Utilizing Consumer-Based Label Equity to Signal Consumer Products Free From Endocrine-Disrupting Chemicals

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Abstract

Endocrine-disrupting chemicals (EDCs) in consumer products present a global health concern. Yet, the understanding of consumer perceptions of EDC-related product labels is limited. This study investigated consumer reactions to such labels using data from 602 Scandinavian consumers. The results indicate a positive association between label performance (willingness to buy, pay in a local currency, pay extra, and recommend a product with the label) and a modified version of the consumer-based food label equity scale proposed by Coderre et al. (2022). Findings also suggest a positive relationship between awareness of EDCs and label performance of products with EDC-related labels. Our recommendations involve educating consumers, utilizing labels more effectively, and avoid warning labels for risks that are not well known and/or have a relatively low consumer-based label equity (CBLE).

Introduction

Endocrine-disrupting chemicals (EDC) are substances that interfere with the hormones in the human body. They adversely affect the health of the reproductive and endocrine systems, and metabolism, and can lead to hormone-sensitive cancers in females, prostate cancer, diabetes, and obesity (Diamanti-Kandarakis et al., 2009; Gore et al., 2015; Vandenberg, 2021; Zoeller et al., 2012). Certificates signalling the absence of endocrine-disrupting chemicals (EDC) are called 'low EDC' certifications. For example, the Nordic Swan Ecolabel (Nordic Ecolabelling, n.d.) is awarded exclusively to brands that either eliminate substances harmful to human health or significantly restrict them to the lowest possible levels.

The literature examining the clinical aspects of EDC exposure and its impact on human health is abundant and has provided valuable insights for policymakers and consumers (e.g., Kassotis et al., 2020; Khan et al., 2020; Lauretta et al., 2019). However, the impact of EDC-related labels on consumer purchasing behaviour is relatively unexplored. Recently, digital applications were introduced to help consumers detect EDCs. For example, the German app ToxFox allows users to scan the barcode of a cosmetic product and uses a green or red symbol to indicate whether the product is EDC-free (Bund Naturschutz, n.d.). Similarly, the Danish Consumer Council's app, Kemiluppen, enables users to assess the safety of a product's ingredients. The safety assessment is symbolized by an A, B, or C rating, displayed on a green or black chemistry flask icon (Forbrugerrådet Tænk, 2022). A green flask with an A rating signals that the product contains no potential EDCs. Conversely, a black flask with a C rating represents the lowest chemical safety rating and acts as a visual warning for consumers. Such ratings indicate the presence of controversial or harmful chemicals and are designed to draw attention and alert consumers to potential harm. In a test involving a broad range of deodorants, the

Danish Consumer Council assigned the C rating to as much as 26.2% of the tested products (Forbrugerrådet Tænk, 2020). This distinctive use of the C rating sets Kemiluppen apart from other labelling systems which emphasize the positive attributes of a product. In short, the C rating acts as a warning label. Warning labels are well known in the context of alcohol (Kokole et al., 2021) and cigarette smoking (Bogliacino et al., 2015; Strahan et al., 2002). Steinhart et al. (2013) found that warning labels about potential side effects of risky behaviours (e.g., smoking or taking certain medications) can have an unintended effect. Consumers may view the warning message as a sign of honesty, making the product seem more trustworthy and appealing.

EDC-related labels can be used by manufacturers to differentiate their products and appeal to consumers who are concerned about their exposure to EDCs. Retailers can also use these certifications to appeal to health-conscious consumers seeking safer, more environmentally friendly products. By obtaining an EDC-free or a low-EDC certification, retailers can signal to consumers that they are taking proactive steps to reduce the presence of potentially harmful chemicals in products like deodorants and perfumes. It can also serve as a way to influence consumers' willingness to buy (WTB), willingness to pay (WTP), willingness to pay extra (WTE), and willingness to recommend (WTR) a product. However, from a retailer perspective, the increased awareness of such potential health risks can lead to lower consumption of products associated with EDCs, which in turn leads to a decline in sales. Retailers may also face increased scrutiny from consumers and regulatory authorities, which could lead to increased costs.

Signals and labels have proved useful in guiding consumers toward healthier and/or more sustainable choices when selecting food products (Liem et al., 2018; Nikolova & Inman, 2015; Sigurdsson et al., 2022). Coderre et al. (2022) developed and validated a measure of the facets of consumer-based food label equity, thereby creating the consumer-based food label equity

