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Analysis of packaging design its colour coding and labelling of contained sugar in dairy and cereal products

ABSTRACT

The purpose of developing the colour coding system is to create better awareness and help consumers monitor and understand the sugar content of foods. Our research focused on food products (dairy products and cereal products on the Slovenian market) that contain so-called hidden sugars, as these can cause many health risks. The aim of the study was to raise awareness of the sugar content in dairy products and cereals through a packaging design with a uniform labelling and coding system. During the process of this research, few answers were provided to the following questions: How can a labelling system be designed to be clear and impartial, what is the hierarchy and layout of food information on packaging, and how can the system be coherently integrated with existing packaging? The impact of the information design on the consumer in the food packaging industry, which helps in further execution, was analysed. Based on the research, variants of a multi-colour labelling system were created, differing in primary information graphics, colour, placement and formats. The packaging for an imaginary brand and the placement of the code system were designed. Finally, the packaging design was implemented in the 3D models for each food group. The result of this research is a collection of packaging models with a labelling system that informs consumers about sugar content, facilitates decision-making and helps them control their food intake. The colour-coded labels were applied to the packaging in a uniform and coherent manner, which can provide sufficient attention and information.

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Introduction

People encounter sugar in ever greater quantities in our daily lives, as it is found in almost every packaged food. When defining sugar, it is important to know the difference because there is natural sugar, which is safe for health, and added or free sugar, which can affect the body in different ways. Sugar is added to foods for its myriad beneficial properties, but at the same time it can also quickly become over-added, leading to excessive consumption and damage to health. Therefore, it is important to pay attention to and inquire about the ingredients when buying and consuming certain products. The excessive sugar content of many products is well known (carbonated drinks, ice cream, sweets, etc.), but some foods are often advertised as healthy or beneficial to health (yoghurt, milk or muesli). The latter products belong to the so-called hidden sugar products, of which there are more and more on the market today. As the name suggests, these sugars are quite hidden and their presence is almost unknown to the average consumer, as reported by the University of California, San Francisco (University of California San Francisco, 2023). Either the buyer does not pay attention to the declaration, does not notice it at all or does not understand it, as many unfamiliar

and professional terms are used to indicate the sugar content. Different types and formats of declaration labelling have been created to make the nutritional value of foods easier to understand. Although there are already some inconsistent versions of sugar content labelling on the world market, not all of them are effective.

In research by Scapin et al. (2020) and Jonas et al. (2019), several different labels to which consumers responded differently were analysed. For better understanding and to encourage the choice of foods with lower sugar content, they were the most effective interpretive formats with the sugar content in grammes combined with colours, a statement about the high sugar content ("high in sugar") or the percentage of the daily value (the daily value is the same as the value that describes what percentage of the final value the food contributes in a per serving (U.S. Food & Drug Administration., 2023). Labels explaining high sugar text, warnings, health claims and a graphical representation of sugar content in teaspoons were slightly less effective than. Erickson and Slavin (2015) investigated how new sugar recommendations and guidelines with only 5% free sugars in total calories influenced consumer behaviour and labelling on the packaging of the same products. Scapin et al. (2020) investigated and found that formats that provide interpretation of sugar information, regardless of food category, but particularly those that indicate whether a product is high in sugar, are more helpful than numerical information alone in improving consumer understanding and encouraging lower sugar food choices.

So far, the uniform labelling system in Slovenia has been little explored and is not yet used on the market. In the European Union, it has not been possible to establish a uniform model or labelling format for nutritional profiling of foods due to the lack of uniform nutritional reports (chapters with recommendations on sugar intake), uniform food composition data and insufficient data on consumers' dietary habits (Eržen, 2014).

As mentioned, the lack of a clear definition of free and added sugars leads to inconsistencies and misinterpretations of the declarations by consumers, scientists and manufacturers. Some organisations use the term "added sugars", while others, such as the World Health Organisation (WHO), use the term "free sugars" for the same purposes (World Health Organization, 2015). Furthermore, labelling claims that only define the total amount of all sugars and not the individual amount of added or natural sugars create uncertainty for consumers. Additional labelling issues also arise from the method used to measure sugar content, as nutritional analysis uses different chemical methods to measure the nutritional value of foods, such as quantitative analysis to determine the amount and chromatography to identify the sugar. Two different types of chromatography are used, namely gas chromatography and liquid chromatography (HPLC). However, both are unable to distinguish whether the sugar in a food is naturally occurring or added by the manufacturer (Goldfein & Slavin, 2015). Consumers can find out the sugar content of a food themselves by looking at the ingredients, which are listed in descending order of quantity (Yeung, Goodfellow & Flanagan, 2015). Again, complications arise as consumer knowledge is often limited and many sugar terms are difficult to understand. The following table (Table 1) lists some common names for sugars in food ingredients.

