=242), containing consumers who did not like nor used the Nutri-Score label, is in the first place characterized by the importance they attached to certain factors during food shopping. The factors health, natural content were significantly less important for these consumers where price was significantly more important. Also, in general they thought all food information sources are less trustworthy compared to the other clusters. Furthermore, their intention to use the label in the future was significantly lower compared to the other clusters. Also, their attitudes towards making the Nutri-Score label mandatory in the EU on all products was significantly lower compared to the other clusters. Remarkable, subjective knowledge about nutrition and subjective healthiness of their diet was for this cluster only significantly lower than for the one with consumers who already like and use the label. This may indicate that this cluster was concerned about what they eat and have some knowledge about nutrition. Still, they were not really interested in the Nutri-Score label. This was also made clear by the fact that 60% of them did not want to receive additional information about the Nutri-Score label because they were not interested.

The second cluster (n=615), consisting of consumers who liked the Nutri-Score label but not used it, contains the largest number of consumers (i.e. 49% of the overall sample). Therefore, it is important to find the right recommendations to motivate them to use the label. This cluster is characterised firstly by the fact that their opinion regarding the importance of health, natural content, and presence of a nutritional or health claim or a FOP label opinions during food shopping lied between those of the other clusters. Remarkable, they were significantly less concerned with the price of food products compared to the other clusters. Also, trust in food information sources lied between the other clusters. The same goes for perceived credibility and attitudes towards the Nutri-Score label. Last and most remarkable, their objective knowledge of the Nutri-Score label is significantly lower compared to the other clusters. Nevertheless, 46% of these consumers would like to receive more information. From them, 70% wants to know how the Nutri-Score is determined.

Last, the third cluster (n=389) consists of consumers that already liked and used the Nutri-Score label. Therefore, it will be the easiest to encourage them to keep using the Nutri-Score label. In addition, their intention to use the label in the future is the highest compared to the other clusters. Furthermore, this cluster was characterised by the fact that they considered all factors mentioned in the survey, except price, to be significantly more important during food shopping compared to the other clusters. In addition, their objective knowledge of the label was also significantly higher, as is perceived credibility, perceived usefulness, attitudes towards the Nutri-Score label, subjective knowledge of nutrition and subjective healthiness of their diet. Last, 56% of this cluster indicated that they would like extra information about the label. Of them, 27% would like more information about how the Nutri-Score is determined, 26% would like to how the Nutri-Score is calculated and 14% would like to know what the purpose of the Nutri-Score is.

5 DISCUSSION

This study aimed to get a better view on current reactions of Belgian and French consumers towards the Nutri-Score label and the Yuka app determined by variables such as liking, perceived usefulness, perceived credibility, etc. Hereby, differences in reactions of Belgian and French consumers were also taken into account. Also, intentions to use the Nutri-Score label and the Yuka app and influencing factors on these intentions were examined. Based on the found results, recommendations to increase the use of the Nutri-Score label and the Yuka app will be made in Paragraph 5.8.

5.1 Consumers' evaluations compared to those of the Nutri-Score label and the Yuka app

Hypothesis 1 stated that consumers perceive most products healthier than they are independent of the product category. Therefore, it was also suspected that consumers would indicate higher nutrition and overall quality scores compared to the Nutri-Score label and the Yuka app.

Results of this study showed that in general, nutritional, and overall quality of healthier products were evaluated lower by consumers compared to evaluations by the Nutri-Score label and the Yuka app, independent of food categories. The opposite was observed for unhealthier products as consumers' evaluations were more positive compared to those of the Nutri-Score label and the Yuka app independent of food categories for these products. Therefore, hypothesis 1 is partially accepted as this applies for unhealthier products but not for healthier products.

These results could be explained from two perspectives. First, they could indicate a lack of consumers' knowledge of nutritional values of food products. Previous research also showed inaccurate estimations of the calorie content of food products (Lansky & Brownell, 1982; Lichtman et al., 1992; Livingstone & Black, 2003; Tooze et al., 2004) which can be related to the incorrect assessment of the nutritional quality of food products in this study. In addition, Block et al. (2013) concluded that consumers underestimate the nutritional value of food products from fast food restaurants which may support the results from this study for unhealthier products. The second perspective is that the Nutri-Score label and the Yuka app may not correctly evaluate nutritional and overall qualities.

Last, results are contradictory to previous studies suggesting that consumers tend to see food products as healthy or unhealthy (Chernev, 2011; Raghunathan, Naylor, & Hoyer, 2006) where in this study they tend to evaluate the healthiness of products rather neutral. This may be explained by the fact that consumers are unsure about the nutritional quality of food products. This can be because a lot of contradictory information is nowadays distributed regarding healthiness of food products. In addition, additives are also not put in a good light which also can influence consumers' evaluations of food products. This study also showed low objective knowledge of consumers about additives.

5.2 Current consumers' reactions towards the Nutri-Score label

Hypothesis 2 stated that current consumers' reactions toward the Nutri-Score label is neutral for reactions themselves and all the underlying aspects (i.e. liking, perceived usefulness, perceived credibility, attitude, and objective knowledge). The second part of hypothesis 2 claimed that reactions of French consumers regarding the Nutri-Score label is more positive compared to those of Belgian consumers.

Results showed that current consumers' reactions towards the Nutri-Score label are in general neutral to slightly positive. So, the first part of hypothesis 2 can be accepted. Also, reactions of French were significantly more positive compared to those of Belgian consumers. Therefore, the second part of hypothesis 2 is also accepted. However, differences are small. Compared to studies conducted in the Netherlands (Consumentenbond, 2019) and France (Ducrot et al., 2019), our results are less positive. This may be because in this study, reactions were measured based on underlying items where in the other studies consumers' opinions about the label was directly assessed.

Liking of the Nutri-Score label was the first item measuring reactions. It appeared that consumers in general did not like nor dislike the label. The study of Talati et al. (2019) showed that the Nutri-Score label was relatively well liked by consumers and was not significantly different between twelve different nationalities. A possible explanation for these different outcomes is the difference in measurement between both studies as in the study of Talati and al. (2019) liking was measured by the statement 'I like the Nutri-Score label' while in the presents study, it was measured by a combination of four statements.

Next, consumers slightly agreed that the Nutri-Score is usefulness and also, perceived usefulness was higher for French consumers compared to Belgian consumers although the difference was small. A previous study showed lower perceived usefulness for the Nutri-Score label compared to other labels like the MTL and the nutrition facts panel (Hagmann, 2019). This may be because the Nutri-Score label is relatively new, so consumers were less familiar with it and therefore found it less useful. Contradictory, in the study of Crosetto et al. (2019) the Nutri-Score label was perceived the most useful compared to the MTL, RIs and Health Star Rating. These conflicting results may be the result of different interpretations of usefulness.

Following, perceived credibility of the Nutri-Score label was rated slightly positive by both Belgian and French consumers. Also, mean perceived credibility was significantly higher for French than for Belgian consumers. However, the difference was small. A previous study showed lower perceived credibility of the Nutri-Score label compared to the health star rating, the MTL, the RIs, the warning label and the nutrition facts panel (Talati, Egnell, Hercberg, Julia, & Pettigrew, 2019) as well as significant differences between twelve countries. Ducrot et al. (2019) concluded that 75% of French consumers who were familiar with the label have confidence in the information it provides which shows that an increase in familiarity may also lead to an increase in perceived credibility.

Subsequently, mean objective knowledge score of the Nutri-Score label was 4.04 on 10 for the overall sample. Also, mean objective knowledge was significantly higher for Belgian than for French consumers. To our knowledge, this was the first study to examine objective knowledge of the Nutri-Score label. Observed low objective knowledge can possibly be explained by the fact that the Nutri-Score label was introduced only 4 years ago in France and 2 years ago in Belgium. However, when consumers were asked about which aspect of the Nutri-Score label they would like more information, it became clear that they mainly want information about how the Nutri-Score is calculated and which aspects are taken into account in the calculation. This is in accordance with results of the *Consumentenbond* (2019).

Last, consumers' attitudes towards the Nutri-Score label were (slightly) positive. Also, attitudes of French consumers were significantly more positive for the statements 'A Nutri-Score label on all food products in the EU should be mandatory.', 'A Nutri-Score label should appear on all products regardless of their healthiness.' and 'All food manufacturers and supermarkets should put a Nutri-Score label on their food products.' The positive reactions towards making the Nutri-Score label mandatory in the EU is already shown for French consumers by Ducrot and al. (2019) as 87% thought the Nutri-Score label should become mandatory on all food products. To our knowledge, this question was never asked to Belgian consumers. Last, consumers generally agreed that all food manufacturers and retailers should put Nutri-Score labels on their products and that the label should be used independently of the healthiness. These results were expected based on a similar study in the Netherlands (Consumentenbond, 2019).

5.3 Current consumers' reactions towards the Yuka app

Next, hypothesis 3 stated that current consumer's reactions towards the Yuka app are in general rather negative and that those of French are more positive compared to those of Belgian consumers.

Results showed that current reactions of Belgian and French consumers were in generally average to slightly positive. Also, the reactions of French consumers were slightly, but significantly, more positive compared to those of Belgian consumers. Therefore, the first part of hypothesis 4 is rejected while the second part is accepted. Possible reasons for these results are that consumers are in favor of nutritional apps but do not know the Yuka app enough to be largely in favor of this app. Also, the underlying factors, perceived usefulness and perceived credibility were on average slightly positive and significantly higher for French than for Belgian consumers.

To our knowledge, this study is the first to examine current reactions of Belgian and French consumers towards the Yuka app. Consequently, these results can provide a basis for improving Belgian and French consumers' reactions towards the Yuka app which can possibly lead to an increase in its use.

5.4 Familiarity and current use of the Nutri-Score label and the Yuka app

Hypothesis 4 stated that familiarity and current use of the Nutri-Score label is in general average but higher for French than for Belgian participants. Also, familiarity and current use of the Yuka app are low but higher for French than for Belgian participants.

Results showed first that familiarity with the Nutri-Score label was in general high, i.e. 92% of the overall sample had already heard of the Nutri-Score label and was not significantly different between Belgian (92%) and French (91%) consumers. Secondly, current use of the label, i.e. by 56% of the overall sample, was significantly higher for French (60%) than for Belgian (52%) consumers. It has already been demonstrated that French consumers are familiar with the Nutri-Score label by Ducrot et al. (2019) who showed that 81% of the consumers was aware of the Nutri-Score label. As a result, hypothesis 4 can partially be accepted for the part about the Nutri-Score label as familiarity and current use are average to high and that use is significantly higher for French than for Belgian consumers. Nevertheless, familiarity was not significantly different between Belgian and French consumers.

Next, in general, 41% of the overall sample was familiar with the Yuka app and 24% already used the label. Also, differences in familiarity and current use of the Yuka app were significant between Belgian and French consumers. This was shown by the results that familiarity with the Yuka app is significantly higher for French (59%) than for Belgian (23%) consumers. Also, current use of the Yuka app is significantly higher for French (33%) than for Belgian (14%) consumers.

To our knowledge, this is the first large-scale study to determine familiarity and current use of the Yuka app in Belgium and France. Still, *Test Aankoop* conducted an online survey with a small non-scientific sample of Belgian consumers and showed and thereby showed that between 22% and 38% of them used one or more similar apps (Test Aankoop, 2020). Also, especially for French consumers, there is a large gap between familiarity and current use. In the past, it has already been shown that, despite high familiarity, even well-known apps were still not highly used (Doub et al., 2015). Therefore, the part of hypothesis 4 regarding the Yuka app can be accepted as both familiarity and current use were low but significantly higher for French than for Belgian consumers. Still, current use of the app by French consumers was lower than expected.

5.5 Intention to use the Nutri-Score label during food shopping and influencing factors

Hypothesis 5 estimated that intentions to use the Nutri-Score label is in general low but that French consumers are more willing to use it compared to Belgian consumers. Also, expected influencing variables on intentions to use the Nutri-Score label are affective and instrumental attitudes, subjective norms, perceived behavioural control, sociodemographic and personal characteristics (i.e. country, gender, age, income, education, and BMI), familiarity, perceived usefulness, perceived credibility and objective knowledge.

It was shown that 59% of the consumers intent to use the Nutri-Score label during food shopping and that significantly more French (60%) then for Belgian (58%) consumers. Still, difference was small. Therefore, the first part of hypothesis 5 is rejected as overall intention was larger than expected but French consumers still had higher intentions than Belgian ones.

Further, an MLR was conducted based on an adapted version of the TPB and results from EFAs to determine significant influencing variables on the intention to use the Nutri-Score label during food shopping. Results showed that the variables SN, PBC, IA, AA, no education vs. primary school and reactions towards the Nutri-Score label were significantly influencing variables on the intention to use the Nutri-Score label. Therefore, the second part of hypothesis 5 regarding influencing variables on the intention to use the Nutri-Score label is partly rejected as only a few of the suggested variables were significant.

Influences of the variables of the original TPB partly corresponds with the results of Vijaykumar et al. (2013) and Lim et al. (2015). Both studies showed, indirectly, a significant high relative importance of PBC as influencing variable on food label use. This study showed that AA have a higher relative importance compared to PBC while IA has a lower relative importance. In addition, our results also showed that PBC has a higher relative importance compared to SN. Differences between our study and previously mentioned studies may be explained by cultural difference as the studies of Vijaykumar and al. (2013) and Lim and al. (2015) were conducted in Asia and that they were about food labels in general.

In addition, influence of sociodemographic and personal variables on intentions to use the Nutri-Score label were examined. First, no significant of living country were found. Next, also no significant influence of gender was revealed which is contradictory to previous research (Baltas, 2001; Cowburn & Stockley, 2005; Grunert & Wills, 2007). This may be because these studies result from more than 10 years ago. Since then, men are more responsible for household chores.

Next, no significant effect of income was observed which did not correspond with previous research showing that consumers with higher incomes were more likely to report food label use (Grunert & Wills, 2007). Regarding education, only consumers with no education/primary school had a significantly higher intention to use the Nutri-Score label compared to those with a secondary school degree. Education was also the only sociodemographic significant influencing variable of the use of food labels in another study (Song et al., 2015). Other studies showed that consumers with a lower level of education tend to only look at food labels (Bender & Derby, 1992; Drichoutis et al., 2005). Nevertheless, another study showed no significant effect of education on food label use (Nayga Jr, 2000). So, the Nutri-Score label may be a good label as only one look is enough to get an impression of the nutritional quality for consumers with lower education to still get a good idea of the nutritional quality of food products. In addition, other previous studies also concluded that age, gender and education did not significantly influence food label use (Drichoutis et al., 2005; Fitzgerald, Damio, Segura-Pérez, & Pérez-Escamilla, 2008; Grunert, Fernández-Celemín, et al., 2010).

The last sociodemographic influencing variable assessed was BMI. This also not significantly influenced intention to use the label. This is disputed by previous results showing that obese consumers (i.e. with a BMI > 30) were more likely to use food labels compared to consumers with a normal BMI (i.e. between 18.5 and 25) (Satia et al., 2005). Still, another study showed equal results as ours (Drichoutis et al., 2008).