(CBFLE) scale. Sigurdsson et al. (2023) utilized the scale and found that the food labels need high CBLFE to be effective in terms of WTB. Limited research has been conducted on using such signals in selecting personal care items, particularly in the context of EDC avoidance. This constitutes one of the main contributions of the current paper. Consequently, we evaluated the predictive validity of the CBFLE scale beyond the scope of food products and determined its applicability to labels and certificates within different product categories, with a specific emphasis on low-EDC labels. We, therefore, tested the effects of CBLE (removing the F from CBFLE, as we are not looking into food labels) on consumers' willingness to buy (WTB), pay (WTP), pay extra (WTE), and recommend (WTR) deodorants in the context of EDCs. As limited information is available on the different facets of label equity, we tested the *subscales Visibility, Awareness, Clarity, Design, Relevance, Credibility, and Honesty* put forward by Coderre et al. (2022), documenting their relevance for the effectiveness of low-EDC labels. Three of the five labels used in our study are categorized as certifications (Nordic Swan, Ecocert Cosmos Organic, and Asthma Allergy Nordic). These certifications are used by producers who believe they fulfil specific predetermined criteria in order to use the label. By applying for these certifications, the producers voluntarily subject themselves to an evaluation process to validate the claims of fulfilling these requirements. The remaining two labels used in our study (Danish Consumer Council Rated A, and Danish Consumer Council Rated C) rate consumer products based on available scientific research and current chemical regulations. These labels, administered by the Danish Consumer Council, are independent of producer involvement. A product labelled A is considered safe in terms of (the lack of) potential EDCs, whereas a product labelled C should be avoided. This study is centred on the Scandinavian market, with a specific focus on Denmark, Norway, and Sweden. The Scandinavian countries have consistently ranked among the top 20

green countries on the Environmental Performance Index (Karel & Savarimuthu, 2021). We took five labels commonly used in Denmark, Sweden, and Norway, and explored the consumer label equity for different certifications/labels related to EDC-disrupting chemicals. We focused on the following research questions for a product that can include EDC:

RQ1: What is the association between the CBLE index and consumers' willingness to buy, pay, pay extra, and recommend the product?

RQ2: Are the different facets of CBLE associated with consumers' willingness to buy, pay, pay extra, and recommend the product?

RQ3: What are the effects of different label signalling on consumers' willingness to buy, pay, pay extra, and recommend the product?

RQ4: Which labels have more impact on consumers' willingness to buy, pay for in local currency, pay extra, and recommend the product; general labels or those explicitly designed to communicate safety in relation to EDCs?

RQ5: Does consumer awareness of EDC positively associate with their willingness to buy, pay, pay extra, and recommend the product?

Our research makes three key contributions to the literature on health and sustainability marketing in retailing:

- We show a strong association between scores on modified CBFLE scale (Coderre et al., 2022) and label performance (i.e., WTB, WTP, WTE, and WTR) when signalling consumer products free from endocrine-disrupting chemicals.

- We compare the effects of general environmental and health labels (the Nordic Swan, Asthma Allergy Nordic, and Ecocert Cosmos Organic) with labels explicitly designed to communicate safety in relation to EDCs on label performance (such as the Rated A by the Danish Consumer Council). The results show stronger effects for general labels with higher CBLE.

- We demonstrate that consumers' awareness of EDCs is positively associated with the label performance and that consumers express a similar willingness to buy, pay, and recommend products with a warning label and some of those labels intended to help consumers avoid EDC-related products.

The paper is structured as follows. First, we provide a comprehensive introduction to the theoretical foundation of CBLE outlining the main literature. Next, we present the empirical research with a thorough methodological description of the results. Finally, we discuss the findings, acknowledge limitations, and suggest potential avenues for future research.

2 Conceptual framework and hypotheses

2.1 Signalling in retailing to avoid endocrine-disrupting chemicals

EDCs raise substantial concern for public health. The annual costs related to the adverse health effects caused by EDCs amount to around €157 billion (Demeneix, 2017). In a large study of European consumers by the EU Commission, 85% of the participants worried about the impact of chemicals present in everyday products on their health (European Union, 2020).

The current paper draws on signalling theory as its overarching theoretical perspective. Harmful substances in products go unnoticed by many consumers (Hartmann & Klaschka, 2017). Consumers spend only a few seconds evaluating a product at the point-of-purchase (Mauri et al., 2021), and many do not have sufficient knowledge to make informed choices (Hartmann &

Klaschka, 2017). Such exchange situations reflect information asymmetry in a way that buyers have lesser knowledge of the purchased product and its production process than those selling/producing it. Signalling theory (Spence, 1973) is commonly used as a theoretical foundation to countermeasure the problem of asymmetric information (Connelly et al., 2011). By signalling relevant product attributes that consumers find difficult to assess, brand manufacturers and retailers can influence consumers' perceptions of product quality (Boulding & Kirmani, 1993; Larceneux et al., 2012). In the context of EDC, the use of labels can draw attention to information, enabling consumers to differentiate products with less adverse health effects from potentially more harmful alternatives. A label that signals a lack of harmful substances can thus be perceived as one with a positive quality, thereby increasing consumer value (Carpenter & Larceneux, 2008) and positively affecting consumer preferences and willingness to pay.