Table 1

The most common types of sugars and the names under which they often appear (Zupančič, 2020)

Type of the sugar	Other names
glucose	dextrin, dextrose, rice syrup, maltose, barley malt
sucrose	crystallized fructose, fructose syrup, fruit sugar
fructose	beet sugar, cane sugar, demerara sugar, sugar, caramel, brown sugar, sugar cane juice, muscovado sugar

By requiring clear sugar labelling for products such as dairy products and cereals, governments can help consumers make more informed choices. Therefore, clear and unique sugar labelling for mentioned products could be labelled with the amount of added sugar as well as the total amount of sugar. The aim of the study was to raise awareness of the sugar content in dairy products and cereals through packaging design and to design a uniform labelling system that can be used for many products.

Materials and methods

This research followed a systematic approach consisting of five steps carried out to analyse the sugar content in dairy and cereal products and then incorporate the results into 3D packaging placements. A novel colour labelling system was also developed for improved visual presentation. The individual steps of this research are described below:

1. Sampling and sugar content analysis of dairy and cereal products from the Slovenian market

The research involved two primary steps:

a. sampling the dairy and cereal products available in the Slovenian market,
b. analysing the sugar content in dairy and cereal products.

a) Sampling the dairy and cereal products available in the Slovenian market

The analysis included a comprehensive examination of dairy and cereal products available in the Slovenian market in total of 47 dairy product samples sourced from 12 different producers and 15 cereal product samples. The samples were carefully selected to include a diverse range of product types. For 5 food groups, several products were analysed in different stores as followed:

- cereal box-15 samples,
- yoghurt or milk bottle/bottle-10 samples,
- butter packet-12 samples,
- milk carton-10 samples,
- yoghurt container-15 samples.

b) Analysing the sugar content in dairy and cereal products

Using the samples that contained natural, fruit and protein yoghurts, the statistical functions of frequency distribution were used to determine the classes based on the increasing amounts of sugar in the foods. The classes enabled the use of logical colour coding in the further development of the scale, as we could assign a specific colour to a specific class, e.g., the lowest class with the lowest sugar content belongs to the blue colour, etc. In the product range, the minimum sugar content was 3.8 g and the maximum was 14.0 g. Table 2 below shows the distribution of the products in 5 consecutive classes with an interval of 2.5 g sugar. The class describes the range of sugar content in grammes and the frequency describes the number of products belonging to that class.

Table 2

Frequency distribution of the amounts of contained sugar and distribution into classes at analysed dairy and cereal products.

Class	Frequency
3.0-5.4	28
5.5-7.4	1
8.0-10.4	7
10.5-12.9	9
13.0-15.4	4

The levels or classes of sugar in food were created based on analyses of dairy and cereal products available on the Slovenian market. The sugar scale contains five classes ranging from the lowest to the highest sugar content (Table 3). In contrast to the middle three open intervals, the minimum and maximum classes have less than 3 g of sugar and more than 15.4 g of sugar, respectively.

Table 3

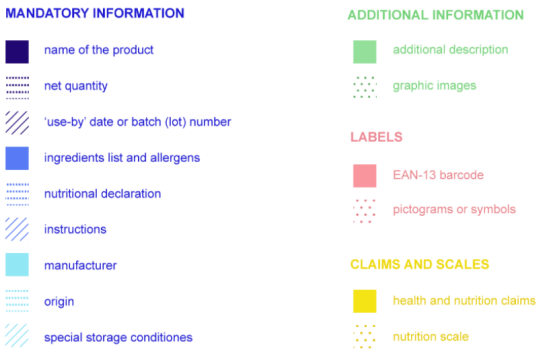
Ascending classes of amounts of sugar in grams [g].

Very low	Low	Medium	High	Very high
< 0.3	1.5 – 7.9	8.0 – 10.4	10.5 – 12.9	> 15.4

2. The graphic analysis and the preparation of the layout and the hierarchy of information on the packaging for a specific food group

For each piece of information (classified into one of the 4 groups in the legend – Figure 1), each of the samples for that food group was analysed, its position noted and then counted and determined where on the packaging the information occurred most frequently, and then that option chosen for placement on the packaging. Each sample was meticulously documented, recording the product manufacturer, the product type and the corresponding amount of sugar contained. This approach ensures a robust and representative data set for the analysis of sugar content in these food categories.