Remarkable is that familiarity did not significant influence intention to use the Nutri-Score label as previous studies showed the that this has a positive influence on the usage of the label (EUFIC, 2012; Moorman, 1990; J. Song et al., 2015). This could be explained by the given that familiarity could increase the perceived validity of information (Park, Mothersbaugh, & Feick, 1994).

Next, reactions towards the Nutri-Score label significantly influenced positively intentions to use the Nutri-Score label during food shopping. This variable was constructed by combining statements measuring liking, perceived usefulness, and perceived credibility. Previous research already showed that higher perceived usefulness, higher perceived credibility, and higher liking could lead to higher use of food labels (Grunert & Wills, 2007; Obayashi et al., 2003). Therefore, results of this study are more or less in line with previous studies which examined the use of food labels.

Last, this study showed that objective knowledge about the Nutri-Score label did not significantly influence the intention to use it. This may be because the Nutri-Score label was only introduced 4 years ago in France and 2 years ago in Belgium. In addition, it is only used on a voluntary basis and not yet present on all food products. However, more and more large companies such as Nestlé, Danone, Hak, and McCain are supporting the idea of the Nutri-Score label and are in the process of implementing the label on their products (BEUC, 2020). Another possible reason is that this study measured conceptual knowledge and no practical understanding of the label in real live food shopping situations.

Previous research showed that consumers have more difficulties with understanding the concept compared to using the label for comparing food products in one category (Grunert, Fernández-Celemín, et al., 2010; Grunert & Wills, 2007; Malam et al., 2009).

5.6 Intention to use the Yuka app during food shopping and influencing factors

Hypothesis 6 stated that intention to use the Yuka app is in general low but that French consumers are more willing to use it compared to Belgian consumers. Also, following factors are suspected to influence the intention to use the Yuka app: affective and instrumental attitudes, subjective norms, perceived behavioural control, sociodemographic and personal characteristics (i.e. country, gender, age, income, education and BMI), familiarity, perceived usefulness, perceived credibility, technology adoption and avoidance of additives.

Results showed that intentions to use the Yuka app during food shopping was significantly higher for French (47%) then for Belgian (40%) consumers. Still, only 44% of all consumers intended to use the Yuka app in the future. Therefore, the first part of hypothesis 6 regarding the Yuka app is accepted as intention was higher than suspected but intention was higher for Belgian than for French consumers.

Further, an MLR, based on an adapted version of the TPB and results from EFAs, was used to determine significant influencing variables on intentions to use the Yuka app during food shopping. Results showed that the variables SN, familiarity, reactions toward the Yuka app, avoidance of additives and food related app use were significant influencing variables. Based on these results, the second part of hypothesis 6 is partly rejected as only a few of the expected variables have a significant influence on intentions to use the Yuka app.

First, sociodemographic variables were added to the framework. Hereby it was assumed that these variables had the same effect on intentions to use the Yuka app as on intentions to use the Nutri-Score label. So, it was expected that young or middle-aged female consumers with a higher degree of education and income are more likely to use nutritional apps in general. Nevertheless, results of this study showed that sociodemographic and personal characteristics did not significantly influence intention to use the Yuka app compared to the baseline group. However, no studies were found on the effect of these variables on the intention to use a food-related app.

Next, familiarity with the Yuka app showed a significant negative effect. This may indicate that when consumers are familiar with the concept behind the Yuka app, they are not convinced that the Yuka app is useful or credible and also have a lower intention to use the app. This is not good news for increasing the use of the Yuka app.

Next, also avoidance of additives, food related app use and reactions toward the Yuka app were added to the framework. Both avoidance of additives and food related app use showed to be significant predictors of the intention to use the Yuka app during food shopping. To our knowledge, this was the first study to determine the influence of these variables on intention to use the Yuka app. It was predicted that when consumers tried to avoid additives and/or have a higher food related app use, they would have a higher intention to use the Yuka app and results confirmed these assumptions. Also, reactions towards the Yuka app was a significant influencing factor on intention to use it. Results showed that when consumers had positive reactions towards the Yuka app, they also had higher intentions to use the Yuka app during food shopping.

Lastly, original variables of the TPB were added to the framework. From all variables (i.e. SN, PBC, AA and IA), only SN was a significant influencing variable. This means that good reactions of others in their environment (e.g. friends and family) could increase consumers' intentions to use the app. As for the Nutri-Score label, it was expected that PBC was higher compared to other variables of the original framework. However, this was not concluded from the results of this study.

5.7 Clusters based on liking and current use of the Nutri-Score label

Hypothesis 7 stated that three clusters could be deduced based on current use and liking of the Nutri-Score label. This hypothesis can be accepted as it was possible to make three clusters: 'Consumers who like and use the Nutri-Score label', 'Consumers who like but do not use the Nutri-Score label' and 'Consumers who do not like nor use the Nutri-Score label'.

Characterisation of these clusters showed that sociodemographic and personal characteristics were not really helpful to make recommendations to increase the use of the Nutri-Score label. Therefore, more interesting were differences between the clusters regarding importance of factors during food shopping, perceived trustworthiness of food information sources, reasons for not liking, thinking the Nutri-Score label is useful or credible and need for extra information about the label. Therefore, based on these characteristics, recommendations can be made to increase the use of the Nutri-Score label (Paragraph 5.8.1).

5.8 Recommendations to increase the use of the Nutri-Score label and the Yuka app

5.8.1 Recommendations to increase the use of the Nutri-Score label

Based on the results discussed in Paragraph 0, 4.5.1, 4.6.1 regarding reactions, familiarity, current use, intentions to use and influencing factors on this intention, general recommendations can be proposed to increase the use of the Nutri-Score label.

The most important reason for not liking the Nutri-Score label or thinking that the label is not credible or useful, was 'The Nutri-Score label is a marketing trick'. However, 49% of the consumers who did not like the Nutri-Score label, 51% of those who did not find the Nutri-Score label credible and 46% of those who did not find the label useful, and indicated 'The Nutri-Score label is a marketing trick', did not know that the Nutri-Score label was not proposed by the food industry or retailers. Therefore, teaching consumers that the Nutri-Score label was developed by scientist may be a possibility to increase liking, perceived usefulness, and perceived credibility of the Nutri-Score label.

This because trustworthiness of food manufacturers and retailers as food information sources is lower compared to the trust in governments and scientists as food information sources.

Education is also a possible reply to the second and third most indicated reasons (i.e. not finding the Nutri-Score label transparent, clear, or meaningful) for more negative consumer reactions towards the Nutri-Score label. First, it should be made clear that calculation-sheets and the method of calculation for the Nutri-Score are available online. Thereby, consumers can calculate Nutri-Scores themselves. Next, focus should be more on the fact that the Nutri-Score label can help to make more informed food choices and in this way live healthier to increase perceived usefulness.

Hereby it is better to promote the label as an instrument to maintain health instead of a measure to prevent illnesses (Lim et al., 2015). This is crucial as most important reasons for not using the Nutri-Score label were that consumers were not interested, did not trust the label, and did not think it was credible.

Following, a campaign focussing on what the Nutri-Score label means and how it should be used is a next option to increase awareness and use of the label during grocery shopping. The study of Ducrot and al. (2019) already showed that a campaign increased awareness and knowledge of the Nutri-Score label in France. In this campaign it is best to emphasize the information that consumers definitely want to know, namely where the Nutri-Scores are based on and how they are calculated.

The next thing that came up for discussion were attitudes of consumers regarding making the Nutri-Score label mandatory on all food products and signing the 'PRO-NUTRISCORE' petition. There were only small differences between attitudes of Belgian and French consumers towards making the Nutri-Score label mandatory in the EU, presence on all products and regardless of products' healthiness. Still, in general, consumers were quite convinced that it should become mandatory. However, only 39% of the overall sample was willing or had already signed the petition to make the Nutri-Score mandatory while 37% was indifferent about signing. Still, it can be recommended to make the Nutri-Score label mandatory for all products to increase its use as 59% of the consumers (strongly) agreed that the Nutri-Score label should appear on all products regardless of their healthiness. In addition, a previous study concluded that the label should appear on all products in order to increase the effectiveness of the label (Hagmann, 2019).

Regarding the last general recommendation, authorization by official institutions like for example governments, in line with making the Nutri-Score label mandatory, can help to improve reactions and following maybe also use of the label. As trust in governments as food information source was in this study lower compared to retailers and food manufacturers. As a result, authorisation by governments does not immediately seem to be the most efficient way to increase use of the Nutri-Score label. A better option would be recommendations by scientists, FSAs, and consumer organisations because confidence in these authorisations as food information sources is generally higher compared to trust in governments, retailers, and food manufacturers as food information sources.

In the following, some specific recommendations are deduced for the three clusters described in Paragraph 4.7.

Consumers who do not like nor use the Nutri-Score label

In order to promote the Nutri-Score label to consumers who do not like nor use the Nutri-Score label yet, it is firstly important to point out all the positive aspects of the label such as that it can help to estimate the nutritional value of food products and can help to determine which product is the healthiest within a food category. Next, price is for them the most important factor during food shopping. Therefore, it should be underlined that food products with a Nutri-Score label are not more expensive than products without a Nutri-Score label. In addition, discount actions based on the Nutri-Score may motivate these consumers. For example, a discount of 20% on products with a Nutri-Score A or B can encourage them to buy healthier products.

Consumers who like but not use the Nutri-Score label

In the first place, the most obvious recommendation would be increasing objective knowledge about the Nutri-Score label to increase its use by consumers who like but not use the label yet. Nevertheless, results of the MLR contradict this as objective knowledge had no significant influence on the intention to use the Nutri-Score label. Still, a positive aspect is that 43% of them indicated that they would like more information about the Nutri-Score label. From them, 50% would like to know how the Nutri-Score is determined, 46% would like to know how the Nutri-Score is calculated and 28% would like to know how to use it. So, when providing information, it is therefore essential to take into account these aspects.

Consumers who like and already use the Nutri-Score label

As the last cluster contains consumers who like and use the Nutri-Score label, few recommendations need to be made to convince this cluster to keep using Nutri-Score label while shopping. A recommendation is to provide additional information about the Nutri-Score label, the same information as for the other clusters. This because 56% of this cluster also indicated that they would like to receive more information about the label.

5.8.2 Recommendations to increase the use of the Yuka app

Recommendations to increase the use of the Yuka app can also be made based on the results discussed in Paragraph 4.4, 4.5.2 and 4.6.2 regarding reactions, familiarity, current use, intentions to use the Yuka app during food shopping and influencing factors on these intentions.

In general, there is room for improvement for both Belgian and French consumers regarding familiarity and use of the Yuka app. Reasons why consumers did not use the app yet were that they did not want to download the app, did not have a smartphone, or did not have enough space on their smartphone were the most important reasons. Therefore, responding on these reasons is rather difficult. However, the most important reason for not using the apps, 'I find it too time-consuming', can be addressed by pointing out that the app is easy to use, and usage does not take much time. Following, the MLR examining possibly significant influencing factors on intention to use the Yuka app, showed that significant influencing variables on the intention to use the Yuka app were familiarity, subjective norms, reactions towards the app, avoidance of additives and food related app use. The first most logical thing to do would be to be to raise awareness of the Yuka app, especially amongst Belgian consumers. However, results of the MLR showed that an increase in familiarity resulted in a decrease of intention to use the app. Therefore, it is important to distribute correct information so that consumers form a good reactions towards the app from the beginning.

However, at the moment the Yuka app is mostly put in a negative light in the media (Vanlommel, 2019; Verweire, 2019). A campaign by the company behind the Yuka app or consumer organizations would therefore be good to increase consumers' reactions towards the Yuka app.

Also, an option to further increase familiarity would be to place the Nutri-Score label on more products and that applications which display the Nutri-Score label can help. Therefore, as the Yuka score is already based on the calculation of the Nutri-Score label, it could be interesting to also show the label in the app.

Next, reactions towards the Yuka app were neutral to slightly positive. Subsequently the underlying variables of the reactions towards the Yuka app, perceived usefulness and perceived credibility, the overall opinion was also neutral. The same was true for time consumption: consumers generally thought that the use of the Yuka app takes too much time. Therefore, it may be possible to increase use of the Yuka app by making clear that the Yuka app is credible and useful and that it does not take that much time to use the app. This information can be spread by means of a campaign established by the company behind the Yuka app. This campaign should emphasize in the first place ease to use the app. This can be done through slogans such as 'By simply scanning the barcode of a food product, you get important nutrition information about the food product'.

Lastly, to increase perceived credibility, it can be pointed out that the Yuka app was developed by an independent company. As the trust in consumer organisations and FSAs as food information sources is higher compared to trust in food manufacturers or retailers. Therefore, support from national consumer organisations and FSAs and corresponding promotion could help to increase its use. Unfortunately, for example, *Test Aankoop*, is not entirely confident in the Yuka app (Test Aankoop, 2020). Because of this, consumer organisations first need to be convinced of the usefulness of the Yuka app before they can start promoting the app themselves.

5.9 Limitations of the study

Despite best efforts to carry out this study in the best possible way, it is nevertheless necessary to point out some limitations. First, there were some limitations in the methodology of the survey. A sampling method by quotas may not reach the most vulnerable consumers of the population which can possibly lead to significant differences in the observed results compared to when random sampling methods are used (Guignard, Wilquin, Richard, & Beck, 2013). Next, sampling was done from an online access panel. Therefore, selection and coverage bias may be created as consumers should have access to internet (Bigot, Croutte, & Recours, 2010). These limitations may lead to a sample which is not completely representative for the Belgian and French population.

When processing the results, some limitations of the design of the survey were noticed. First, specific food products that might have been unknown to consumers were used for the product evaluation question. The use of other food products might have yielded better results. Next, there was not asked about the objective knowledge of nutrition as several studies concluded that knowledge about nutrition can positively influence the use of food labels (Drichoutis et al., 2005; Grunert, Fernández-Celemín, et al., 2010; Misra, 2007; Petrovici et al., 2012).

6 CONCLUSION

In this study, current reactions of consumers towards the Nutri-Score label and the Yuka app were determined. Results showed that both Belgian and French consumers are rather positive about the Nutri-Score label but that the Yuka app is in general less appreciated by consumers. In addition, Belgian consumers were less positive about both tools compared to French consumers.

Following, familiarity with the Nutri-Score label was in general relatively high as 92% of the consumers knew the label. Still, only 56% of the overall sample already used the Nutri-Score label. Regarding the Yuka app, results showed that 41% of the overall sample was familiar with the Yuka app and 24% already used the app. So, familiarity and current use of the Yuka app were rather low.

Next, intention to use the Nutri-Score label showed to be positive as 59% of the overall sample intended to use the label during food shopping. For the Yuka app, results were less positive as only 44% had the intention to use the Yuka app during food shopping. Also, intention to use both tools was higher for French (47%) than for Belgian (40%) consumers. Following, significant influencing variables on the intention to use the Nutri-Score label were subjective norms, perceived behavioural control, instrumental attitudes, affective attitudes, no education vs. primary school and reactions towards the Nutri-Score label. Significant influencing variables on the intention to use the Yuka app were subjective norms, familiarity with the app, reactions towards the Yuka app, avoidance of additives and food related app use.