Consumers are more willing to pay for products with an EDC-free label (Kim et al., 2018). Such labels, therefore, appeal to consumers looking for healthy and green products. Denmark has been proactive in protecting people against EDCs (Ministry of Environment of Denmark, n.d.). More specifically, Denmark has shown leadership by investing in research to better understand EDCs and their impacts, implementing national strategies to combat the use and effects of these chemicals, and pushing for more robust regulations within the EU. However, the international retail landscape of health and eco-certifications is complex and evolving. At present, there is no global standard for EDC-free or low-EDC certifications. Different countries and regions have their own certification programmes and requirements. For example, the Eco Mark certification in Japan identifies products within several product categories that meet certain environmental standards, including limits on EDCs (Japan Environment Association Eco Mark Office, n.d.). South Korea has considered implementing an EDC-free label, certifying products

that do not contain EDCs (Kim et al., 2018). In the European Union, the EU Ecolabel on deodorants and other products guarantees that the product has restricted the use of hazardous substances (European Commission, n.d.). Starting in 2008, the Nordic Swan label's requirements were aligned with the EU Ecolabel system, leading to identical criteria for both labels (Jørgensen & Moen, 2015). The 2030 vision for the Nordic Council of Ministers emphasizes the importance of promoting a circular and bio-based economy, sustainable and competitive production, sustainable food systems, and non-toxic, resource-efficient production cycles in the Nordic region, making the region the most sustainable globally. Furthermore, it aims to make it easier for Nordic consumers to make informed decisions about healthy, environmentally friendly, and climate-friendly products (Nordic Co-operation, n.d.). As consumer awareness of EDCs grows, the demand for more consistent and comprehensive EDC-free or low-EDC labels is likely to increase, leading to greater harmonization and standardization across different countries and regions.

Although some policymakers such as the EU (European Commission, 2018) have established safety standards for the use of harmful chemicals such as EDCs in personal care products, it does not necessarily guarantee complete safety to consumers. When multiple products containing these chemicals are used concurrently, there exists the potential for a 'cocktail effect', which may result in adverse health consequences (CHEMTrust, 2022). On average, women use 12 different products in a day, many of which contain multiple chemical components (Harvard Health Publishing, 2020). Additionally, the level of exposure to EDCs from sources other than beauty care products is not taken into account. Although each product may contain EDCs within safe limits, the cumulative effect of exposure to these chemicals can cause harm. However, these effects have not been adequately studied (CHEMTrust, 2022).

Therefore, consumers should err on the side of caution and consider EDC-free alternatives among the vast array of personal care products available in the market.

2.2 Consumer-based label equity and the informed consumer

Our study focused on developing a framework designed for researchers, brand managers, and retailers to assess the effectiveness of labels, as opposed to the approach taken by Coderre et al. (2022), who primarily aimed to construct a psychometric scale for exploring the structure of latent variables. The original CBFLE scale (Coderre et al., 2022) relates to values and beliefs associated with a specific food label. Our approach aligns with the methodologies employed by Valette-Florence and De Barnier (2013) and Coderre et al. (2022), both of whom conducted a detailed examination of label equity following the study conducted by Reynolds (1985). Reynolds called for targeted investigations, emphasizing the unique requirements for each research domain and advising against the use of broad, generalized inventories. These studies focused on food label equity while we show that the label equity and the Coderre (2022) scale, including the seven facets, can be utilized to promote consumer products free from EDCs.

Studies show that consumer-based label equity (that is, consumers' knowledge and perceptions of a specific label signalling intrinsic or extrinsic product attributes) has the capacity to generate positive associations about certain aspects of a product, which can increase perceived quality (Carpenter & Larceneux, 2008). The literature also demonstrates that commercial value (e.g., in terms of WTP) can be derived from consumers' knowledge and perception of a product label (e.g., Carpenter & Larceneux, 2008; Sigurdsson et al., 2023). For instance, Sigurdsson et al. (2023) found that the higher the label equity (in terms of familiarity, understanding, and trust), the more consumers are willing to pay for a product. This paper uses label performance as a common term for such commercial value, focusing on WTB, WTE, WTP, and WTR.

Our conceptual model is built on the Coderre et al. (2022) study which identified and validated seven facets of CBFLE: Visibility, Awareness, Clarity, Design, Relevance, Credibility, and Honesty. These dimensions form the underlying structure of our model. Visibility refers to the extent of the consumer's exposure to the label, and their familiarity with it in the marketplace. Awareness refers to the consumer's level of understanding of the meaning and significance of the label. Clarity refers to the ease with which the label's logo can be identified, remembered, and understood. Design refers to consumers' perception of the logo's visual elements. Relevance refers to how relevant the label's criteria are for the consumer. Credibility refers to the level of trust the consumer places in the organization associated with the label. (Dis)honesty refers to the consumer's belief that the label is deceptive and untrustworthy.