Further in the research process, the scales were applied to the graphically designed food packaging, which was designed on the basis of the previously mentioned analyses. The packaging for each food group was analysed, focusing on the presence and placement of information in the legend (Figure 1).



» **Figure 1:** *Legend of the data used in the analyses according to packaging and sugar content.*

The first group of data is coloured blue on the analysis cards and includes the legally required information, such as product name, net quantity, best-before date or batch (lot) of the food if the best-before date is not indicated, list of ingredients followed by allergens if the product contains any (cereals, eggs, nuts....), nutritional value of the food, instructions (only if there is a possibility that the consumer will not be able to use the food properly without them), manufacturer, origin (only if the absence of information could mislead the consumer as to the true origin) and special storage conditions.

The second group of data is coloured green and represents additional information, such as additional description of the product, e.g., suggestions for preparing a dish, information about the production (e.g. natural and organic grown on a farm), a description of one of the ingredients (e.g. oatmeal and its influence on a healthy diet), contact of the producer, distributor, etc. The second option is represented by

green dots and includes graphic images such as the company logo, various illustrations and photos.

The third group is indicated by the pink colour used to represent the labels, namely the EAN-13 barcode and pictograms or symbols (mostly these are indications of the type of packaging material, the label suitable for contact with food and the placement of the packaging in a suitable place).

In the last or fourth yellow group are health and nutrition claims and various scales (e.g. Nutri-score).

3. Graphical analysis and comparison of the different types of the current labelling

A graphic analysis and comparison of the different types of labelling (symbols, colours, formats) on the Slovenian market and in other countries of the world followed. Based on this analysis, several versions of labels were created, differing in symbols, colours, formats and layout.

4. Creation of new sugar labelling system and packaging design

The created labelling systems were placed and designed on the designed packaging (labels) for an imaginary brand based on the previously conducted analysis.

5. Preparation of 3D packaging design model with new sugar labelling

Finally, a 3D model of the packaging was created to represent it more simply and realistically. For each food group (yoghurt, milk, butter, cereals) a packaging model was created with two versions of the labelling.

Results

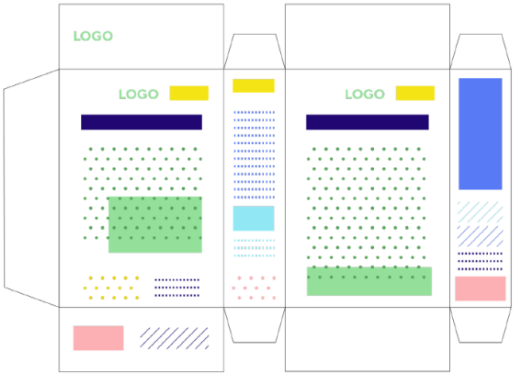
Results of the graphic analysis and the hierarchy of information on the packaging for a specific food group

A detailed analysis of dairy products was carried out to establish a scale corresponding to ascending sugar content. Using dairy samples, a frequency distribution was made to classify them according to ascending sugar content. These classifications facilitated the introduction of a coherent colour coding system, where specific colours were assigned to specific sugar content ranges. Subsequently, the scales derived from this analysis were applied to visually designed food packaging, focusing on the arrangement and inclusion of information. The packaging analysis included mandatory information, additional product details, contact information, barcodes, symbols and health claims as described in the following chapters.

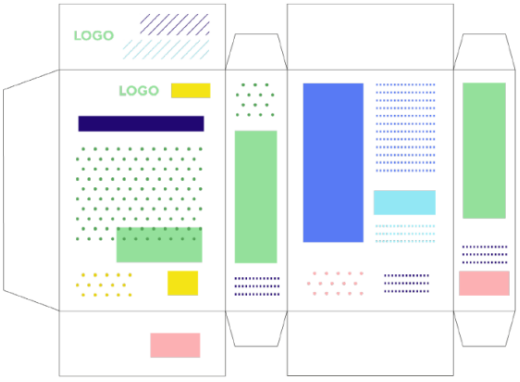
Packaging design for cereal box

An analysis of cereal boxes showed two versions most found in stores (Figure 2a and 2b). Both versions have a common main side with the logo and product name in the top third of the box and the nutritional information on the right-hand side. An alternative placement for the nutrition information, which is often interchanged with the nutrition label, is the bottom third of the package on the right or left side. In addition, the logo also appears on the top or lid of the packaging for both versions. The two versions differ mainly in the design of the ingredient list and the nutritional information.

a)



b)