First, based on our results, the Nutri-Score label can serve as a favoured tool to make more informed food choices. Following it may promote better overall health of Belgian and French consumers. This because Nutri-Score label is known by a large amount of Belgian and French consumers, reactions towards the label are quite positive and a large part intent to use the Nutri-Score label during food shopping. These results contribute to the fact that the Nutri-Score label can serve as a single mandatory FOP label in the EU. Also, the results can help policy makers to properly promote the Nutri-Score label to consumers.

Secondly, the Yuka app may be useful to complement the Nutri-Score label in helping consumers' understand nutritional and overall quality of food products and therefore help to make more informed food choices. However, current reactions and intentions to use the app are quite low. As a result, specific policies should be implemented to make sure consumers' reactions towards the Yuka app improve and in this way improve its use.

To conclude, the Nutri-Score label and in extension the Yuka app may be good tools to help consumers make more informed food choices and improve their diets. Possible recommendations to increase their use may be to educate consumers that it are not marketing tools from food manufacturers to increase their sales. In addition, giving more information about how the Nutri-Score and the overall quality score by the Yuka app are calculated, would be appreciated by consumers and may increase their use.

6.1 Possibilities for further research

Since previous work has shown that objective knowledge of FOP labels can vary widely between European countries (Grunert, Fernández-Celemín, et al., 2010), it may be useful to distribute similar surveys in other European countries. Also, carrying out this study in other European countries could help to determine whether consumers would like the Nutri-Score label to become mandatory on all products within the EU.

For the MLRs, the baseline categories chosen were those with the largest number of consumers. However, other baseline categories may give rise to significant differences in intention to use the Nutri-Score label between groups with a different age, income, education, or BMI. Therefore, it can be interesting to perform MLRs with other baseline categories.

Also, several studies found that subjective knowledge about a food label could influence the use of the label positively. They further found that subjective knowledge had a stronger influence on consumer decision compared to objective knowledge (Hess et al., 2012; Pieniak, Aertsens, & Verbeke, 2010; Raju, Lonial, & Glynn Mangold, 1995). Therefore, it could be interesting to include the variable 'subjective knowledge of the Nutri-Score label' in the MLR to see whether this is a significant influencing variable on the intention to use the Nutri-Score label during food shopping. The same goes for subjective knowledge of nutrition as this is already been determined as a positive influencing variable on label use (Liu, Hoefkens, & Verbeke, 2015).

Last, this study has examined some aspects of the Yuka app. However, there is still sufficient room for further research on nutritional apps. Further, this study did not ask for liking of the Yuka app, reasons why consumers did not think it was useful or credible. However, this information could provide useful information to improve current consumers reactions and use of the Yuka app. Finally, it may be useful to research whether consumers would like additional information and, if so, about which aspect of the Yuka app.

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8 APPENDICES

A. SURVEY

NUTRI-SCORE - Hélène Van der Stricht

Start of Block: Language selection

Q1 Choose your language.

- ○ I speak Dutch
- ○ I speak French

End of Block: Language selection

Start of Block: Informed consent form

ICF1 TITLE OF THE STUDY: Consumers' reactions towards food label and smartphone-app

Dear participant,

You are invited to participate in a study. Before you decide to participate in this study, take sufficient time to read this information sheet carefully and discuss this with other people. Please take time to ask questions if there are any uncertainties or if you require additional information. This process is called "informed consent". Once you have decided to participate in the study, you will be asked to sign the consent form at the end of this information sheet.

1 DESCRIPTION AND PURPOSE OF THE STUDY

The Department of Agricultural Economics, Ghent University conducts an investigation to study consumers' reactions towards nutrition label Nutri-Score and smartphone-app Yuka. We kindly ask you if you would like to take the time to complete a questionnaire for us. This will take approximately 30 minutes of your time.

This study was evaluated by the Ethics Committee of Ghent University hospital which will grant the ethics approval. The study is conducted in accordance with the guidelines of good clinical practice (ICH/GCP) and the Helsinki Declaration, written to protect those involved in the studies. This collection of data is carried out under the supervision of Prof. Wim Verbeke and Dr. Christine Yung Hung.

2 CONSENT AND REFUSAL

Your participation in this study is entirely free and voluntary. You can refuse to complete the questionnaires and you are free to withdraw from this study at any time, without having to justify your decision.

3 ADVANTAGES

Participation in this study will probably not bring you any benefits. However, the results obtained can lead to development of nutrition information schemes that potentially improve consumer food choice.

4 COSTS

Your participation in this study does not entail any additional costs for you.

5 CONFIDENTIALITY

In accordance with the General Data Protection Regulation (or GDPR) (EU) 2016/679 on the protection of personal data (GDPR of April 27, 2016), your privacy will be respected. If you consent to participate in this study, we will process your data in accordance with the purpose of the study. This processing of data is provided by law on the basis of Article 6, § 1, (b), (e) or (f) and Article 9, § 2 (j) of the General Data Protection Regulation.

All information collected during this study will be pseudonymized, here your data can still be linked to your personal file. In case of pseudonymization the key to the code assigned to you will only be accessible to the investigators or to the appointed replacement. In this study, data are collected via an electronic questionnaire.

Only pseudonymized data will be used for analysis and in any type of documentation, reports or publications concerning this study. Both personal data and data concerning your health will be processed and stored for at least 20 years. The controller of the data is the principal investigator of the study, Prof. Wim Verbeke (Wim.Verbeke@UGent.be). His research team will gain access to your personal file.

In the context of data protection, your pseudonymized data may become publicly available after the study, therefore any interested parties can have access to, process, and/or further analyse your pseudonymized data.

If you wish, the Data Protection Officer can provide you with more information about the protection of your personal data. Please contact privacy@ugent.be.

Representatives of the promoter, auditors, the Medical Ethics Committee and the competent authorities, all bound by professional secrecy, can have direct access to your data under the responsibility of the investigator (or one of his/her collaborators) in order to check the study procedures and/or the data, without violating its confidentiality. This is only possible within the limits of the relevant laws. By signing this consent form and having received the preliminary explanations, you consent to this access. You have the right to submit a complaint about how your data is processed to the Data Protection Authority:

Data Protection Authority (DPA)
Rue de la Presse 35 – 1000 Brussels
Tel: +32 2 274 48 00
E-mail: contact@apd-gba.be
Website: www.dataprotectionauthority.be

I have read and understood the “Information sheet for the participants”. I have been informed of the nature of the study, its purpose, its duration and what is expected of me.

- ○ Yes
- ○ No

ICF2 I agree to participate in the study.

- ○ Yes
- ○ No

ICF3 I understand that participation in the study is voluntary and that I can withdraw from the study at any time without giving a reason for this decision and without this having any influence on my further treatment.

- ○ Yes
- ○ No

ICF4 I am aware that this study has been approved by an independent Medical Ethics Committee at UZ Gent and Ghent University and that this study will be conducted according to the guidelines for good clinical practice (ICH/GCP) and the declaration of Helsinki, designed to protect people participating in experiments. This approval should under no circumstances be taken as an incentive to participate in this study.

- ○ Yes
- ○ No

ICF5 I have been informed that both personal data and data concerning my health are processed and stored for at least 20 years. I agree and am aware that I am entitled to access and correct this information. As this data is processed for scientific purposes, I understand that access to my data may be postponed until after the end of the study. If I want access to my data, I will address the investigator who is responsible for the processing of the data.

- ○ Yes
- ○ No

End of Block: Informed consent form

Start of Block: Screening

Q2 What is your gender?

- Female
- Male

Q3 What is your age?

_____

Q4 In which region do you live?

- Antwerp
- Limburg
- East Flanders
- Flemish Brabant
- West Flanders
- Hainaut
- Liège
- Luxembourg
- Namur
- Walloon Brabant
- Brussels Capital Region

Q5 Which of the following statements describes best the level of your responsibility for food shopping in your household?

- I am responsible for all or most of the food shopping.
- I am responsible for food shopping occasionally.
- I am not responsible for any of the food shopping.

Skip To: End of Survey If Which of the following statements describes best the level of your responsibility for food shoppi... = I am not responsible for any of the food shopping.

End of Block: Screening

Start of Block: Product evaluation Lays - Salted chips

Q6 How would you rate this product on a scale of 1 (very poor) to 5 (excellent)?

Lays - Salted chips

Ingredient list: Potatoes, vegetable oils (sunflower, rapeseed, corn, in varying amounts), salt.

Nutritional value (per 100 g) Energy 2305 kJ / 551 kcal Fat 34 g of which Saturates 4,2 g Carbohydrate 53 g of which Sugars 0,5 g Fibre 4,2 g Protein 6,3 g Salt 1,1 g.

	Very poor				Excellent
	1	2	3	4	5
Nutritional value					
Healthiness					
Quality-price ratio					
Naturalness (presence of additives)					
Taste					

Q7 Please give an overall quality score from 0 (very poor) to 100 (excellent) to this product taking into account only the **nutritional quality** and **presence of additives**.

Lays - Salted chips

Ingredient list: Potatoes, vegetable oils (sunflower, rapeseed, corn, in varying amounts), salt.

Nutritional value (per 100 g) Energy 2305 kJ / 551 kcal Fat 34 g of which Saturates 4,2 g Carbohydrate 53 g of which Sugars 0,5 g Fibre 4,2 g Protein 6,3 g Salt 1,1 g.

	Very poor										Excellent
	0	10	20	30	40	50	60	70	80	90	100
Overall quality score											

End of Block: Product evaluation Lays - Salted chips

Start of Block: Purchasing habits

Q8 Where do you usually purchase food products? Please indicate and rank the store types from 1 (the most frequent) to 3 (less frequent) by dragging and dropping the items into the box.

	Here I do most of my food shopping
Supermarkets/ Hypermarkets	
Market places	
Specialized stores (e.g. baker, butcher, fishmonger)	
Small grocers' stores/corner stores/convenience stores	
Directly from farmers/ Small producers/ Farmers' markets	
Natural food stores/ Zero-waste stores	
Online delivery/ Pick-up service	
Discount stores (e.g. Aldi, Lidl)	
Somewhere else _____	

Q9 In which of the following supermarkets / retailers do you usually purchase food products? Please indicate and rank the store from 1 (the most frequent) to 3 (less frequent) by dragging and dropping the items into the box.

	Here I do most of my food shopping
Carrefour	
Delhaize	
Albert Heijn	
Colruyt	
Bioplanet	
Spar	
Okay	
Match	
Aldi	
Lidl	
Smatch	
Somewhere else _____	

Q10 How important are the following factors when you choose the food that you eat on a typical day?

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Health (e.g. keeps me healthy, is high in fibre, contains a lot of vitamins	○	○	○	○	○
Sensory appeal (e.g. it tastes, smells, looks good, has a pleasant texture)	○	○	○	○	○
Natural content (e.g. contains natural ingredients, no additives, no artificial ingredients)	○	○	○	○	○
Convenience (e.g. takes no time to prepare, is easy to prepare)	○	○	○	○	○
Price (e.g. it is good value for money, is cheap or not expensive)	○	○	○	○	○
Presence of nutrition or health claim (e.g. 'low energy', 'Calcium is needed for the maintenance of normal bones')	○	○	○	○	○
Presence of nutritional front-of-pack label (e.g. Nutri-Score)	○	○	○	○	○

End of Block: Purchasing habits

Start of Block: Use of information on labels

Q11 To what extent do you find the following information sources trustworthy with regard to food safety, nutrition, and health related information about food?

	Not at all trustworthy	Slightly trustworthy	Moderately trustworthy	Very trustworthy	Extremely trustworthy
Food producer	○	○	○	○	○
Retailer /supermarket	○	○	○	○	○
Scientist	○	○	○	○	○
Food safety authority (e.g. FAVV)	○	○	○	○	○
Consumer organization (e.g. Test Aankoop)	○	○	○	○	○
Government	○	○	○	○	○
Blogger/influencer	○	○	○	○	○
Celebrity chef	○	○	○	○	○

End of Block: Use of information on labels

Start of Block: Theory of Planned Behaviour for food ingredient and nutritional information use

Q12 To what extend do you agree with the following statements about using **food information** to determine the healthiness of foods?

Food information refers to food ingredient and nutritional information in this question.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
People who are important to me (e.g. family and friends) think that I should use food information to determine the healthiness of foods.	○	○	○	○	○
People who are important to me use food information to determine the healthiness of foods.	○	○	○	○	○
People who are important to me advise me to use food information to determine the healthiness of foods.	○	○	○	○	○
It is easy to use food information to determine the healthiness of foods.	○	○	○	○	○
I am confident when using food information to determine the healthiness of foods.	○	○	○	○	○
If I would have more time for food shopping, I would use food information to determine the healthiness of foods more accurately.	○	○	○	○	○
I am able to use food information to determine the healthiness of foods.	○	○	○	○	○

Q13 "Using food ingredients and nutrition information to determine the healthiness of foods is…"

	1	2	3	4	5	
Unenjoyable	○	○	○	○	○	Enjoyable
Boring	○	○	○	○	○	Interesting
Stressful	○	○	○	○	○	Easy
Useless	○	○	○	○	○	Useful
Foolish	○	○	○	○	○	Wise
Harmful	○	○	○	○	○	Beneficial

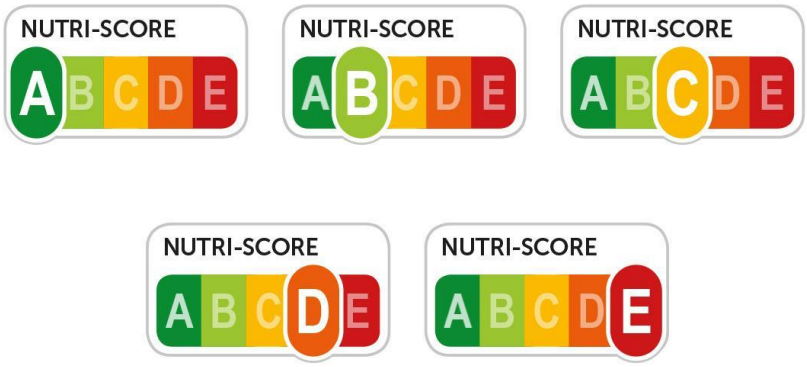
End of Block: Theory of Planned Behaviour for food ingredient and nutritional information use

Start of Block: Introduction Nutri-Score

Q14 Have you heard about Nutri-Score?

- Yes
- No

In Belgium, the government has introduced the Nutri-Score label, which indicates the nutritional value of a food product, using a letter from A to E and a corresponding colour, from dark green to red as in the following pictures.



Q15 Have you heard of or seen the Nutri-Score label before this survey?

- Yes, and I always use the label during food shopping.
- Yes, and I often use the label during food shopping.
- Yes, and I sometimes use the label during food shopping.
- Yes, but I have never used the label during food shopping.
- No, I have never heard of or seen the label.