2.3 Research foundations and hypotheses

Based on the literature, we proposed that the presence of a third-party label will result in increased willingness to pay, as opposed to its absence (baseline). A warning label is expected to have the opposite effect, resulting in lower WTB, WTP, WTE, and WTR. As such, consumers will be more willing to buy, pay, pay extra, and recommend products with positive labels showing higher (compared to lower) scores on the CBLE scale. In the case of warning labels, they should be less willing to buy, pay, pay extra, and recommend products. Our study included one negative (warning) label, as comparing its performance with the performance of positive labels could prove interesting. However, as the CBLE scale we used is not designed for labels signalling negative information, our hypotheses focus on the four labels signalling positive information. The WTB, WTP, WTE, and WTR measures are all related to consumer value and marketing performance. Figure 1 shows the relationship between the seven facets of consumer-based label equity and WTB, WTP, WTE, and WTR.

Figure 1

A conceptual model for consumer-based label equity on label performance
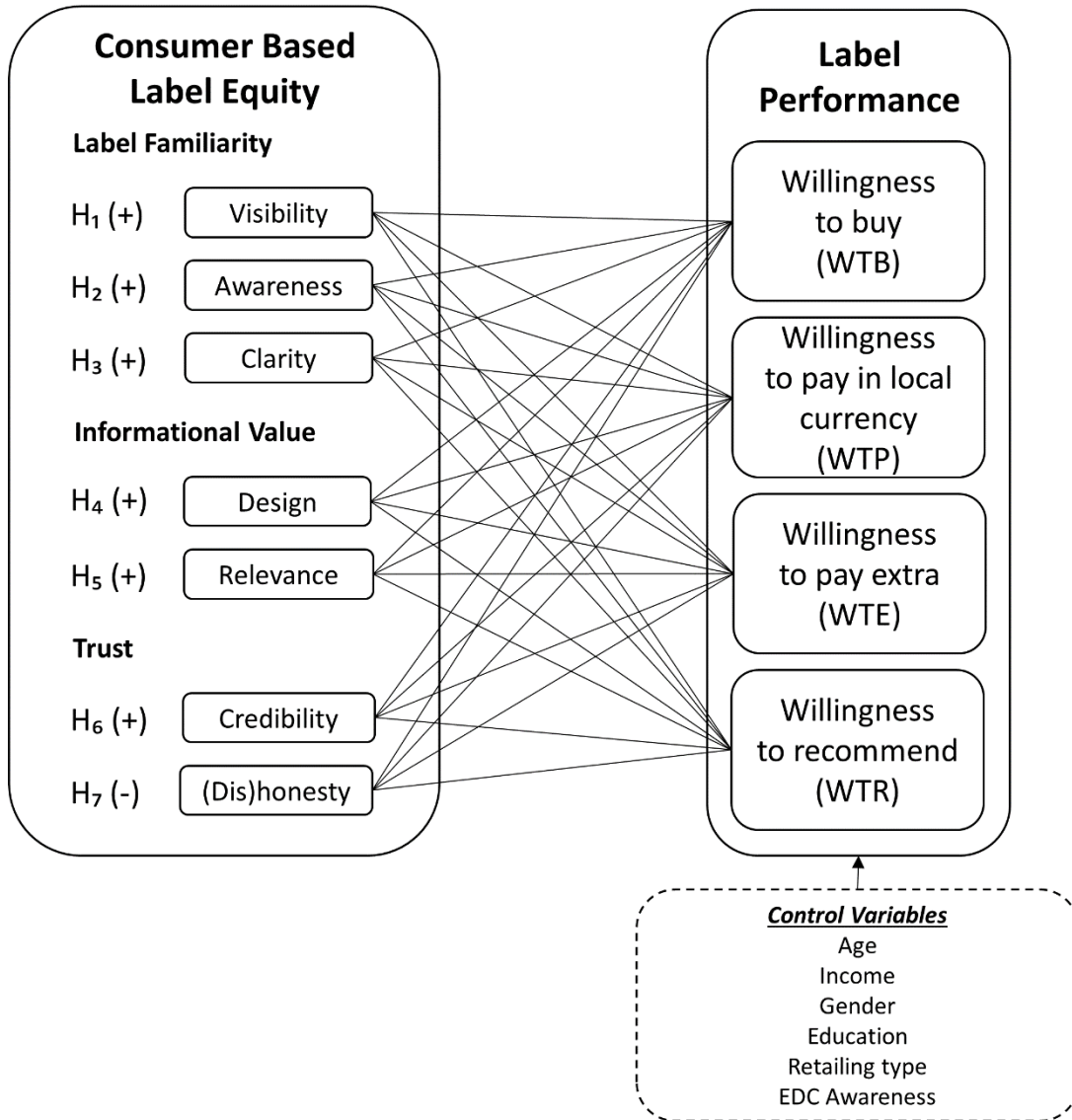
2.3.1 Label Familiarity