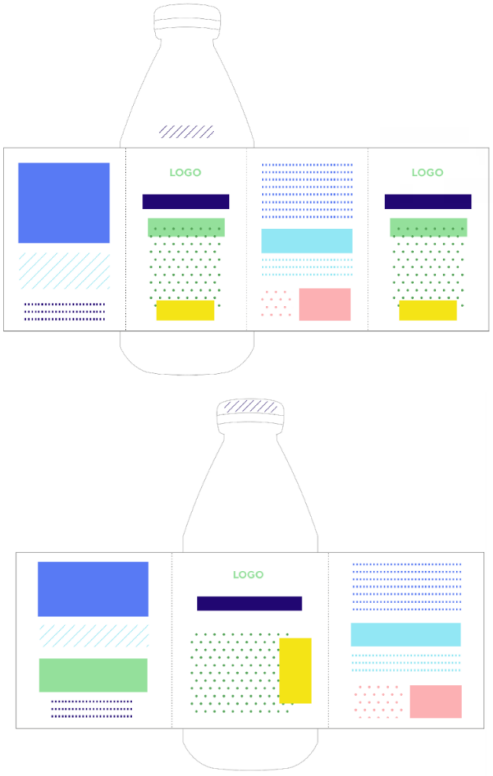
» **Figure 2:** *Two different versions (a and b) of the analysis of information placement on cereal packaging (boxes).*

The two versions differ mainly in the layout of the list of ingredients and nutritional values. One noticeable difference is that in the first version (a) the primary page is repeated exactly the same or with a similar graphic and additional information on the back. Consequently, the information on ingredients, nutritional values, instructions and manufacturer appear on the right and left sides. Because of the seemingly smaller surface area, these details are often close together, they can appear less clear and are more difficult to see. On the sides, this

information is usually accompanied by labels (EAN-13 and pictograms). The net quantity often appears on the first page and on one of the sides. In the second version (b), the primary page is not repeated, but the ingredients and other obligatory information are on the back. Additional descriptions and graphics appear on the sides because there is much less information and therefore, they are better suited for smaller spaces. In both cases, the barcode appears not only on one of the sides, but also on the bottom of the box. Also, the date of use can be found at the bottom in the first version (a), while in the second version (b) it is at the top together with the storage conditions. The latter is easier to see and the arrangement with the storage conditions makes sense, as the storage of the product can influence its usability.

Packaging design of bottle for milk or yogurt

As with the analysis of the boxes, the bottle labels could also be divided into the two most frequently found variants (Figure 3a and 3b).



a)

b)

» **Figure 3:** *Two different versions (a and b) of the analysis of information placement on bottle for milk or yogurt.*

The two versions differ mainly in the repetition of the primary side, namely that the label of the first version (a) is divided into three relatively equal parts, of which the primary side appears only once, while the label of the second version (b) is divided into 4 equal parts and the primary side is also repeated on the reverse side in the same image. The repetition could allow faster recognition of the product on the shelf from different angles, as bottles and vials are often turned in random directions on the shelf, either by the customer or by the staff when stacking the products.

In the second version (b), there are two pages with most of the compulsory information between the two main pages. On one of the pages you will usually find the ingredients and the storage conditions, while on the opposite page you will find the nutritional value of the product as well as the manufacturer and the origin. This page also contains labels (EAN-13 and pictograms). In the first version (a), the data is arranged almost identically to the second (b), but the first version, by eliminating the primary page, allows a larger area of the page and thus its use for additional information. The best-before date for bottles appears either on the bottle itself or on the cap, whereas for bottles it usually appears only on the cap. The net fill quantity usually appears only once on the entire label for both versions.

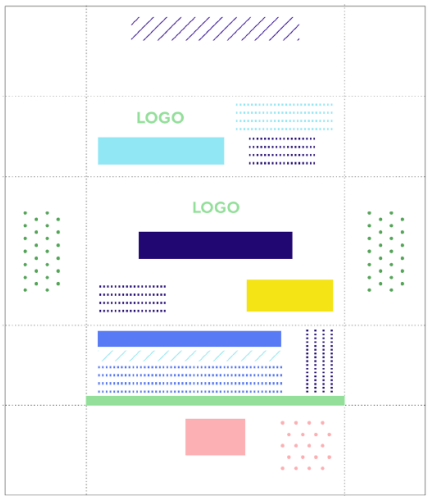
Packaging design of butter

Just as with the bottle and the box, twelve samples (Slovenian and foreign producers) were used to identify two dominant versions (Figure 4a and 4b) and to design a standard packaging.