Display This Question:

If Have you heard of or seen the Nutri-Score label before this survey? = Yes, and I always use the label during food shopping.

Or Have you heard of or seen the Nutri-Score label before this survey? = Yes, and I often use the label during food shopping.

Or Have you heard of or seen the Nutri-Score label before this survey? = Yes, and I sometimes use the label during food shopping.

Q16 Why do you use the Nutri-Score label during food shopping?

- ☐ To get informed about the nutritional value of the products
- ☐ To compare the same type of products of different brands
- ☐ To compare different types of products
- ☐ To avoid unhealthy products
- ☐ To find healthy products
- ☐ To purchase the same type of products with a better Nutri-Score among the different brands
- ☐ To purchase different types of products with a better Nutri-Score
- ☐ Other _____

Display This Question:

If Have you heard of or seen the Nutri-Score label before this survey? = Yes, but I have never used the label during food shopping.

Q17 Why do you not use the Nutri-Score label during food shopping?

- ☐ I do not like the Nutri-Score label.
- ☐ I do not trust the Nutri-Score label.
- ☐ I do not understand the Nutri-Score label.
- ☐ I do not agree with the Nutri-Score.
- ☐ I do not find the Nutri-Score label useful.
- ☐ I am not interested in the nutritional value of food products.
- ☐ Other _____

Display This Question:

If Have you heard of or seen the Nutri-Score label before this survey? != No, I have never heard of or seen the label.

Q18 Where have you heard of or seen the Nutri-Score label?

- ☐ Packaging of food products
- ☐ Advertisement leaflet, poster, or billboard of supermarket
- ☐ Television/radio from food producers
- ☐ Social media from consumer organization
- ☐ Information materials from the government
- ☐ Other _____

Q19 To what extent do you agree with the following statements regarding the Nutri-Score label?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I have the intention to use the Nutri-Score label the next time I go food shopping.	○	○	○	○	○
I will use the Nutri-Score label the next time I go food shopping.	○	○	○	○	○
It is important for me to use the Nutri-Score label the next time I go food shopping.	○	○	○	○	○
I intend to buy alternative food products that have a better Nutri-Score.	○	○	○	○	○
I expect to buy food products of a brand that have a better Nutri-Score even the brand is unfamiliar to me.	○	○	○	○	○
I will buy the food products that have the best Nutri-Score in the same product category.	○	○	○	○	○

End of Block: Introduction Nutri-Score

Start of Block: Perception towards Nutri-Score

Q20 Please indicate whether you believe the following statements are true or false. Mark one answer per question.

	False	True	I do not know
The Nutri-Score label is mandatory on foods in Belgium.	○	○	○
On a Nutri-Score label, dark green with a letter A stands for the best Nutri-Score, red with a letter E stands for the worst Nutri-Score.	○	○	○
A diet coke has a better Nutri-Score than a regular coke.	○	○	○
The content of fibre, fruit and vegetables in the food product partially determines the colour and letter of the Nutri-Score label.	○	○	○
The calorie content alone determines the colour and letter of the Nutri-Score label.	○	○	○
The Nutri-Score label is only a nutritional information label, not an overarching score on food quality.	○	○	○
The higher the content of energy, sugars, saturated fat, sodium of the food products, the better the Nutri-Score.	○	○	○
The Nutri-Score label was proposed by the food industry or retailers.	○	○	○
Nutri-Score labels should not be used to compare food products across different categories.	○	○	○
The Nutri-Score label enables the comparison between food categories such as olive oil and frozen pizza.	○	○	○

Q21 To what extent do you agree with the following statements regarding the Nutri-Score label?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I like the Nutri-Score label.	○	○	○	○	○
I want to see the Nutri-Score label on more food products.	○	○	○	○	○
I would choose food products based on the Nutri-Score label.	○	○	○	○	○
I would choose the product with a Nutri-Score label even at a higher price.	○	○	○	○	○
I think the Nutri-Score label is a trustworthy source of nutritional information.	○	○	○	○	○
The Nutri-Score label gives confidence to choose the product with this label.	○	○	○	○	○
I can trust the Nutri-Score label.	○	○	○	○	○
The Nutri-Score label is useful.	○	○	○	○	○
The Nutri-Score label can help you choose healthier products.	○	○	○	○	○
The Nutri-Score label gives enough information, so I do not need to look at the information on the back of the food package anymore.	○	○	○	○	○
The Nutri-Score label helps understand the nutritional quality of a product.	○	○	○	○	○

Display This Question:

If To what extent do you agree with the following statements regarding the Nutri-Score label? = I like the Nutri-Score label. [Strongly disagree]

Or To what extent do you agree with the following statements regarding the Nutri-Score label? = I like the Nutri-Score label. [Disagree]

And If

To what extent do you agree with the following statements regarding the Nutri-Score label? = I want to see the Nutri-Score label on more food products. [Strongly disagree]

Or To what extent do you agree with the following statements regarding the Nutri-Score label? = I want to see the Nutri-Score label on more food products. [Disagree]

And If

To what extent do you agree with the following statements regarding the Nutri-Score label? = I would choose food products based on the Nutri-Score label. [Strongly disagree]

Or To what extent do you agree with the following statements regarding the Nutri-Score label? = I would choose food products based on the Nutri-Score label. [Disagree]

And If

To what extent do you agree with the following statements regarding the Nutri-Score label? = I would choose the product with a Nutri-Score label even at a higher price. [Strongly disagree]

Or To what extent do you agree with the following statements regarding the Nutri-Score label? = I would choose the product with a Nutri-Score label even at a higher price. [Disagree]

Q20 You have indicated that you disagree somewhat/strongly with the statements regarding liking of the Nutri-Score. What are the reasons you do not like the Nutri-Score label?

- ☐ The Nutri-Score label is not interesting.
- ☐ The meaning of the Nutri-Scores is not clear.
- ☐ It is difficult to understand the Nutri-Scores.
- ☐ The letters on the Nutri-Score label are too small.
- ☐ The look and feel of Nutri-Score label is not appealing.
- ☐ The Nutri-Score label is not trustworthy.
- ☐ The Nutri-Score label system is not transparent.
- ☐ The Nutri-Scores are not correctly in line with the public health guideline.
- ☐ The Nutri-Score label is a marketing trick.
- ☐ Other _____

Display This Question:

If To what extent do you agree with the following statements regarding the Nutri-Score label? = I think the Nutri-Score label is a trustworthy source of nutritional information. [Strongly disagree]

Or To what extent do you agree with the following statements regarding the Nutri-Score label? = I think the Nutri-Score label is a trustworthy source of nutritional information. [Disagree]

And If

To what extent do you agree with the following statements regarding the Nutri-Score label? = The Nutri-Score label gives confidence to choose the product with this label. [Strongly disagree]

Or To what extent do you agree with the following statements regarding the Nutri-Score label? = The Nutri-Score label gives confidence to choose the product with this label. [Disagree]

And If

To what extent do you agree with the following statements regarding the Nutri-Score label? = I can trust the Nutri-Score label. [Strongly disagree]

Or To what extent do you agree with the following statements regarding the Nutri-Score label? = I can trust the Nutri-Score label. [Disagree]

Q21 You have indicated that you disagree somewhat/strongly with the statements regarding credibility of the Nutri-Score. What are the reasons you think the Nutri-Score label is not credible?

- ○ The meaning of Nutri-Scores is not clear.
- ○ It is difficult to understand the Nutri-Scores.
- ○ The letters on the Nutri-Score label are too small.
- ○ The Nutri-Score label system is not transparent.
- ○ The Nutri-Scores are not correctly in line with the public health guideline.
- ○ The Nutri-Score label is a marketing trick.
- ○ Other _____

Display This Question:

If To what extent do you agree with the following statements regarding the Nutri-Score label? = The Nutri-Score label is useful. [Strongly disagree]

Or To what extent do you agree with the following statements regarding the Nutri-Score label? = The Nutri-Score label is useful. [Disagree]

And If

To what extent do you agree with the following statements regarding the Nutri-Score label? = The Nutri-Score label can help you choose healthier products. [Strongly disagree]

Or To what extent do you agree with the following statements regarding the Nutri-Score label? = The Nutri-Score label can help you choose healthier products. [Disagree]

And If

To what extent do you agree with the following statements regarding the Nutri-Score label? = The Nutri-Score label gives enough information, so I do not need to look at the information on the back of the food package anymore. [Strongly disagree]

Or To what extent do you agree with the following statements regarding the Nutri-Score label? = The Nutri-Score label gives enough information, so I do not need to look at the information on the back of the food package anymore. [Disagree]

Q22 You have indicated that you disagree somewhat/strongly with the statements regarding the usefulness of the Nutri-Score. What are the reasons you do not find the Nutri-Score label useful?

- ☐ The meaning of Nutri-Scores is not clear.
- ☐ It is difficult to understand the Nutri-Scores.
- ☐ The letters on the Nutri-Score label are too small.
- ☐ It is time-consuming to use the Nutri-Score label.
- ☐ The Nutri-Scores are not correctly in line with the public health guideline.
- ☐ The Nutri-Scores are not meaningful.
- ☐ The Nutri-Score label is a marketing trick.
- ☐ Other _____

Q23 To what extend do you agree with the following statements regarding the Nutri-Score label?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I do not know/No opinion
Voluntary Nutri-Score labelling implementation is sufficient.	○	○	○	○	○	○
A Nutri-Score label on all food products in the EU should be mandatory.	○	○	○	○	○	○
A Nutri-Score label should appear on all products regardless of their healthiness.	○	○	○	○	○	○
All food manufacturers and supermarkets should put a Nutri-Score label on their food products.	○	○	○	○	○	○

End of Block: Perception towards Nutri-Score

Start of Block: Additional information Nutri-Score

Q24 Would you like to receive more information about the Nutri-Score?

- ○ Yes, I would like to receive more information about the Nutri-Score.
- ○ No, I know enough about the Nutri-Score.
- ○ No, I am not interested in more information about the Nutri-Score.

Display This Question:

If Would you like to receive more information about the Nutri-Score? = Yes, I would like to receive more information about the Nutri-Score.

Q25 About which aspects of the Nutri-Score would you like to receive more information?

- ☐ The goal of the Nutri-Score label
- ☐ How the Nutri-Score is determined (i.e. which nutrients and ingredients)
- ☐ How the Nutri-Score is calculated
- ☐ How to use the Nutri-Score label
- ☐ Where to find the Nutri-Score label on food products
- ☐ Who has developed and endorsed the Nutri-Score label
- ☐ Other _____

Display This Question:

If Would you like to receive more information about the Nutri-Score? = Yes, I would like to receive more information about the Nutri-Score.

Q26 How would you like to receive more information about the Nutri-Score?

- ☐ Labelling on food package
- ☐ Signs/posters in supermarkets
- ☐ Smartphone apps
- ☐ Internet/TV/radio
- ☐ Newspapers/magazines
- ☐ Information provided by food producers
- ☐ Information provided by consumer organizations

End of Block: Additional information Nutri-Score

Start of Block: Nutri-Score petition

Q27 Have you heard about the 'PRO-NUTRISCORE' petition launched by seven national consumer organisations, from the European Consumer Organisation's (BEUC) network of the European Citizens' Initiative, before this survey?

The aim of 'PRO-NUTRISCORE' petition is to ask the European Commission to impose the Nutri-Score label on all food products.

- ○ Yes, and I have already signed the petition.
- ○ Yes, and I will sign the petition.
- ○ Yes, but I will not sign the petition.
- ○ No, but I will sign the petition.
- ○ No, and I will not sign the petition.
- ○ No, I do not know if I will sign the petition.

Display This Question:

If Have you heard about the 'PRO-NUTRISCORE' petition launched by seven national consumer organisati... = Yes, but I will not sign the petition.

Or Have you heard about the 'PRO-NUTRISCORE' petition launched by seven national consumer organisati... = No, and I will not sign the petition.

Q28 You have indicated that you will not sign the petition in the future. What is the reason for this?

- ☐ I do not like the Nutri-Score label.
- ☐ I do not trust the Nutri-Score label.
- ☐ I do not understand the Nutri-Score label.
- ☐ I do not agree with the Nutri-Score
- ☐ I do not find the Nutri-Score label useful.
- ☐ I am not interested in the Nutri-Score label.
- ☐ Other _____

End of Block: Nutri-Score petition

Start of Block: Food additives

Q29 To what extent do you avoid or seek the following ingredients during food shopping?

	I avoid this ingredient	I tend to avoid this ingredient	I neither seek nor avoid this ingredient	I tend to seek this ingredient	I seek this ingredient
Ingredients with E-number	○	○	○	○	○
Artificial additives	○	○	○	○	○
Natural additives	○	○	○	○	○
Plant extracts	○	○	○	○	○
Sweeteners	○	○	○	○	○
Colourings	○	○	○	○	○
Flavourings	○	○	○	○	○
Antioxidants	○	○	○	○	○
Ingredients that are unfamiliar to me	○	○	○	○	○

Q30 Which information source do you use to check if a food product contains ingredients that you want to avoid or seek?

- ☐ Claims on the front of the food package (e.g. 'no artificial flavours', 'no flavour enhancers')
- ☐ List of ingredients
- ☐ Smartphone app
- ☐ Other _____

Q31 Please indicate if the following statements regarding food additive legislation in the European Union are true or false.

	True	False	I do not know
Approved additives are regularly re-tested for their safety.	○	○	○
Additives are only approved if they are safe.	○	○	○
Maximum amounts of additives in foods are legally defined.	○	○	○

End of Block: Food additives

Start of Block: Smartphone use for information about food products

Q32 How often do you use your smartphone for the following activities during food shopping?

	Never	Sometimes	About half the time	Most of the time	Always
I use more than one smartphone app during food shopping.	○	○	○	○	○
I use a smartphone app during food shopping.	○	○	○	○	○
I look actively for the next great food related smartphone app.	○	○	○	○	○
I scan QR codes on food products or advertisements that interest me.	○	○	○	○	○
I research information about products that I am thinking of purchasing during food shopping.	○	○	○	○	○

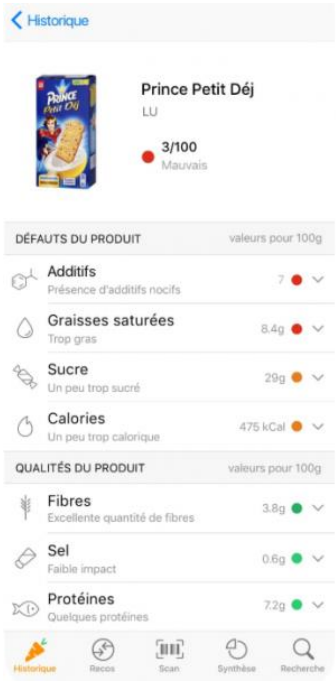
End of Block: Smartphone use for information about food products

Start of Block: Yuka

Also recently introduced in Belgium is the smartphone app Yuka. By scanning the barcode on a food product, the app will provide you with information about the food label on the product.