According to Coderre et al. (2022), Visibility, Awareness, and Clarity are subsets of label familiarity. *Visibility* is defined as the degree to which a label is recognized by consumers and the ease with which it is located by consumers in the marketplace. Coderre et al. (2022) found that familiarity does not always translate into trust, despite some studies (e.g., Sirieix et al., 2013;

Teisl et al., 2002) suggesting that familiarity with a label can influence consumers' level of caution or trust. Consumers are known to choose well-known brands over lesser-known brands (Colombo & Morrison, 1989). Additionally, consumers' perceptions of food labels can be improved with frequent exposure (Zajonc, 1968). Studies on food labels (Sigurdsson et al., 2022, 2023) have shown that label familiarity is associated with customer preferences and willingness to pay. Since consumers tend to develop a preference for familiar things (Zajonc, 1968), their perception of the value of a product/label can be positively influenced by familiarity. Studies in different contexts have shown a positive relationship between perceived value and willingness to recommend (see e.g., Baker & Fulford, 2016; Lee et al., 2007; Walsh et al., 2014). Therefore, we proposed:

H1: Visibility is positively related to WTB (H1a), WTP (H1b), WTE (H1c), and WTR (H1d) for products that feature labels signalling positive information about the product.

Awareness refers to how well consumers are aware of a label's meaning (Coderre et al., 2022). According to Feucht and Zander (2014), labels are not very helpful to consumers who are ignorant of sustainability and certification processes. Carpenter and Larceneux (2008) demonstrated that consumers' likelihood of purchasing a product increases when they clearly understand the label's meaning and significance. Likewise, there is a positive association between consumers' acceptance of sustainability labels and their understanding of these labels (Grunert et al., 2014). Similarly, value perceptions can be formed without an actual purchase or use of a product (Sweeney & Soutar, 2001). Therefore, an awareness of a label's meaning can have a positive impact on how consumers perceive the value of the product or service and, consequently, their willingness to recommend (Baker & Fulford, 2016; Lee et al., 2007; Walsh et al., 2014). Therefore, we hypothesized:

H2: Awareness is positively related to WTB (H2a), WTP (H2b), WTE (H2c), and WTR (H2d) for products that feature labels signalling positive information about the product.

Clarity is defined as the simplicity with which a label's logo can be seen, remembered, and understood (Coderre, et al., 2022). Food labels frequently have logos that blend various graphic and linguistic design components. Self-explanatory labels are better at communicating their meaning (Grunert et al., 2014), while complicated labels may be more challenging for consumers to comprehend (Nikolova & Inman, 2015). Consequently, the label messages should be easy to understand and emphasize the benefits of the product (Donato & Adgüzel, 2022; Luffarelli et al., 2019). Research has suggested that labels containing familiar meanings are readily identifiable (Henderson & Cote, 1998; Kohli et al., 2002), and when it comes to design components, everyday objects and biological elements (such as a swan) are preferable to abstract logos (Machado et al., 2015). Labels should also incorporate various features, including text/tags, to enhance consumer comprehension and interpretation of their content (Donato & Adgüzel, 2022; Sigurdsson et al., 2022). The simplicity with which a label's logo can be seen, remembered, and understood can positively affect how consumers perceive the value of the product and, thus, their willingness to buy, pay, and recommend the product (Walsh et al., 2014). For instance, Sigurdsson et al. (2023) found that consumers are more willing to pay for products with easily understandable labels. We, therefore, proposed:

H3: Clarity is positively related to WTB (H3a), WTP (H3b), WTE (H3c), and WTR (H3d) for products that feature labels signalling positive information about the product.

2.3.2 Informational Value

According to Coderre et al. (2022), Design and Relevance are the subsets of Informational Value. *Label Design* relates to a label's appeal in terms of its visual and aesthetic elements (Coderre et al., 2022). According to Zepeda et al. (2013), the label's design, including elements such as appearance, perceived beauty, and the use of vibrant colours, influences how well a label attracts consumers' attention. For example, traffic light labels utilizing green, yellow, and red colour codes to indicate varying degrees of environmental friendliness were found to be effective in general grocery shopping (Bernard et al., 2015) as well as in specific product categories such as coffee (Thøgersen & Nielsen, 2016) and seafood (Hallstein & Villas-Boas, 2013). Studies show that a logo's qualities can affect how easily consumers recognize and feel about it (Henderson & Cote, 1998; Machado et al., 2015). Thus, we hypothesized:

H4: Design is positively related to WTB (H4a), WTP (H4b), WTE (H4c), and WTR (H4d) for products that feature labels signalling positive information about the product.