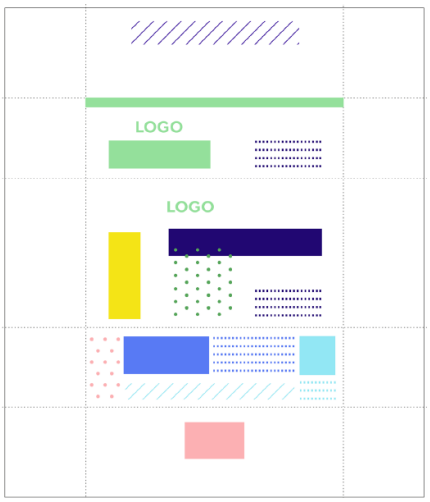
The primary sides are quite similar on both versions, as they both contain the logo and product name as well as the net fill quantity in the lower left or right corner. Nutrition or health claims appear less frequently on butter packaging than on muesli, yoghurt and milk, but when they do, they appear on the left-hand side or in the lower right-hand corner. Graphic images also appear on both versions, but to a much lesser extent than on other products, as the lid also has a relatively smaller surface area. The images appear directly to the left and right of the primary page on the first version (a) and directly on the primary page on the second version (b). The biggest difference is the placement of the mandatory information. In the first version (a) they are directly above and below the primary page, with manufacturer, origin and net quantity appearing most frequently above the page. Below the primary page are the ingredients, followed by the storage conditions, the nutritional value and the repeated net quantity. In contrast to the first version (b), most of the information (ingredients, nutritional value, storage conditions, manufacturer, origin and pictograms) is rather compressed on one of the pages (usually below the primary page). This makes the information appear less orderly, harder to understand and also harder to recognise due to the reduced font size. The page above the primary page contains a repetition of the logo, similar to the first version, which helps to recognise the product or brand from different angles. This page is often accompanied by an additional description and

the net quantity. For both versions, the barcode EAN-13 and the date of use appear at the bottom of the label.

a)



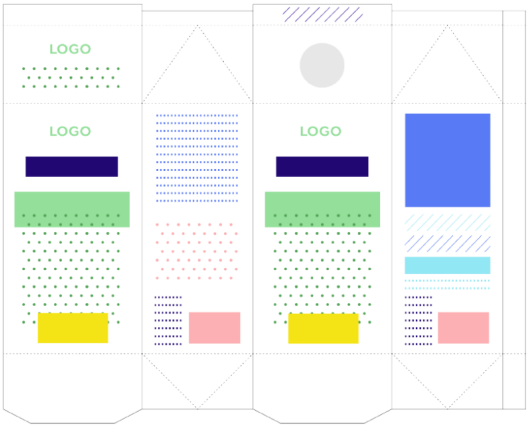
b)



» **Figure 4:** *Two different versions (a and b) of the analysis of information placement on butter packaging.*

Packaging design of milk carton box (e.g., Tetra Pak®)

Milk and yoghurt are not only put into a bottle or flask, but are often also in a carton (e.g. a Tetra Pak®). In contrast to the packaging mentioned in the previous sub-chapters, there is only one version in the carton analysis, as almost all ten samples appear with this data distribution, with the exception of one. The producers of the analysed milk are mostly Slovenian (most of them coincide with the producers listed in the yoghurt content analysis (Table 2)). The following figure (Figure 5) shows the visualisation of the distribution of the data, based on which the graphic image of the packaging was later designed. Similar to the bottle and box versions, the carton has a primary side that is repeated in the same image on the back, which can facilitate the recognition of the product from several directions. The primary side contains the most important information, namely the logo and product name in the top third, with an additional product description and/or graphic image below. In the lower third, in the middle or on the right-hand side, there are health or nutrition claims.



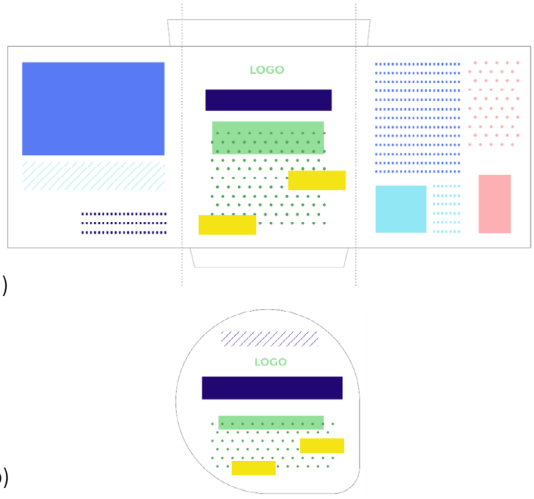
» **Figure 5:** *The analysis of information placement on milk carton box.*

The repetition of the main page makes sense for cardboard because the areas of the side pages are relatively large (compared to a cereal box), so the rest of the information (ingredients, nutritional value...) is not so compressed and in most cases has satisfactory visibility and recognition. The obligatory information and labels are therefore distributed on the left and right side according to the main page. A table with the nutritional value of the food appears on one of the pages, and there are pictograms below it. At the bottom of the page is the barcode EAN-13 and the net quantity, which is also repeated on the opposite page. On the opposite side is a list of ingredients, followed by the storage conditions and the instructions for use, and below that the manufacturer and the origin. The expiry date is usually on the top flap above the cap on the primary side.