The quality of a product is represented as a score ranging from 0 (worst quality) to 100 (best quality) accompanied by a coloured dot ranging respectively from red to green. The score is determined based on the nutritional quality, the presence of additives and the organic status.

For example:



If the determined quality of a scanned product is rather poor, Yuka suggests alternatives with a higher score from the same product category. These recommendations are made independently from food producers or retailers.

Q33 Have you heard of the smartphone app Yuka before this survey?

- ○ Yes, and I always use Yuka during food shopping.
- ○ Yes, and I often use Yuka during food shopping.
- ○ Yes, and I sometimes use Yuka during food shopping.
- ○ Yes, but I have never used Yuka during food shopping.
- ○ No, but I would like to download the Yuka app and use it.
- ○ No, I have never heard of Yuka.

Display This Question:

If Have you heard of the smartphone app Yuka before this survey? = Yes, and I always use Yuka during food shopping.

Or Have you heard of the smartphone app Yuka before this survey? = Yes, and I often use Yuka during food shopping.

Or Have you heard of the smartphone app Yuka before this survey? = Yes, and I sometimes use Yuka during food shopping.

Or Have you heard of the smartphone app Yuka before this survey? = No, but I would like to download the Yuka app and use it

Q34 Why do you use Yuka during food shopping?

- ☐ To get informed about the nutritional value of the products
- ☐ To get informed about the presence of additives in the products
- ☐ To compare the same type of products of different brands
- ☐ To compare different types of products
- ☐ To avoid unhealthy products
- ☐ To find healthy products
- ☐ To purchase the products with a better score suggested by Yuka
- ☐ Others _____

Display This Question:

If Have you heard of the smartphone app Yuka before this survey? = Yes, but I have never used Yuka during food shopping.

Q35 Why do you not use Yuka during food shopping?

- ☐ I do not like Yuka.
- ☐ I do not trust Yuka.
- ☐ I do not understand the Yuka score.
- ☐ I do not agree with the Yuka score.
- ☐ I do not find Yuka useful.
- ☐ I find using Yuka time-consuming.
- ☐ I am not interested in the nutritional quality and presence of additives.
- ☐ I am interested but do not want to install the app.
- ☐ Other _____

Q36 To what extent do you agree with the following statements regarding to Yuka?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I have the intention to use Yuka the next time I go food shopping.	○	○	○	○	○
I will use Yuka the next time I go food shopping.	○	○	○	○	○
It is important for me to use Yuka the next time I go food shopping.	○	○	○	○	○
I intend to buy alternatives with a higher score suggested by Yuka.	○	○	○	○	○
I expect to buy food products of a brand that have a better Yuka score even the brand is unfamiliar to me.	○	○	○	○	○
I will choose the food products that have the best Yuka score in the same product category.	○	○	○	○	○

Q37 To what extent do you agree with the following statements regarding to Yuka?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I think Yuka is a trustworthy source of nutritional information.	○	○	○	○	○
Yuka gives confidence to choose the product with a higher score.	○	○	○	○	○
I can trust Yuka.	○	○	○	○	○
I think Yuka is generally trustworthy.	○	○	○	○	○
Yuka is useful.	○	○	○	○	○
Yuka can be helpful in choosing healthier products.	○	○	○	○	○
Yuka gives enough information, so I do not need to refer at the information on the food package.	○	○	○	○	○
Using Yuka is time consuming.	○	○	○	○	○

End of Block: Yuka

Start of Block: Subjective knowledge

Q38 As compared to other people of your age with a similar background, how do you estimate your knowledge about following subjects?

	Very poor	Poor	Average	Good	Excellent
Nutrition	○	○	○	○	○
Nutri-Score	○	○	○	○	○
Smartphone app Yuka	○	○	○	○	○
Food additives	○	○	○	○	○

End of Block: Subjective knowledge

Start of Block: Diet pattern/ Personal health

Q39 In general, how would you rate your diet or food consumption in general?

- ○ Extremely unhealthy
- ○ Unhealthy
- ○ Neither healthy nor unhealthy
- ○ Healthy
- ○ Extremely healthy

Q40 Please indicate any diets that you are currently following.

- [ ] None
- [ ] Healthy eating/balanced diet
- [ ] Low sugar/diabetic diet
- [ ] Cholesterol lowering/heart healthy
- [ ] Weight control
- [ ] Gluten free
- [ ] Low fat
- [ ] Low sugar and low fat
- [ ] Reduced carbohydrates (Low carb)
- [ ] Vegetarian/vegan
- [ ] Other _____

Q41 Do you have any of the following diet-related health conditions? Please indicate all condition(s) that apply.

- [ ] None
- [ ] High cholesterol
- [ ] Diabetes
- [ ] Digestion problems
- [ ] High blood pressure
- [ ] Food allergy (e.g. for milk, eggs, soy)/gluten intolerance
- [ ] Other nutrition related health condition _____

End of Block: Diet pattern/ Personal health

Start of Block: Socio-demographic and personal characteristics

Q42 What is your highest obtained degree?

- ○ No education
- ○ Primary school
- ○ High school
- ○ Professional bachelor
- ○ Academic bachelor
- ○ Master
- ○ PhD

Q43 Which of the following best describes your current employment situation?

- ○ Student/in full time education
- ○ Employed full/part time
- ○ Self-employed
- ○ Unemployed/looking for a job
- ○ Housewife/househusband
- ○ Long-term sick or disabled
- ○ Retired

Q44 Is your (past or current) education or job related to food and/or nutrition?

- ○ Yes
- ○ No

Q45 What is your monthly net household income?

- ○ < 1000 euros
- ○ 1000 - 2000 euros
- ○ 2000 - 3000 euros
- ○ 3000 - 4000 euros
- ○ 4000 - 5000 euros
- ○ > 5000 euros
- ○ Prefer not to answer

Q46 In general, how would you describe the financial situation of your household nowadays?

- ○ Very difficult
- ○ Difficult
- ○ Enough to make a living
- ○ Comfortable
- ○ Very comfortable

Q47 How many persons live in your household (yourself included)? Mark one answer only.

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6 or more

Display This Question:

If How many persons live in your household (yourself included)? Mark one answer only. != 1

Q48 If there are children in your household, how many are in the following age groups? (Indicate “0” if you do not have children).

0-3 years (1)	○ 0 (1)	○ 1 (2)	○ 2 or more (3)
4 -12 years (2)	○ 0 (1)	○ 1 (2)	○ 2 or more (3)
13-17 years (3)	○ 0 (1)	○ 1 (2)	○ 2 or more (3)
18 years or above (4)	○ 0 (1)	○ 1 (2)	○ 2 or more (3)

Q49 What is your height in cm?

_____

Q50 What is your weight in kg?

_____

End of Block: Socio-demographic and personal characteristics

Start of Block: End Block

Thank you for your participation. Please press the next button to complete the survey.

End of Block: End Block

B. ETHICS APPROVAL

Afz.: Commissie voor Medische Ethiek

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Ons kenmerk	Uw kenmerk	datum	pagina
BC-07064	NVT	10/03/2020	1/3

Betreft :

Advies voor monocentrische studie met als titel:

"Reactie van consumenten ten aanzien van het voedingslabel Nutri-Score en de smartphone app Yuka"

B.U.N.: B670202042998

* Antwoord onderzoeker dd 02/03/2020 op opmerkingen EC dd 24/02/2020
* Adviesaanvraagformulier Versie 2 dd 27/2/2020 (Herwerkte versie n.a.v. opmerkingen EC dd 24/02/2020)
* Patiënteninformatie- en toestemmingsformulier Versie 2 dd 27/2/2020 (Herwerkte versie n.a.v. opmerkingen EC dd 24/02/2020) NL, FR
* Vragenlijsten NL, FR

Advies werd gevraagd door: Wim Verbeke

BOVENVERMELDE DOCUMENTEN WERDEN DOOR HET ETHISCH COMITÉ BEOORDEELD. ER WERD EEN POSITIEF ADVIES GEGEVEN OVER DIT PROTOCOL OP 04/03/2020 INDIEN DE STUDIE NIET WORDT OPGESTART VOOR 04/03/2021, VERVALT HET ADVIES EN MOET HET PROJECT TERUG INGEDIEND WORDEN.
Vooraleer het onderzoek te starten dient contact te worden genomen met HIRUZ CTU (09/332 05 00).

THE ABOVE MENTIONED DOCUMENTS HAVE BEEN REVIEWED BY THE ETHICS COMMITTEE.A POSITIVE ADVICE WAS GIVEN FOR THIS PROTOCOL ON 04/03/2020 IN CASE THIS STUDY IS NOT STARTED BY 04/03/2021, THIS ADVICE WILL BE NO LONGER VALID AND THE PROJECT MUST BE RESUBMITTED.
Before initiating the study, please contact HIRUZ CTU (09/332 05 00).

DIT ADVIES WORDT OPGENOMEN IN HET VERSLAG VAN DE VERGADERING VAN HET ETHISCH COMITE VAN 24/03/2020.
THIS ADVICE WILL APPEAR IN THE PROCEEDINGS OF THE MEETING OF THE ETHICS COMMITTEE OF 24/03/2020.

* *Het Ethisch Comité werkt volgens 'ICH Good Clinical Practice' - regels*
* *Het Ethisch Comité beklemtoont dat een gunstig advies niet betekent dat het Comité de verantwoordelijkheid voor het onderzoek op zich neemt. Bovendien dient U er over te waken dat Uw mening als betrokken onderzoeker wordt weergegeven in publicaties, rapporten voor de overheid enz., die het resultaat zijn van dit onderzoek.*
* *In het kader van 'Good Clinical Practice' moet de mogelijkheid bestaan dat het farmaceutisch bedrijf en de autoriteiten inzage krijgen van de originele data. In dit verband dienen de onderzoekers erover te waken dat dit gebeurt zonder schending van de privacy van de proefpersonen.*
* *Het Ethisch Comité benadrukt dat het de promotor is die garant dient te staan voor de conformiteit van de anderstalige informatie- en toestemmingsformulieren met de nederlandstalige documenten.*
* *Geen enkele onderzoeker betrokken bij deze studie is lid van het Ethisch Comité.*

ALGEMENE DIRECTIE
Commissie voor Medische Ethiek

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* *Alle leden van het Ethisch Comité hebben dit project beoordeeld. (De ledenlijst is bijgevoegd)*
* *The Ethics Committee is organized and operates according to the 'ICH Good Clinical Practice' rules.*
* *The Ethics Committee stresses that approval of a study does not mean that the Committee accepts responsibility for it. Moreover, please keep in mind that your opinion as investigator is presented in the publications, reports to the government, etc., that are a result of this research.*
* *In the framework of 'Good Clinical Practice', the pharmaceutical company and the authorities have the right to inspect the original data. The investigators have to assure that the privacy of the subjects is respected.*
* *The Ethics Committee stresses that it is the responsibility of the promotor to guarantee the conformity of the non-dutch informed consent forms with the dutch documents.*
* *None of the investigators involved in this study is a member of the Ethics Committee.*
* *All members of the Ethics Committee have reviewed this project. (The list of the members is enclosed)*

Namens het Ethisch Comité / On behalf of the Ethics Committee

Prof. dr. P. Deron
Voorzitter / Chairman

CC: UZ Gent – HIRUZ CTU
FAGG - Research & Development; Victor Hortaplein 40, postbus 40 1060 Brussel

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	Dr. K. DE GROOTE (UZG – kindercardioloog, ♀)
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C. QUOTAS

Table C1: Original quotas from Kantar for Belgian (n=600) and French (n=600) consumers

BELGIUM

	% population	Number of participants
Gender		
Male	50	300
Female	50	300
Age categories		
18-29	20	120
30-39	18	108
40-49	19	114
50-59	20	120
66-65	10	60
66-75	13	78
Region		
Brussels-Capital Region	11	66
Antwerp	16	96
Limburg	8	48
East Flanders	13	78
Flemish Brabant	10	60
West Flanders	11	66
Walloon Brabant	3	18
Hainaut	12	72
Liège	10	60
Luxembourg	2	12
Namur	4	24

FRANCE

	% population	Number of participants
Gender		
Male	50	300
Female	50	300
Age categories		
18-29	20	120
30-39	17	102
40-49	20	120
50-59	19	114
66-65	10	60
66-75	14	84
Region		
Aquitanien	6	33
Auvergne	3	15
Basse-Normandie	3	15
Bretagne	6	33
Burgund	4	21
Centre	5	27
Champagne-Ardenne	3	15
Elsass	4	21
Franche-Comté	3	15
Französische Süd- und Antarktisgebiete	1	3
Französisch-Guayana	1	3
Guadeloupe	2	9
Haute-Normandie	4	21
Île-de-France	19	111
Korsika	1	3
Languedoc-Roussillon	5	27
Limousin	2	9
Lothringen	5	27
Martinique	2	9
Mayotte	1	3
Midi-Pyrénées	5	27
Nord-Pas-de-Calais	7	39
Pays de la Loire	6	33
Picardie	4	21
Poitou-Charentes	4	21
Provence-Alpes-Côte d'Azur	9	51
Réunion	2	9
Rhône-Alpes	11	63

Table C2: Adapted quotas for Belgian (n=660) and French (n=660) consumers

BELGIUM

	% population	Number of participants
Gender		
Male	50	330
Female	50	330
Age categories		
18-29	21	139
30-39	19	125
40-49	20	132
50-59	21	139
66-65	11	73
66-75	14	92
Region		
Brussels-Capital Region	12	79
Antwerp	17	112
Limburg	9	59
East Flanders	14	92
Flemish Brabant	11	73
West Flanders	12	79
Walloon Brabant	4	26
Hainaut	13	86
Liège	11	73
Luxembourg	3	20
Namur	5	33

FRANCE

	% population	Number of participants
Gender		
Male	50	330
Female	50	330
Age categories		
18-29	21	139
30-39	18	119
40-49	21	139
50-59	20	132
66-65	11	73
66-75	15	99
Region		
Aquitanien	5	33
Auvergne	2	13
Basse-Normandie	2	13
Bretagne	5	33
Burgund	3	20
Centre	4	26
Champagne-Ardenne	2	13
Elsass	3	20
Franche-Comté	2	13
Französische Süd- und Antarktisgebiete	0	0
Französisch-Guayana	0	0
Guadeloupe	1	7
Haute-Normandie	3	20
Île-de-France	18	119
Korsika	0	0
Languedoc-Roussillon	4	26
Limousin	1	7
Lothringen	4	26
Martinique	1	7
Mayotte	0	0
Midi-Pyrénées	4	26
Nord-Pas-de-Calais	6	40
Pays de la Loire	5	33
Picardie	3	20
Poitou-Charentes	3	20
Provence-Alpes-Côte d'Azur	8	53
Réunion	1	7
Rhône-Alpes	10	66

D. PRODUCTS USED IN THE SURVEY

Danone Natuur

Nutritional value (per 100 g)					
	Official site	**Yuka 1**	**Yuka 2**	**Yuka 3**	
Energy	44 188	44	56	44	kcal kJ
Fats	1				g
Of which saturated	0,6	0,6	0,8	0,6	g
Carbs	5,1				g
Of which sugars	5,1	5,1	6,4	5,1	g
Fibres	0				g
Protein	3,8	3,8	4,8	3,8	g
Salt	0,14	0,14	0,18	0,14	g

Score Yuka		84	84	84	

List of ingrediënts	Skimmed yoghurt (of which 96 % **milk**).