Relevance refers to the significance of the label criteria such as the certification of product origin, production processes, expertise, or trade practices in terms of influencing consumers' consideration of the label (Coderre et al., 2022). The extent to which consumers are motivated to interact with the information on the label is influenced by its relevance. According to Vermeir et al. (2020), eco-labels work best if they are informative and easy to interpret. Consumers are more likely to pay attention to a label if the attributes match their values (Ghvanidze et al., 2017; Zepeda et al., 2013). Relevance also affects consumers' intentions to consult labels before making a purchase. Abdu and Mutuku (2021) showed that consumers were willing to pay more for coffee with organic, fairtrade, and country of origin labels. A label's influence on consumer preference and choice is increased by positive opinions toward it (Grunert et al., 2014; Taufique

et al., 2017). Label relevance should also increase perceived value of the product and, thus, have a positive effect on willingness to recommend (Walsh et al., 2014). Thus, we proposed:

H5: Relevance is positively related to WTB (H5a), WTP (H5b), WTE (H5c), and WTR (H5d) for products that feature labels signalling positive information about the product.

2.3.3 Trust

Coderre et al. (2022) argued that Credibility and (Dis)honesty are two subsets of trust. *Credibility* refers to consumers' trust in the organization that provides a food label (Coderre et al., 2022). Labels are often regarded as a credence attribute due to the frequent inability of consumers to confirm whether a product fits the label criteria (Anisimova & Sultan, 2014). For a label to be effective, it must originate from a reliable source. In fact, studies have shown that consumers favour brands that are regarded as trustworthy (Sigurdsson et al., 2023). Numerous studies have demonstrated the importance of credibility in food label investigations (Janssen & Hamm, 2012; Sigurdsson et al. 2023; Taufique et al, 2017; Vecchio et al., 2016). Erdem and Swait (1998) showed that brand credibility positively influences consumer perceptions of quality, reduces perceived risk, and lowers information costs. These factors collectively contribute to an increase in consumers' expected utility, making them more likely to choose and recommend products from credible brands. Moreover, there is a positive association between brand trust and intentions to recommend and purchase the brand (Japutra et al., 2014). Additionally, brand credibility plays a significant role in influencing consumers' WTP (Dwivedi et al., 2018). Furthermore, perceived value has been found to be associated with trust and willingness to recommend (Walsh et al., 2014). Therefore, we hypothesized:

H6: Credibility is positively related to WTB (H6a), WTP (H6b), WTE (H6c), and WTR (H6d) for products that feature labels signalling positive information about the product.

(Dis)honesty pertains to how consumers view a label as being deceitful or dishonest (Coderre et al., 2022). When consumers encounter marketing messages they perceive as manipulative or improper, it leads to feelings of being deceived and mistrust, resulting in a loss of confidence (Campbell, 1995). Numerous studies have demonstrated the impact of perceived deception on consumer attitudes towards a product and their purchase intention (An et al., 2019; Campbell, 1995; Darke & Ritchie, 2007; Newell et al., 1998). Therefore, we proposed:

H7: (Dis)honesty is negatively related to WTB (H7a), WTP (H7b), WTE (H7c), and WTR (H7d) for products that feature labels signalling positive information about the product.

2.3.4 Control Variables

Findings from a recent systematic review (Pravednikov et al., 2023) showed that people generally perceive EDCs such as Bisphenol A (BPA), pesticides, and polyfluorinated alkyl substances (PFAS) to be risky. Several factors influence EDC risk perceptions, such as knowledge of and familiarity with EDCs, age, gender, education, and income. For instance, greater knowledge of and familiarity with EDCs is associated with a higher risk perception (Hu & Chen, 2021; Rouillon et al., 2017). Several studies have found a positive association between age and the risk perception of various EDCs, with older adults generally perceiving them as riskier than younger adults (e.g., Brewer & Ley, 2011; Ott, 1990). A number of studies (e.g., Brewer & Ley, 2011; Dosman et al., 2001; Knight & Warland, 2005) have discovered a link between gender and the perceived risk of EDCs, with the majority of them finding that women perceive such risks to be higher than do men. Results for education are mixed; that is, they differ

for various EDCs (Viscusi et al., 2020; Williams & Hammitt, 2001), and higher income (Dosman et al., 2001; Hirsch & Baxter, 2009) has been associated with lower EDC-risk perceptions.

In line with existing literature, we anticipate stronger relationships between consumer responses and certain demographics. Specifically, women and older individuals may perceive higher risks, while individuals with more education may have a more defined position on the risk perception of EDCs. Additionally, those with higher incomes might exhibit lower EDC-risk perceptions. Type of retailer was also tested as we anticipated that the effects of labels are stronger for those typically buying their personal care products at specialty stores (pharmacies and cosmetic stores) than at grocery stores. Research shows that products sold in specialty stores are associated with higher levels of perceived product safety (Tse, 1999), and that trust makes consumers prefer to buy their products from a pharmacy rather than a supermarket (Chan & Tran, 2016).