Packaging design for yogurt container

In the design of yoghurt packaging, the first page is the primary page, which is centrally aligned as with all the food groups analysed previously. The company logo and product name are in the top third or half of the label, while the bottom third or half features a graphic image and additional description of the product (Figure 6a). Nutrition information is located in the lower half of the label on the left or right side. The repetition of the primary side could only be distracting on the pot, as the label of the pot is much smaller than the other described packages. As a result, the other data would be too compressed and more difficult to distinguish. The obligatory information and labels are on the right and left side of the main page. On one of the pages is the nutritional value of the food with manufacturer and origin in combi-

nation with the barcode EAN-13 and other labels. On the second page there is a list of ingredients with allergens, followed by the storage conditions. In most cases, the net quantity appears on only one page, usually as close as possible to the first page so that it can be noticed earlier. The second part of the analysis of the pot includes the lid (Figure 6b), which in most cases is almost identical to the primary side of the label. All the information is the same and differs only slightly in layout from the primary side as it is adapted to the round shape of the lid. The expiry date also appears on the lid. It is often printed directly above the dates and is difficult to see in these cases.



» **Figure 6:** *The analysis of information placement on yogurt container a) side and b) lid.*

Results for a colour coding and labelling system on packaging for dairy products and cereals

Previous research and the results of analyses of food packaging have shown that declaration information can be very inaccurate and incomprehensible. In our design, we have not removed the declarations and other information about the food on the packaging, but only added labels that make it quicker and easier to determine the amount of sugar contained. With the help of an analysis of labelling systems on the world market, we designed labels that are clear and distinct. Several versions of the scale have been developed, divided into a multi-coloured (colour-coded) scale containing data presented in words or letters. For each version of the scale, the best placements on the packaging (front or back) are presented. What the tables have in common is that they all contain the same information and that this data is presented with the same typographic choice.

Coding system (colours and typography)

The multi-coloured scale was created with the aim of identifying the sugar content in products more quickly and easily. The colour coding enables a clearer and more concise determination of the content of sugar contained, so that the customer can obtain the desired information more quickly. Colour codes have been assigned to the classes, allowing the customer to make both an intuitive and a logical connection between the amount of sugar and the colour it represents.

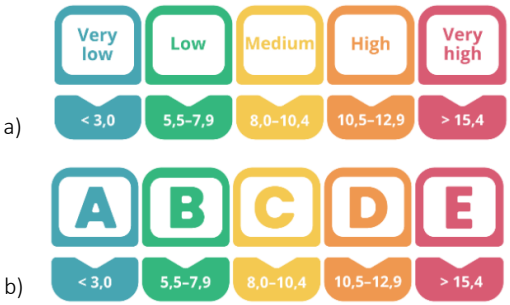
The colours used to create the scale were selected based on the analysis of existing scales and research conducted in 2015 (Wąsowicz, Styśko-Kunkowska & Grunert, 2015; Huang & Lu, 2015). Thus, five different colours were selected that are similar in terms of saturation and brightness, as shown in the following figure (Figure 7). The colours appear coherent and harmonious with each other, and they can also be seamlessly integrated into the existing packaging while still being visible and clear. The colours tend to be pastel or slightly less saturated colours of medium brightness, as they can still be perceived quickly but would not distract the shopper's attention from the product itself and other information.

On the scale, the colours follow each other exactly as they do in nature on the colour spectrum of visible light. The colour blue is assigned to the lowest sugar content and green to the next class, as these colours are perceived as the healthiest according to research. Moderate sugar content is represented by a neutral yellow colour, followed by an orange colour with an amber tint, which is also common in this role in existing labelling. The highest sugar content is indicated by a pink hue that is not too noticeable and aggressive, but still conveys unhealthy eating habits due to excessive sugar consumption. The scale (Figure 7) is minimalist and refined, with an elongated rectangular shape. The classes are divided into smaller frames, edited by white stripes connected to the background. The primary and secondary information for each class is separated by negative space that creates an arrow pointing to the associated data. The corners of the shapes are slightly rounded and express a friendly, yet clean visual appearance.