Alpro Dessert moments Almond Vanilla

Nutritional value (per 100 ml)				
	Official site	Yuka	Yuka 2	
Energy	72	72	72	kcal
	305			kJ
Fats	2,1			g
Of which saturated	0,3	0,3	0,3	g
Carbs	10,6			g
Of which sugars	8,1	8,1	8,1	g
Fibres	0,6			g
Protein	2,5	2,5	2,5	g
Salt	0,13	0,13	0,13	g

Score Yuka		48	48
Additives		6	9

List of ingrediënts	water, sugar, dehulled **soya beans** (6%), modified starch, **almond** (1.7%), calcium carbonate, natural vanilla flavour, thickener (carrageenan), acidity regulator (potassium phosphates), flavouring, sea salt, vitamins (B2, B12, D2), colours (curcumin, annatto).

Additives		
Name	**Function**	**Risk**
Carrageenan (E407)	Texturizing agent	moderate
Monopotassium phosphate (E340i)	antioxidant	moderate
Annatto (E160b)	food coloring	limited
Artificial flavor (not specified)	flavor	limited
Curcumin (E100i)	food coloring	No
Riboflavin (E101i)	food coloring	No
Calciumcarbonate (E170) [2]	food coloring	limited
Bleached starch (E1403) [2]	Various	No
Vitamin B2 (E101a) [2]	food coloring	No

[2]Only mentioned by Yuka 2

Alternatives[1]	
Name	**Score Yuka**
Alpro Blackcurrent & pomegranate	94
Alpro More fruit No Added Sugars Mango	90
Alpro More fruit No Added Sugars Cherry	90
Alpro More fruit No Added Sugars Raspberry Apple	90
Sojade Bio Raspberry	85
Alpro coconut	84
Alpro greek style High protein Strawberry	84
Alpro greek style Mango	72
Milbona vegetal Mango coco	60

[1]Only mentioned for Yuka 1

Galbani mozzarella

Nutritional value (per 100 g)				
	Site Delhaize	Yuka	Yuka 2	
Energy	238	236	260	kcal
	989			kJ
Fats	18			g
Of which saturated	13	13	13,2	g
Carbs	2			g
Of which sugars	1	1	1,6	g
Fibres	0			g
Protein	17	17	20	g
Salt	0,7	0,7	0,88	g

Score Yuka		48	39
Additives		1	

List of ingrediënts	Pasteurised whole cow **milk** (EU), salt, rennet, acidity regulator: citric acid.

Additives [1]		
Name	**Function**	**Risk**
Citric acid (E330)	Antioxidant	No

[1]Only mentioned for Yuka 1

Alternatives [1]	
Name	**Score Yuka**
Lovilio Mini Mozzarella light	69
D'Antelli Mozzarella light	66
Linessa Mozzarella light (8,5% MG)	63
Carrefour Bio Mozzarella au lait pasteurisé	58
Carrefour Discount Mozarella	54
Carrefour Mini Mozarella	51
Boni Mini Mozzarella	51

[1]Only mentioned for Yuka 1

La Rustique Camembert

Nutritional value (per 100 g)			
	Site Delhaize	**Yuka**	
Energy	268	268	kcal
	1114		kJ
Fats	20		g
Of which saturated	14	14	g
Carbs	1		g
Of which sugars	<0,5	0,5	g
Fibres	0		g
Protein	21	21	g
Salt	1,6	1,6	g

Score Yuka		34	

No alternatives found by Yuka

List of ingrediënts	Cow **milk**, salt, starter, rennet, mould culture.

Président beurre tendre doux

NUTRI-SCORE

A B C D E

Nutritional value (per 100 g)			
	Official site	**Yuka**	
Energy	745	745	kcal
	3063		kJ
Fats	82		g
Of which saturated	57		g
Carbs	1		g
Of which sugars	1	1	g
Fibres	0		g
Protein	0,7		g
Salt	0,03	0,03	g

Score Yuka		35	

List of ingrediënts	Pasteurized butter (fat content 82 %).

Alternatives	
Name	**Score Yuka**
Vitaquell Bio-Soja	67
Boni Omega 3 Végétal	66
Benecol	60
Bertolli à l'huile d'olive	57
Solo liquid baking butter	51

Garden Gourmet Vegetable burgers

Nutritional value (per 100 g)			
	Carrefour site	**Yuka**	
Energy	181 754	181	kcal kJ
Fats	11		g
Of which saturated	1,2	1,2	g
Carbs	7,6		g
Of which sugars	2	2	g
Protein	9,5	9,5	g
Salt	1,3	1,3	g
Fibres	7	7	g

Score Yuka		90	
Additives		1	

List of ingrediënts	56,5 % vegetables (carrots, maize, peas, onion, **celery**), water, vegetable oils (rapeseed, sunflower), **wheat** protein, potatoes, **powdered egg white** from free-range hens, spices (onion, garlic, black pepper, turmeric), pea fibre, pea starch, maize starch, salt, vinegar, apple puree, garlic powder, dried onion, natural flavour, **soy** protein

Additives		
Name	**Function**	**Risk**
Curcumin (E100i)	Food coloring	No

Saupiquet Tuna

NUTRI-SCORE

A B C D E

Package in Belgium

Package in France

Nutritional value (per 100 g)							
	Delhaize site	Yuka 1	Yuka 2	Yuka 3	Yuka 4	Yuka 5	
Energy	101 423	109	109	97	97	101	kcal kJ
Fats	0,5						g
Of which saturated	0,2	0,5	0,5	0,2	0,2	0,2	g
Carbs	0						g
Of which sugars	0	0	0	0	0	0	g
Fibres	0						g
Protein	24	25	25	23	23	24	g
Salt	1,3	0,5	1,3	1,3	1,3	1,3	g

Score Yuka		90	75	75	75	75

List of ingrediënts	**Tuna***, water, salt. *Skipjack, Katsuwonus pelamis

Herta ham superieur natuur

Additives		
Name	**Function**	**Risk**
Sodium nitrite (E250)	Preservative	High
Artificial flavor [1]	Flavor	Limited
Sodium erythorbate (E316)	Antioxidant	No

[1]Only mentioned by Yuka 1

Alternatives	
Name	**Score Yuka**
Herta Jambon nature superieur	76
Herta Jambon Superieur sans nitrites	69
Aoste jambon cuit	60
Aoste jambon cuit à la broche	57
Colruyt Magistral a l'os	57

Nutritional value (per 100 g)						
	Site Delhaize	**Yuka**	**Yuka 2**	**Yuka 3**	**Yuka 4**	
Energy	105 441	109	105	105	105	kcal kJ
Fats	2,5					g
Of which saturated	1	0,58	1	1	1	g
Carbs	0,5					g
Of which sugars	0,5	0,11	0,5	0,5	0,5	g
Fibres	0					g
Protein	20	21	20	20	20	g
Salt	1,8	1,77	1,77	1,8	1,8	g

Score Yuka		39	39	39	39	
Additives		3	2	2	2	

List of ingrediënts	Pork ham, salt, broth (water, pork rinds, onions, pork bones, carrots, salt, parsley, garlic, cloves, pepper, bay leaf), corn dextrose, natural flavours, antioxidant sodium isoascorbate; preservative sodium nitrite.

Labeyrie smoked salmon Le tradition

Nutritional value (per 100 g)			
	Site carrefour	**Yuka**	
Energy	198	198	kcal
	828		kJ
Fats	12		g
Of which saturated	2,5	2,5	g
Carbs	0,6		g
Of which sugars	0,6	6	g
Fibres	0		g
Protein	22	22	g
Salt	2,9	2,9	g

Score Yuka		34	

No found alternatives by Yuka

List of ingrediënts	Atlantic **salmon** (Salmo salar), salt.

Justin Bridou Le Batôn de berger

Nutritional value (per 100 g)			
	OpenFoodFacts	**Yuka**	
Energy	441	469	kcal
	1847,79		kJ
Fats	33		g
Of which saturated	12	16	g
Carbs	1,6		g
Of which sugars	1,1	2,7	g
Fibres	0		g
Protein	27	25	g
Salt	2	4,12	g

Score Yuka		0	
Additives		2	

No found alternatives by Yuka

List of ingrediënts	Pork, salt, lactose (**milk**), dextrose, spices, herbs, sugar, natural flavours, preservatives : potassium nitrate, sodium nitrite; ferments.

Additives		
Name	**Function**	**Risk**
Potassium nitrate (E252)	Preservative	High
Sodium nitrate (E251)	Preservative	High

Nestlé Fitness nature breakfast cereals

Additives		
Name	**Function**	**Risk**
Mono- and diglycerides of fatty acids (E471)	Texturizing agent	Moderate
Tocopherol-rich extract (E306)	Antioxidant	No
Nicotinic acid (E375)	Antioxidant	No
Vitamine B2 (E101a)	Food coloring	No

Nutritional value (per 100 g)			
	Official site	**Yuka**	
Energy	368 1557	367	kcal kJ
Fats	1,8		g
Of which saturated	0,6	0,5	g
Carbs	74,8		g
Of which sugars	10,8	11	g
Fibers	7,6	7,5	g
Protein	9,4	9,4	g
Salt	0,9	0,95	g

Score Yuka		63	
Additives		4	

List of ingrediënts	Whole grain **wheat** 50.9%, rice 37.3%, sugar, whole grain **oat** flakes 7.1%, invert sugar syrup, **barley** malt extract, calcium carbonate, salt, glucose syrup, molasses, emulsifier: mono- and diglycerides of fatty acids; antioxidant: tocopherol-rich extract; iron, vitamin B3, B5, B6, B2, B9. Can contain **milk**, **peanuts** and **nuts**.

Cracotte Multi-Céréales

Additives		
Name	**Function**	**Risk**
Lecithin (E322)	Antioxidant	No

Nutritional value (per 100 g)			
	Site Delhaize	**Yuka**	
Energy	371	380	kcal
	1553		kJ
Fats	3,4		g
Of which saturated	0,9	1	g
Carbs	71		g
Of which sugars	12	12	g
Fibers	4,6	4,4	g
Protein	11	11	g
Salt	0,74	0,73	g

Score Yuka		84	
Additives		1	

List of ingrediënts	Cereals 90.3% (**wheat** flour 64.3%, whole grain **oat** flour 8.9%, quinoa flour 6.6%, rice flour 5.5%, malted **barley** flour 5.0%), sugar, **wheat** germ, whey powder (from **milk**), palm oil, salt, mineral (iron pyrophosphate), emulsifier (sunflower lecithin).

Lay's Naturel

Alternatives	
Name	**Score Yuka**
Superbon Chips de madrid	75
Lay's oven baked Natural	57
Lay's Sticks naturel salted	57
Everyday salted chips	57
Lay's oven baked chips	57

Nutritional value (per 100 g)					
	Site Delhaize	**Yuka**	**Yuka 2**	**Yuka 3**	
Energy	551	541	541	541	kcal
	2305				kJ
Fats	34				g
Of which saturated	4,2	27	2,7	4,2	g
Carbs	53				g
Of which sugars	0,5	0,5	0,3	0,3	g
Fibers	4,2	4,4	4,4	4,4	g
Protein	6,3	6	6,1	6,1	g
Salt	1,1	1,3	1,3	1,3	g

Score Yuka	33	54	48	

List of ingrediënts	Potatoes, vegetable oils (sunflower, rapeseed, corn, in varying amounts), salt.

Lu Pim's Orange

Nutritional value (per 100 g)				
	Site Colruyt	Yuka	Yuka 2	
Energy	396	400	398	kcal
	1558			kJ
Fats	13			g
Of which saturated	5,8	6,1	5,8	g
Carbs	66			g
Of which sugars	49	49	48	g
Fibers	2,6	2	25	g
Protein	3,3	3,5	3,3	g
Salt	0,44	0,36	0,41	g

Score Yuka		0	5
Additives		10	8

Additives		
Name	**Function**	**Risk**
Disodium pyrophosphate (E450i)	Texturizing agent	High
Artificial flavor	Flavor	Limited
Citric acid (E330)	Antioxidant	No
Ammonium hydrogen carbonate (E503ii)	Anticaking Agent	No
Lecithin (E322i)	Antoxidant	No
Pectin (E440) [1]	Texturizing agent	No
Sodium bicarbonate (E500ii)	Various	No
Xanthanegum (E415)	Texturizing agent	No
Sodium citrate (E331)	Antioxidant	No
Calcium citrate (E333) [1]	Antioxidant	No

[1]Only mentioned by Yuka 1

Alternatives	
Name	**Score Yuka**
Gerlinéa oat	100
Céréal biscuits figues-son	84
Céréal gôuters aux raisins	78
Cora Tartines craquantes four fruits	60
Quaker havermout break	60
Boni Muesli barres	84
Gullon Diet nature sin azucares	72
Gullon galletas de desayuno con ce..	72
Supersec croquants de sésame au miel..	67
WW Chia & lemon biscuits	54

List of ingrediënts	Orange marmalade 41 % [glucose-fructose syrup, sugar, orange pulp 4,5 %, concentrated orange juice 1,4 % (orange juice equivalent 1,4 %), concentrated orange pulp 0,6 % (orange pulp equivalent 2,6 %), gelling agent (pectins), food acid (citric acid), acidity regulators (calcium citrate, sodium citrate), natural orange flavouring, thickener (xanthan gum)], chocolate 24,9 % [sugar, cocoa mass, cocoa butter, vegetable oils (illipe, mango, sal, shea and palm in varying proportions), flavouring, emulsifier (**soy lecithin**), lactose and **milk proteins**], **wheat** flour, sugar, **eggs,** gluctose-fructose syrup, rapeseed oil, raising agents (ammonium hydrogen carbonate, disodium diphosphate, sodium hydrogen carbonate), salt, emulsifier (**soy lecithin**).

Côte d'or L'Original Milk

Nutritional value (per 100 g)			
	Site Carrefour	Yuka	
Energy	527 2201	527	kcal kJ
Fats	29		g
Of which saturated	18	18	g
Carbs	56		g
Of which sugars	55	55	g
Fibers	3.3	3.3	g
Protein	7.8	7.8	g
Salt	0.33	0.3	g

Score Yuka		15
Additives		2

List of ingrediënts	Sugar, cocoa mass, skimmed **milk** powder, cocoa butter, whey powder (of **milk**), **milk** fat, emulsifier (**soy lecithin**), flavourings, cocoa: not less than 33 %.