3 Method

3.1 Sample

We collected a total of 1,016 initial submissions via the double-opt-in market research panel from Qualtrics, sourced through its sample partners in Denmark, Sweden, and Norway. Qualtrics ensured validity by excluding duplicate answers by individual users. In addition to the quality checks and data scrubbing by Qualtrics, we followed the recommendations by Craft et al. (2022) and adopted a multistep approach to ensure data quality. We enforced three types of screener questions. The first screener involved an attention check where participants were asked to select a specific number on a slider scale. The data from 395 participants were removed using this screener. The second one was a 'captcha' question where the participants were asked to identify the total number of bicycles from an image. An additional 17 responses were removed

using this question. The final question asked participants to write down the approximate

population of their country. We manually reviewed the responses to this question and removed

two nonsensical responses, such as 'Hshhs sjshhs'. Overall, 59.3% of the responses were

considered valid and used for subsequent analysis. This proportion is much higher than in some

studies using crowdsourcing platforms and response filtering (see, e.g., Webb & Tangney, 2022).

The final sample consisted of 602 responses (mean age = 43.5, *SD* = 15.2, range: 18, 82).

In terms of gender distribution, 55.1% identified as female. As for education, 45.4% of

respondents had at least a bachelor's degree, 28.1% had some college or vocational training,

20.4% had a high school diploma, 1.6% had a professional degree, and 5% had education below

high school level. The sample came from three countries, with 34.7% from Norway, 33.7% from

Sweden, and 31.6% from Denmark. Among the respondents who provided information on their

primary deodorant purchase location (95% of the sample), the majority (58.5%) purchased the

product at grocery stores. Cosmetic stores were the second most common location at 20%,

followed by pharmacies or drugstores at 16.5%. Before collecting data, the research protocol was

evaluated by peer review, assessed as low risk, and subsequently approved by the Human Ethics

Committee at one of the author's universities. All participants received monetary compensation

for their participation in the study. Table 1 shows the basic profile of the respondents versus the

populations in the three Scandinavian countries. As shown in Table 1, the average age and

gender distribution of the sample is similar to the population of the three countries.

Table 1

Contrasting sample demographics with averages from the three countries

Variable	Country	Our sample average	Country average
Age	Denmark	41.4	42.2[a]
	Norway	43.4	41[b]
	Sweden	45.5	41.7[c]
Gender	Denmark	57% females	50.3% females[a]
	Norway	52% females	49.5% females[b]
	Sweden	57% females	49.5% females[d]
Income	Denmark	34,600 DKK	45,481 DKK[a]
	Norway	42,500 NOK	53,150 NOK[e]
	Sweden	32,900 SEK	38,300 SEK[f]

Note. [a] Statistics Denmark (n.d.). [b] Statistics Norway (n.d.). [c] Statistics Sweden (n.d.-a). [d] Statistics Sweden (n.d.-b). [e] Statistics Norway (2023). [f] Statistics Sweden (2023).
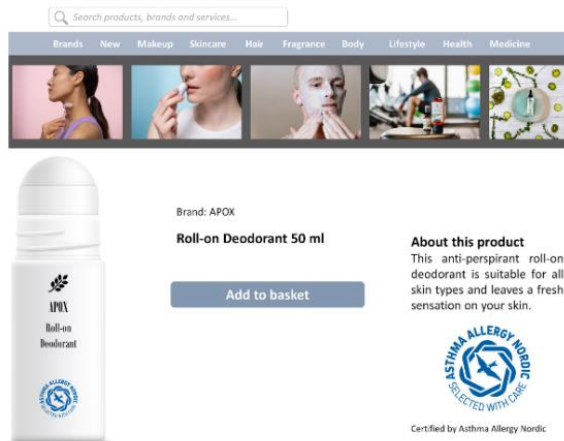
3.2 Procedure and materials

This study used a within-participant design. At the beginning of the study, the participants provided informed consent, which was followed by basic demographic questions. The study task involved evaluating various labels used on deodorant bottles. Prior to evaluating the labels, the participants were asked to evaluate a deodorant product without any label by stating their willingness to pay (WTP), i.e., a price estimate (in a local currency) they were willing to pay for a deodorant without any labelling. Specifically, participants answered the following question: 'What is the maximum amount (in [DKK/SEK/NOK]) you are willing to pay for this product?' We measured this in their local currencies to maximize our measures' ecological validity. This evaluation acted as the baseline. Subsequently, they evaluated (in a random order) five labels, namely Asthma Allergy Nordic, Danish Consumer Council Rated A, Danish Consumer Council Rated C, Nordic Swan, and Ecocert Cosmos Organic, all of which are widely used in the Nordic countries. For a sample task, see Figure 2. The statements within each

question were randomized to account for order effects. To ensure that the potential effects were driven primarily by the type of label rather than other visual aspects of our stimuli (such as the brand name or deodorant description), we exclusively altered the label logos of the presented deodorants while maintaining consistency in other visual elements of the presentation.