» **Figure 7:** *Selected colours on a multi-coloured scale.*

The information contained in the sugar content scale is divided into two important information as primary and secondary. The primary information is the most important and gives the name and meaning of the class of sugar contained (very low, low, moderate...). The secondary information is more specific and would not be essential in itself (a certain interval of the amount of sugar in the class). So that the data frames themselves are not cluttered and skewed, we have added the meaning of the data or the description of the scale below the frame,

namely "sugar content in grammes [g]". Based on the analysis of the practise of existing labelling methods, we have identified two ways to present primary information (Figure 8a). The first option is to use words to describe the increasing classes, i.e. very low, low, moderate, high and very high sugar content. The word extreme is used for extremes as it expresses a large amount or a high level, i.e. a level that is even higher compared to the previous/following class (high/low). Words are written in lower case because they have a more recognisable counterpart form and are consequently easier to read or recognise (Tinker, 1963). According to research conducted in 2022 (Weingerl, Nedeljković & Pušnik, 2022), we used words with upper case letters (sentence structure) because they are recognisable earlier compared to words with only lower-case letters. Another way to present primary information is to use letters, using the Nutri-Score labels as an example (Figure 8b). In the alphabet of the consecutive letters A, B, C, D and E of the extra bold version, capital letters are used.



» **Figure 8:** *Two different variations of the multi-coloured scale a) with words and b) with lettering.*

In choosing the font for the text of the scales, we have paid particular attention to the legibility of the font in a small size or letter height. A font with characteristics that make it easier to read, namely a high central letter belt (x-height), moderately wide letterforms, i.e. avoiding compressed and narrowed typefaces, and a relatively low contrast between bold strokes, has been chosen. We also made sure that the font we chose had recognisable counterforms of the letters, as these are easier to see at smaller sizes (Jones et al., 2019). For this reason, lowercase letters for the text were chosen, but it was important that the font had as many different letter shapes as possible, e.g. b, p, d and q are not just mirrored but matched and there are no substitutions of letters (e.g. lowercase c and o, lowercase l, uppercase i and the number 1 or uppercase B and 8) or combinations of letters (e.g. lowercase r and n do not become m or lowercase c and l become d). We also wanted to avoid substituting letters by using bicular lowercase a and g instead of monocular ones. From the beginning, we refrained from using hand-drawn and handwritten fonts, as their legibility at lower levels is questionable in most cases. Therefore, we decided to use only a serif or sans-serif font, choosing a linear font (i.e. without serifs) because in our case there is very little text on the scale, i.e. we had no serifs to help guide the eye when reading longer texts. needed. By choosing a sans serif font, we also wanted to add a level of seriousness and objectivity to the information that is often lost with serif fonts. The following figure (Figure 9) compares the fonts that were most suitable for the type of use and met our requirements, namely Open Sans, Ubuntu, Roboto and General Sans.

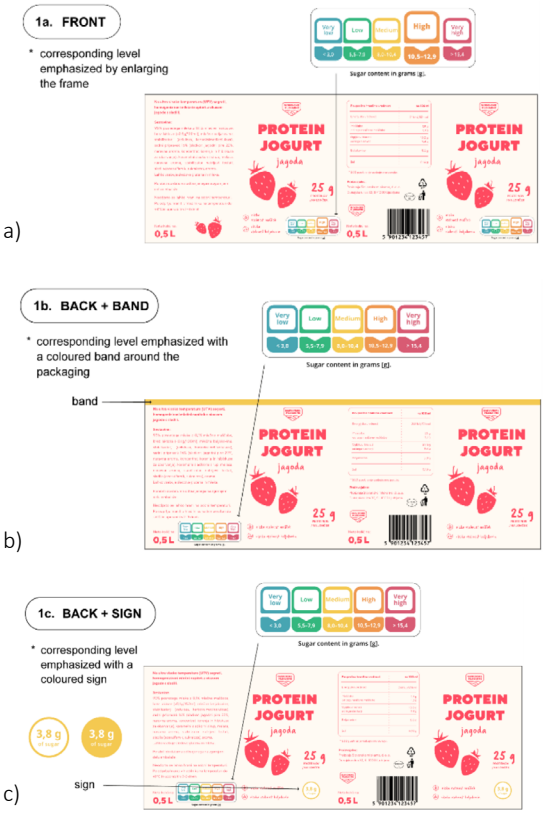
» **Figure 9:** *Examples of selected typography.*

The font Open Sans (by Steve Matteson), which best reproduces all the above characteristics, as it is less narrow and has a slightly higher central letter area compared to the Roboto font has been chosen. When we compared Open Sans with the General Sans font, we found the letterforms themselves slightly more recognisable and readable. In the final phase, we chose between Open Sans and Ubuntu fonts, whose letterforms have a more modern and fun look, but we still chose Open Sans

because we have a choice of monolingual and bilingual lowercase g and relatively more familiar or established letterforms that can inspire a sense of confidence in the consumer. The advantage of the Open Sans font is also the end of some base strokes next to the circles, where the end of the base stroke is narrower, which consequently helps to avoid larger blacks in smaller letter sizes.