Additives		
Name	**Function**	**Risk**
Artificial flavor	Flavor	Limited
Lecitihin (E322i)	Antioxidant	No

Alternatives	
Name	**Score Yuka**
Saveurs & Nature Chocolat 100 % cacao Pérou	70
Côte d'Or Bio Noir	58
Ethiquable Chocolat 85 % Madagascar	58
Terra etica Chocolate noir 85 % Madagascar	58
Vivani Chocolat noir biologique	56
Lindt Chocolat noir extra-fin 99 % cacao	55
Ethiquable 80 % Equador	55

Alpro soja original

Additives (according to Yuka 1)		
Name	**Function**	**Risk**
Potassium phoshate (E340) [1,2,3]	Antioxidant	Moderate
Tricalcium phosphate (E341iii) [3]	Antioxidant	Moderate
Artificial flavor [1,2,3]	Flavor	Limited
Calcium carbonate (E170) [1]	Food coloring	Limited
Gellan gum (E418) [2,3]	Texturizing agent	No
Riboflavine (E101i) [3]	Food coloring	No

[1]Mentioned by Yuka 1
[2]Mentioned by Yuka 2
[3]Mentioned by Yuka 3

Nutritional value (per 100 ml)					
	Official site	**Yuka**	**Yuka 2**	**Yuka 3**	
Energy	39	39	39	39	kcal
	163				kJ
Fats	1,8				g
Of which saturated	0,3	0,3	0,3	0,3	g
Carbs	2,5				g
Of which sugars	2,5	2,5	2,5	2,5	g
Fibres	0,5				g
Protein	3	3	3	3	g
Salt	0,09	0,09	0,09	0,1	g

Alternatives [2]	
Name	**Score Yuka**
Boni Boisson au soja nature	100
Nature Bio Boisson au Soja Nature	100
Lima Boisson biologique à base de fèves de soja	100
Lima soya dink calcium	100
Bonneterre Lait de soja sélection nature	100
Alpro Soya light	90
Alpro soya 1-3ans	78
Provamel Organic Drink Chocolate	100
Alpro caffé	72
Provamel Soya chocolate	100

[2]Mentioned by Yuka 2

Score Yuka		49	49	39	
Additives		3	3	5	

No alternatives found by Yuka

List of ingrediënts	**Soya base** (water, peeled **soya beans** (8%)), sugar, acidity regulator (potassium phosphates), calcium carbonate, flavouring, sea salt, stabiliser (gellan gum), vitamins (B2, B12, D2).

Coca-Cola zero

Nutritional value (per 100 ml)				
	site Delhaize	Yuka	Yuka 2	
Energy	0,3	0	3	kcal
	1,4			kJ
Fats	0			g
Of which saturated	0	0	0	g
Carbs	0			g
Of which sugars	0	0	0	g
Fibers	0			g
Protein	0			g
Salt	0,02	0,02	0,05	g

Score Yuka		39	39
Additives		5	5

List of ingrediënts	Sparkling water; colouring agent E150d; food acids E338, E331; sweeteners aspartame, acesulfame K; natural flavourings (plant extracts), including caffeine.

Additives		
Name	**Function**	**Risk**
Acesulfame K (E950)	Sweetener	High
Aspartame (E951)	Sweetener	High
Suphite ammonia caramel (E150d)	Food colouring	High
Phosphoric acid (E338)	Antioxidat	High
Sodium citrates (E331)	Antioxidat	No

Alternatives	
Name	**Score Yuka**
Perrier citron vert	100
Perrier citron	100
Badoit Zest citron	100
Perrier	100
Delhaize Ogeu	100
Perrier saveur citron	100
Kruidvat Eu minérale pétillante	100
Spa touch of pêche	100
Spa eau aromatisée Grapefruit	100
Spa touch of watermelon kiwi	100

Tropicana Orange without pulp

Nutritional value (per 100 ml)					
	Site Delhaize	**Yuka**	**Yuka 2**	**Yuka 3 (brick 1 L)**	
Energy	41	41	41	48	kcal
	172				kJ
Fats	0				g
Of which saturated	0	0	0	0	g
Carbs	9,3				g
Of which sugars	8,4	8,4	8,4	10	g
Fibers	0,6				g
Protein	0,8				g
Salt	0	0	0	0	g

Score Yuka		64	64	55

No alternatives found by Yuka

List of ingrediënts	100% orange juice without pulp

Lipton Ice Tea Original

Nutritional value (per 100 ml)								
	Site Delhaize	Yuka	Yuka 2	Yuka 3	Yuka 4	Yuka 5	Yuka 6	
Energy	20 85	20	20	20	20	20	20	kcal kJ
Fats	0,5							g
Of which saturated	0,1	0,1	0,1	0,1	0	0,1	0,1	g
Carbs	4,7							g
Of which sugars	4,5	4,5	4,5	4,5	4,5	4,5	4,5	g
Fibres	0							g
Protein	0,5							g
Salt	0,11	0,1	0,1	0,11	0,11	0,1	0,11	g

Score Yuka		18	9	33	33	27	39
Additives		5	8	6	6	6	

List of ingrediënts	Carbonated water, sugar, fructose, tea extract (0.3%), food acids (citric acid, malic acid), acidity regulator (trisodium citrate), lemon juice from concentrated juice (0.1%), flavouring, antioxidant (ascorbic acid), sweetener (steviol glycosides).

Additives		
Name	**Function**	**Risk**
Dimethyl dicarbonate (E242) [1]	Preservative	High
Potassium sorbate (E202) [2]	Preservative	Moderate
Artificial flavor	Flavor	Limited
Ascorbic Acid (E300)	Antioxidant	No
Citric Acid (E330)	Antioxidant	No
Trisodium citrate (E331iii)	Antioxidant	No
Malic acid (E296) [3]	Preservative	No
Steviol glycosides (E960) [3]	Sweetener	No

[1]Only mentioned by Yuka 2

[2]Only mentioned by Yuka 1 & 2

[3]Only mentioned by Yuka 4 & 5

Alternatives	
Name	**Score Yuka**
Arizona Half iced tea & Half lemonade	58
Volvic Essentiel bio menthe ...	100
Chaufontaine Fusion Lime ...	100
Chaufontaine Fusion Lemon & Lime	100
Spa Reine subtile raspberry apple	100
Volvic Essentiel Citron ...	79
Volvoc infusion rooibos	65
Volvic infusion matcha	65
Volvic infusion Hibiscus	65

Coca-Cola regular

Additives		
Name	**Function**	**Risk**
Sulphite ammonia caramel (E150d)	Food coloring	High
Phosphoric acid (E338)	Antioxidant	Moderate

Alternatives	
Name	**Score Yuka**
Perrier citron vert	100
Perrier citron	100
Badoit Zest citron	100
Perrier	100
Delhaize Ogeu	100
Perrier saveur citron	100
Kruidvat Eu minérale pétillante	100
Spa touch of pêche	100
Spa eau aromatisée Grapefruit	100
Spa touch of lemon	100

Nutritional value (per 100 ml)					
	Site Delhaize	**Yuka (bottle)**	**Yuka 2 (cans)**	**Yuka 3 (can)**	
Energy	42	42	42	42	kcal
	180				kJ
Fats	0				g
Of which saturated	0	0	0	0	g
Carbs	10,6				g
Of which sugars	10,6	10,6	10,6	10	g
Protein	0				g
Salt	0	0	0	0	g

Score Yuka		0	0	30
Additives		2	2	

List of ingrediënts	Sparkling water; sugar; colouring matter E150d; food acid E338; natural flavourings (plant extracts) including caffeine.

E. EXTRA TABLES AND FIGURES ANALYSES

Table E1: Calculation of the Nutri-Score for solid and liquid food products with the excel-sheet provided by the federal public service of health, food chain safety and environment of Belgium

Product	Brand	Kilocalories (Kcal/100g or 100mL)	Kilojoules (KJ/100g or 100mL)	Sugars (g/100g or 100mL)	Saturated fatty acids (g/100g or 100mL)	Sodium (mg/100g or 100mL)	Salt (g/100g or 100mL)	Proteins (g/100g or 100mL)	Fibres AOAC (g/100g or 100mL)	Fruits, vegetables, pulses, nuts, and rapeseed, walnut and olive oils (%/100g or 100mL)	Score	Nutri-Score	Color
Yoghurt natural	Danone	44	184	5.1	0.6	56	0.14	3.8	0	0	-1	Nutriscore_A	Dark green
Dessert Almond & Vanilla	Alpro	72	301	8.1	0.3	52	0.13	2.5	0.6	0	0	Nutriscore_B	Light green
Vegetable burger	Garden Gourmet	181	757	2	1.2	520	1.3	9.5	7	56.5	-3	Nutriscore_A	Dark green
Canned tuna	Saupiquet	101	423	0	0.2	520	1.3	24	0	0	1	Nutriscore_B	Light green
Cooked ham	Herta	105	439	0.5	1	720	1.8	20	0	0	3	Nutriscore_C	Yellow
Smoked salmon	Labeyrie	198	828	0.6	2.5	1160	2.9	22	0	0	14	Nutriscore_D	Light orange
Dried sausage	Justin Bridou	441	1845	1.1	12	800	2	27	0	0	23	Nutriscore_E	Dark orange
Breakfast cereals	Nestlé	368	1540	10.8	0.6	360	0.9	9.4	7.6	0	-1	Nutriscore_A	Dark green
Cracotte multicereals	LU	371	1552	12	0.9	296	0.74	11	4.6	0	0	Nutriscore_B	Light green
Salted chips	Lay's	551	2305	0.5	4.2	440	1.1	6.3	4.2	70	8	Nutriscore_C	Yellow
Pim's Orange	LU	396	1657	49	5.8	176	0.44	3.3	2.6	4.5	18	Nutriscore_D	Light orange
Milk chocolate	Côte d'Or	527	2205	55	18	132	0.33	7.8	3.3	0	24	Nutriscore_E	Dark orange
Soy drink	Alpro	39	163	2.5	0.3	36	0.09	3	0.5	8	-1	Nutriscore_A	Dark green

Table E2: Calculation of the Nutri-Score for cheeses with the excel-sheet provided by the federal public service of health, food chain safety and environment of Belgium

Product	Brand	Kilocalories (Kcal/100g)	Kilojoules (KJ/100g)	Sugars (g/100g)	Saturated fatty acids (g/100g)	Sodium (mg/100g)	Salt (g/100g)	Proteins (g/100g)	Fibres AOAC (g/100g)	Fruits, vegetables, pulses, nuts, and rapeseed, walnut and olive oils (%/100g)	Score	Nutri-Score	Color
Mozzarella	Galbani	238	996	1	13	280	0.7	17	0	0	10	Nutriscore_C	Yellow
Camembert	La Rustique	268	1121	0.5	14	640	1.6	21	0	0	15	Nutriscore_D	Light orange

Table E3: Calculation of the Nutri-Score for added fats with the excel-sheet provided by the federal public service of health, food chain safety and environment of Belgium.

Product	Brand	Kilocalories (Kcal/100g)	Kilojoules (KJ/100g)	Sugars (g/100g)	Lipids (g/100g)	Saturated fatty acids (g/100g)	Sodium (mg/100g)	Salt (g/100g)	Proteins (g/100g)	Fibres AOAC (g/100g)	Fruits, vegetables, pulses, nuts, and and rapeseed, walnut and olive oils (%/100g)	score	Nutri-Score	color
Soft butter	Président	745	3117	1	82	57	12	0.03	0.7	0	0	19	Nutriscore_E	Dark orange

Table E4: Calculation of the Nutri-Score for beverages with the excel-sheet provided by the federal public service of health, food chain safety and environment of Belgium

Product	Brand	WATER	Kilocalories (Kcal/100g or 100mL)	Kilojoules (KJ/100g or 100mL)	Sugars (g/100g or 100mL)	Saturated fatty acids (g/100g or 100mL)	Sodium (mg/100g or 100mL)	Salt (g/100g or 100mL)	Proteins (g/100g or 100mL)	Fibres AOAC (g/100g or 100mL)	Fruits, vegetables, pulses, nuts and and rapeseed, walnut and olive oils (%/100g or 100mL)	score	Nutri-Score	color
Coke zero	Coca-Cola	NO	0.3	1	0	0	8	0.02	0	0	0	1	Nutriscore_B	Light gree
Orange juice without pulp	Tropicana	NO	41	172	8.4	0	0	0	0.8	0.6	100	2	Nutriscore_C	Yellow
Ice tea	Lipton	NO	20	84	4.5	0.1	44	0.11	0.5	0	0	6	Nutriscore_D	Light orange
Regular coke	Coca-Cola	NO	42	176	10.6	0	0	0	0	0	0	14	Nutriscore_E	Dark orange

Table E5: Correlation between the variables concerning the evaluation of certain food products (n=1246). [a] Correlation is significant on a 0.05-level across rows (2-tailed)

	Nutritional value	Healthiness	Qualtity-price ratio	Naturalness	Taste
Dairy and dairy substitutes					
Danone - Skimmed yoghurt					
Nutritional value	1	0.69[a]	0.64[a]	0.54[a]	0.59[a]
Healthiness	0.69[a]	1	0.58[a]	0.59[a]	0.61[a]
Qualtity-price ratio	0.64[a]	0.58[a]	1	0.52[a]	0.57[a]
Naturalness	0.54[a]	0.59[a]	0.52[a]	1	0.44[a]
Taste	0.59[a]	0.61[a]	0.57[a]	0.44[a]	1
Alpro - Vanilla & Almond Dessert					
Nutritional value	1	0.72[a]	0.60[a]	0.60[a]	0.53[a]
Healthiness	0.72[a]	1	0.49[a]	0.63[a]	0.44[a]
Qualtity-price ratio	0.60[a]	0.49[a]	1	0.57[a]	0.57[a]
Naturalness	0.60[a]	0.63[a]	0.57[a]	1	0.50[a]
Taste	0.53[a]	0.44[a]	0.57[a]	0.50[a]	1
Galbani - Mozzarella					
Nutritional value	1	0.58[a]	0.44[a]	0.52[a]	0.52[a]
Healthiness	0.58[a]	1	0.37[a]	0.56[a]	,401[a]
Qualtity-price ratio	0.44[a]	0.37[a]	1	0.41[a]	0.51[a]
Naturalness	0.52[a]	0.56[a]	0.41[a]	1	0.48[a]
Taste	0.52[a]	0.40[a]	0.51[a]	0.48[a]	1
La rustique - Camembert					
Nutritional value	1	0.71[a]	0.55[a]	0.49[a]	0.51[a]
Healthiness	0.71[a]	1	0.58[a]	0.48[a]	0.52[a]
Qualtity-price ratio	0.55[a]	0.58[a]	1	0.53[a]	0.57[a]
Naturalness	0.49[a]	0.48[a]	0.53[a]	1	0.44[a]
Taste	0.51[a]	0.52[a]	0.57[a]	0.44[a]	1
La Président - Soft butter					
Nutritional value	1	0.67[a]	0.45[a]	0.47[a]	0.43[a]
Healthiness	0.67[a]	1	0.46[a]	0.47[a]	0.38[a]
Qualtity-price ratio	0.45[a]	0.46[a]	1	0.49[a]	0.51[a]
Naturalness	0.47[a]	0.47[a]	0.49[a]	1	0.39[a]
Taste	0.43[a]	0.38[a]	0.51[a]	0.39[a]	1
Meat, Fish & vegetarian products					
Garden gourmet - Vegetable burger					
Nutritional value	1	0.71[a]	0.55[a]	0.68[a]	0.60[a]
Healthiness	0.71[a]	1	0.57[a]	0.73[a]	0.65[a]
Qualtity-price ratio	0.55[a]	0.57[a]	1	0.62[a]	0.68[a]
Naturalness	0.68[a]	0.73[a]	0.62[a]	1	0.63[a]
Taste	0.60[a]	0.65[a]	0.68[a]	0.63[a]	1
Saupiquet - Canned tuna					
Nutritional value	1	0.77[a]	0.58[a]	0.69[a]	0.66[a]
Healthiness	0.77[a]	1	0.56[a]	0.71[a]	0.63[a]
Qualtity-price ratio	0.58[a]	0.56[a]	1	0.51[a]	0.59[a]
Naturalness	0.69[a]	0.71[a]	0.51[a]	1	0.62[a]
Taste	0.66[a]	0.63[a]	0.59[a]	0.62[a]	1