Options for placement on the packaging

It was also important to consider the possible placement of the scale on the packaging so that it is logical, quickly noticeable, but not distracting in relation to other information about the food. The following figure (Figure 10) shows different placements of the scale on one of the produced packages, which will be described in more detail in the continuation of the thesis (chapter Designed food packaging and placement of scales).



» **Figure 10:** *Three different variations of code placement to the packaging a) front, b) back with band and c) back with sign.*

The first of the layout variants for the multi-coloured scale is on the primary side in the lower left or right third, which is also the most common arrangement in practise. When placing the scale on the primary page, the corresponding class would be highlighted by an enlargement of the frame and a bolder version of the font (black version) compared to the rest of the data (middle version), depending on the amount of sugar contained in the food. The advantage of placing the scale on the primary side is faster and direct access to all the sugar content information, but it can often be somewhat distracting on the most graphically complete (primary) side of the packaging.

Another option is to attach the scale to the side or back of the package. In this case, the scale frames and the font version are the same for all classes, and the corresponding class can be highlighted in two ways. In the first method (1b), the corresponding amount of sugar is indicated by a coloured band enclosing the upper part of the packaging, the width of which is between 2.0 and 3.5 % of the height of the packaging. This allows the buyer to see the information more quickly from all sides without obscuring other data and the graphic image of the packaging. In the second method (1c), which also has a scale on the side or back, the corresponding class is highlighted on the primary side by an ink mark that can contain only the class name or the exact amount of sugar contained. Like the colour strip, this mode allows for quick recognition of important information and less degradation of the primary page image.

Final packaging and coding positions

To facilitate the presentation of the designed packaging and scales, 3D models of the packaging for each food group were created. A model of a cardboard box, a bottle or vial with a label, butter with a wrapper, a carton for milk or yoghurt and a plastic cup with a label and a lid were designed. The models were also designed using simpler modelling techniques with a cube and with subdivision by adjusting the points and sides of the polygon. It was important to design a model at a realistic scale so that the sizes of the packages were in proportion. Simple techniques such as movements, rotations and cutting out were used in the initial modelling. The figures (Figs. 11a-11e) show the final visualisations of the packages of the multi-coloured coding.

Conclusions

Due to the increasingly frequent occurrence of hidden sugars in dairy products and cereals, a labelling system has been developed to raise awareness of sugar content and facilitate enquiries. In this work, the sugar content of 49 samples of yoghurt products was analysed, which allowed us to first design a scale based on sugar amounts with five increasing classes. An analysis of the content and placement of information on the packaging of dairy products and cereals offered on the Slovenian market was carried out. On this basis, the graphic image of the imaginary brand was designed and the developed labelling system was placed so that it functions holistically and coherently. When analysing the existing methods of nutrition labelling, we came

» **Figure 11:** *Code placement to the packaging for different products a) cereals, b) yogurt in a bottle, c) butter, d) milk and e) yogurt in a container.*

to the conclusion that there is not yet a uniform labelling system for sugar content on the Slovenian market. Therefore, different design solutions were designed and compared, which differ from each other in terms of format, colours and interpretability (graphic visualisations). Two types of scales were designed, that differ in the presentation of the most important information. Thus, a multi-coloured scale with word or letter representation of the main information and a coloured scale with symbols or a pattern instead of the main information were created. The optimal placement of the scales on the packaging was prepared in such a way that the information about the amount of sugar is recognised first by the customer but is not destructive in relation to the existing graphic image. The graphic image of our packaging was inspired by the samples analysed and gives a refined, natural and slightly playful impression. The result is a basic outline of the packaging for each food group, with two options presented in each case, the first with a multi-coloured scale in different positions and on different packaging. When designing the labels, further use was important as they could later be used on other food packaging. In the future, additional research such as surveys and questionnaires should be carried out, which would allow more constructive decisions to be made regarding the presentation of information and aesthetics. The final labelling system could reduce confusion about the sugar content of foods and help consumers achieve their desired dietary habits.

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