Table E5: Correlation between the variables concerning the evaluation of certain food products. [a] Correlation is significant on a 0.05-level (2-tailed) across rows (continued)

	Nutritional value	Healthiness	Qualtity-price ratio	Naturalness	Taste
Herta - Superieur natuur - Cooked ham					
Nutritional value	1	0.76[a]	0.57[a]	0.68[a]	0.66[a]
Healthiness	0.76[a]	1	0.55[a]	0.74[a]	0.66[a]
Qualtity-price ratio	0.57[a]	0.55[a]	1	0.57[a]	0.58[a]
Naturalness	0.68[a]	0.74[a]	0.57[a]	1	0.62[a]
Taste	0.66[a]	0.66[a]	0.58[a]	0.62[a]	1
Labeyrie - Le Tradition - Smoked salmon					
Nutritional value	1	0.69[a]	0.53[a]	0.65[a]	0.63[a]
Healthiness	0.69[a]	1	0.55[a]	0.63[a]	0.63[a]
Qualtity-price ratio	0.53[a]	0.55[a]	1	0.60[a]	0.52[a]
Naturalness	0.65[a]	0.63[a]	0.60[a]	1	0.63[a]
Taste	0.63[a]	0.63[a]	0.52[a]	0.63[a]	1
Justin Bridou - Le Batôn de Berger - Dried sausage					
Nutritional value	1	0.69[a]	0.53[a]	0.63[a]	0.49[a]
Healthiness	0.69[a]	1	0.57[a]	0.70[a]	0.44[a]
Qualtity-price ratio	0.53[a]	0.57[a]	1	0.57[a]	0.64[a]
Naturalness	0.63[a]	0.70[a]	0.57[a]	1	0.47
Taste	0.49[a]	0.44[a]	0.64[a]	0.47[a]	1
Sweet and salty snacks					
Nestlé - Fitness - Breakfast cereals	1	0.81[a]	0.69[a]	0.72[a]	0.54[a]
Nutritional value	0.81[a]	1	0.72[a]	0.74[a]	0.52[a]
Healthiness	0.69[a]	0.72[a]	1	0.70[a]	0.64[a]
Qualtity-price ratio	0.72[a]	0.74[a]	0.70[a]	1	0.51[a]
Naturalness	0.54[a]	0.52[a]	0.64[a]	0.51[a]	1
Taste					
Lu - Cracotte - Multicereal					
Nutritional value	1	0.72[a]	0.64[a]	0.66[a]	0.53[a]
Healthiness	0.72[a]	1	0.66[a]	0.72[a]	0.49[a]
Qualtity-price ratio	0.64[a]	0.66[a]	1	0.63[a]	0.58[a]
Naturalness	0.66[a]	0.72[a]	0.63[a]	1	0.50[a]
Taste	0.53[a]	0.49[a]	0.58[a]	0.50[a]	1
Lays - Salted chips					
Nutritional value	1	0.71[a]	0.40[a]	0.53[a]	0.26[a]
Healthiness	0.71[a]	1	0.44[a]	0.57[a]	0.24[a]
Qualtity-price ratio	0.40[a]	0.44[a]	1	0.51[a]	0.53[a]
Naturalness	0.53[a]	0.57[a]	0.51[a]	1	0.31[a]
Taste	0.26[a]	0.24[a]	0.53[a]	0.31[a]	1
Lu - Pim's orange					
Nutritional value	1	0.68[a]	0.52[a]	0.68[a]	0.29[a]
Healthiness	0.68[a]	1	0.52[a]	0.73[a]	0.22[a]
Qualtity-price ratio	0.52[a]	0.52[a]	1	0.47[a]	0.47[a]
Naturalness	0.68[a]	0.73[a]	0.47[a]	1	0.28[a]
Taste	0.29[a]	0.22[a]	0.47[a]	0.28[a]	1

Table E5: Correlation between the variables concerning the evaluation of certain food products. a Correlation is significant on a 0.05-level (2-tailed) across rows (continued)

	Nutritional value	Healthiness	Qualtity-price ratio	Naturalness	Taste
Côte d'Or - Milk chocolate					
Nutritional value	1	0.69[a]	0.46[a]	0.63[a]	0.26[a]
Healthiness	0.69[a]	1	0.47[a]	0.66[a]	0.21[a]
Qualtity-price ratio	0.46[a]	0.47[a]	1	0.49[a]	0.51[a]
Naturalness	0.63[a]	0.66[a]	0.49[a]	1	0.35[a]
Taste	0.26[a]	0.21[a]	0.51[a]	0.35[a]	1
Beverages					
Alpro - Soy milk					
Nutritional value	1	0.78[a]	0.57[a]	0.65[a]	0.57[a]
Healthiness	0.78[a]	1	0.65[a]	0.66[a]	0.54[a]
Qualtity-price ratio	0.57[a]	0.65[a]	1	0.59[a]	0.63[a]
Naturalness	0.65[a]	0.66[a]	0.59[a]	1	0.57[a]
Taste	0.57[a]	0.54[a]	0.63[a]	0.57[a]	1
Coca-Cola - Cola zero					
Nutritional value	1	0.72[a]	0.66[a]	0.71[a]	0.43[a]
Healthiness	0.72[a]	1	0.67[a]	0.73[a]	0.52[a]
Qualtity-price ratio	0.66[a]	0.67[a]	1	0.59[a]	0.65[a]
Naturalness	0.71[a]	0.73[a]	0.59[a]	1	0.43[a]
Taste	0.43[a]	0.52[a]	0.65[a]	0.43[a]	1
Tropicana - Orange juice without pulp					
Nutritional value	1	0.78[a]	0.58[a]	0.62[a]	0.61[a]
Healthiness	0.78[a]	1	0.58[a]	0.66[a]	0.61[a]
Qualtity-price ratio	0.58[a]	0.58[a]	1	0.50[a]	0.53[a]
Naturalness	0.62[a]	0.66[a]	0.50[a]	1	0.48[a]
Taste	0.61[a]	0.61[a]	0.53[a]	0.48[a]	1
Lipton - Ice Tea					
Nutritional value	1	0.79[a]	0.67[a]	0.78[a]	0.52[a]
Healthiness	0.79[a]	1	0.70[a]	0.82[a]	0.56[a]
Qualtity-price ratio	0.67[a]	0.70[a]	1	0.70[a]	0.67[a]
Naturalness	0.78[a]	0.82[a]	0.70[a]	1	0.59[a]
Taste	0.52[a]	0.56[a]	0.67[a]	0.59[a]	1
Coca-Cola - Regular coke					
Nutritional value	1	0.70[a]	0.52[a]	0.69[a]	0.40[a]
Healthiness	0.70[a]	1	0.57[a]	0.74[a]	0.41[a]
Qualtity-price ratio	0.52[a]	0.57[a]	1	0.52[a]	0.59[a]
Naturalness	0.69[a]	0.74[a]	0.52[a]	1	0.45[a]
Taste	0.40[a]	0.41[a]	0.59[a]	0.45[a]	1

Table E6: Other reasons given by Belgian and French consumers for not liking the Nutri-Score label, not thinking it is useful and not thinking it is credible. Translated from Dutch and French to English

Other reasons for not liking the Nutri-Score label
Belgian consumers I buy products I prefer regardless of the Nutri-Score label. I buy what I like and do not look whether something is healthy or not. I do not care about that nonsense. I think it is a marketing argument, nothing more... and of course it sells... Kinda like "organic"! The Nutri-Score label is a political need to control our lives. Unnecessary. If you do not know a piece of fruit is healthier than a pack of chips, you can just give it up, I'm afraid... The best Nutri-Score is undoubtedly offered by our farmers: organic, seasonal products. For the rest, I prefer to rely on other labels. There are some anomalies in the calculation of the Nutri-Score for healthy or more harmful products. Yet another invention to knock money out of our pockets ... **French consumers** Another organic-style lobby I am indifferent towards the Nutri-Score label.
Other reasons for not thinking the Nutri-Score label is useful
Belgian consumers I simply do not agree! Industrial product It is a false argument to increase sales... Like the term "organic." Politics **French consumers** It is a profit for rich people. No interest The Nutri-Score label is not present on all products + little is known by consumers about the label and industrials play a game.
Other reasons for not thinking the Nutri-Score label is credible
Belgian consumers it is not specific enough It is only present on industrial products It is a false argument to increase sales like the term "organic". Political decision Proven hoax There are anomalies. **French consumers** Not all products are labelled, and the industrial food producers play a game !! Besides, the communication was not done correctly, because people do not understand the Nutri-Score. I have little confidence in what is presented as governmental and supposedly validated by "scientists"... It is not determined based on whether or not the product is good for your health. No interest

Table E7: Self-given reasons from Belgian (n=19) and French (n=22) consumers for not willing to sign the 'PRO-NUTRSCORE'-petition

Belgian participants	**Frequency**
?	1
/	1
I am against petitions	1
I do not sign petitions	2
I do not know exactly what is in the petition, so I am not signing it.	1
I have already signed so many petitions that later turned out not to matter. It is the government that has to do something here and this without pressure from the population.	1
I never had the opportunity to sign it.	1
I am against too many rules and for more freedom and no patronizing	1
I am not a "follower" of petitions of any kind!	1
It does not need to become obligatory.	1
It is a false argument to increase sales... Like the term "organic."	1
No overpowering, freedom to choose.	1
Nonsense	1
Not necessary	1
Respect for anonimity	1
Shameful waste of public money	1
The logo is not honest, it is a product of the industry	1
There is no point in petitions	1

French participants	**Frequency**
Don't feel like it	1
Free to self-destruct if one wants; fed up with orders...	1
I already know enough	1
I am for	1
I am more interested in other subjects	1
I do not know it	1
I do not sign petitions	3
I do not give my opinion on petitions because it is not useful.	1
I do not know how the note is conceived...	1
I do not see any point in signing that petition.	1
I do not sign petitions, it's a principle of mine.	1
I never sign petitions	1
I think it is the whole food industry that needs to rethink, and stop the extreme processed products, this logo is manipulation for people who are not educated enough to understand it.	1
I am not signing any petition	1
It never does any good	1
No reason	3
There is no way the petition will succeed!	1
There is nothing wrong with it.	1

Table E8: Self-given reasons why consumers do use or do not use the Nutri-Score label during food shopping. Translated from Dutch and French to English

Reasons for using the Nutri-Score label during food shopping	
Because I am diabetic	
Bij coincidence	
I do not usually look at the Nutri-Score because I think it is not reliable.	
I have diabetes type 1	
They are simply mentioned on it	
To get discount	
Reasons for not using the Nutri-Score label during grocery shopping	
/	I wasn't paying attention.
At the moment I buy products with a good quality/price ratio.	I am just not paying attention; it needs to go fast in the store
Because when there is the Nutri-Score there is no explanation on the score given and sometimes good score on products that we know not good for health	I am more price conscious than I am conscious for the Nutri-Score.
I decide myself what I find healthy	
I do not have the time	I'm not paying attention!
I do not have the time to search for this logo	I am often in a hurry and do not have the reflex to look for it yet...
I do not know	It is not a habitude
I do not know the logo	it is not present on all products
I do not think so	It is really recent
I do not know it well enough	It turned out that the Nutri-Score did not always respond to good food...
I do not spend time checking the Nutri-Score.	It is very simple: Delhaize's organic olive or cola oil is classified D, chips a C. According to the Nutri-Score, it is better to eat chips ! ;-))
I do not buy processed products	I am buying what I already know
I eat what I want and how I want to eat it.	I have not noticed it yet.
I forget	Lack of information
I had not thought about it	Neutral
I have my pre-label shopping habits.	Never mind
I have not seen it in the shop where I buy foods	Never seen before
I have not seen it yet	Never thought about it but I will do in the future
I have not seen this a lot	No attention for that
I have not taken the time yet	No reason
I have not thought about it	Not present on all products
I have not been paying attention so far.	Not suitable for my vegan diet
I have not really been paying attention	Not very visible
I just do not look for it	Nutri-Score is not clear why some products gets a certain score
I just do not use it; it does not matter if it is on there or not...	Products are referred to as unhealthy when they are healthy, such as fish, some fish get a C or D score while every fish is healthy. So I don't follow this.
I know how to judge for myself what is good and what is bad based on the food ingredients.	Since it are the companies that put the Nutri-Score on products, I sometimes have my doubts
I know myself what is suitable for me as a more or less fatty type of cuisine and the products I buy. I am already eating healthy preparing my own dishes.	The Nutri-Score logo is not representative for the quality of the food product
I look myself at the package	The price is a more important factor
I never think about it	There are no Nutri-Score logos on the products I buy.
I often just buy fresh food (fresh vegetables, fruit, ...)	To be tested
I only buy healthy food	We cannot always find him
I pay more attention to the price and product that I forget to look at the Nutri-Score.	With common sense you get much further than with labels
I prefer to look at the label	You do not need this to know what is interesting and healthy.

Table E9: Self-given reasons why consumers do use or do not use the Yuka app during food shopping. Translated from Dutch and French to English

Reasons for using the Yuka app during food shopping	Reasons for not using the Yuka app during food shopping
I do not know it I do not use it yet, but I downloaded it. I have not tested it yet	Did not take the time to install it Do not know the application I do not have a smartphone I do not have enough place on my smartphone I do not have place on my smartphone anymore I do not know it I do not need it I do not know how to scan I have no time I have not yet installed the app I have not downloaded it yet. I use another app I will install Yuka I'm good with labels I am not thinking of using it I am tired of having instruments for every bullshit in life! It limits the consumption of certain food products My mobile phone does not allow me to install the app. Not enough capacity on my smartphone to install it. Nothing in particular Prefer to look at the label and make up my own mind. The application starts by stealing information from the phone, which hinders The products I am used to buying are not in it Too many apps so my phone is full even though I have a memory card.