Figure 2

A sample evaluation task

Here, participants were asked to evaluate a deodorant product without any label by stating their WTB, WTE, and WTR products on a scale ranging from 0 (*strongly disagree*) to

100 (*strongly agree*). Additionally, the participants also provided a price estimate (in their local currency, referred to as WTP in this article) they were willing to pay for each of the labelled products. Finally, we adapted a seven-item measure of consumer-based label equity, or CBLE, from the CBFLE scale developed by Coderre et al. (2022). Specifically, we selected an item with the highest factor loading from the original instrument that captured Visibility, Clarity, Awareness, Design, (Dis)honesty (this negatively worded item was reverse coded for analysis), Credibility, and Relevance of a labelled product, respectively (sample item: 'I have a preference for products that meet criteria established by the [name of label]'). Although many scales in clinical practice use multiple items to assess complex constructs, in marketing research and practice, single-item tools often have a similar predictive validity and yield similar results to multi-item instruments (Bergkvist & Rossiter, 2007; Rossiter, 2002). Here, participants agreed with the selected seven items on a seven-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). This tool was not administered for an unlabelled deodorant, as the seven questions explicitly referred to labels. To simplify the analysis, we created the consumer-based label equity (CBLE) index by averaging responses to these seven items for each labelled product (Cronbach's alphas ranged from .82 to .88 and means for the index measures ranged from 3.59 to 5.28).

After completing the five dependent measures described above, which were administered in random order, including random ordering of items within measures, participants completed 15 statements from Tan et al.'s (2021) EDC awareness scale. The scale contains 24 statements, but we found nine statements to be irrelevant in this case (i.e., statements coded as General 1; General 6; General 8; Impact 2; Impact 5; Impact 8; E_P 2 r; E_P 3 r; E_P 8 r; see Tan et al., 2021, for details). That scale is designed for health care professionals, so we adjusted the

wording in some cases to make it clearer for the public (e.g., writing 'endocrine-disrupting chemicals' instead of the abbreviated form EDC). We also translated 'endocrine-disrupting chemicals' into the relevant languages (Danish, Norwegian, and Swedish), to ensure validity. The statements were randomized for each question. Participants indicated their agreement with the 15 items on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*; e.g., 'I can give examples of kitchenware and utensils where endocrine-disrupting chemicals [EDCs] can be found.'). These items were averaged to create an EDC index (Cronbach's alpha = 0.88, omega = 0.88, $M = 3.72$, $SD = 1.02$). A factor analysis using the minimum residual (minres) solution (unweighted least squares solution) demonstrated the feasibility of extracting a single factor with loadings between 0.27 and 0.86. Because only one item exhibited loadings below the 0.30 threshold, we inferred that the scale could have been treated as unidimensional, especially in the light of this measure not being our focal predictor. We embedded the first attention check question in this measure ('After reading this question, choose the number six using the slider'). To complete the survey, participants indicated where they primarily purchased deodorant, reported their education, listed the number of children living in their household, and their monthly income, and answered the two additional attention check questions. In these attention check items, they had to indicate the number of bicycles in a 'captcha' picture ('How many bicycles do you see in the image below?') and provide a free-text response to the question about the approximate number of people living in their country ('How many people more or less live in your country?').

We decided against translating the entire survey into the relevant languages (Danish, Norwegian, and Swedish) to avoid introducing potential language-specific confounds to data, so the survey was conducted in English. This meant that participants, apart from the key term

'endocrine-disrupting chemicals', read instructions in English and provided their responses in English. Knowledge of English was a prerequisite for participation, a criterion readily fulfilled in these Nordic countries, each ranking highly on the EF English Proficiency Index: Norway (4th), Denmark (5th), and Sweden (7th), globally (EF Education First Ltd., 2022). We ran separate surveys in the three countries. Key terms were translated into the relevant languages (Danish, Norwegian, and Swedish) and the currency referred to in each study was relevant for that country (Danish krona, Norwegian krona, and Swedish krona).

4 Results

The descriptive results for the five tested EDC-labels are presented in Table 2, both for positive signals as well as negative (warning) signals. Given the within-subjects design, in which we captured the dependent measures multiple times across participants (i.e., the nested data structure), we fit linear mixed models to account for autocorrelations in the data using the *lme4* package for R (Bates et al., 2014) and estimated degrees of freedom and significance levels using the *lmerTest* package (Kuznetsova et al., 2017). The table with the models' output was generated automatically using the *stargazer* package (Hlavac, 2022). All analyzes were performed in R version 4.2.2 (R Core Team, 2022).

4.1. Willingness to pay for a labelled deodorant compared with a baseline condition

We began the analysis by testing whether adding a label to a presented deodorant increased WTP compared to the baseline condition (i.e., deodorant without any added label). Thus, as a reference, we input the baseline condition in the model. Here, we used the same random effects' structure as described above. Compared to the baseline (DEN $M = \$5.70$, NOR $M = \$4.98$, SWE $M = \$3.69$), participants wanted to pay more for deodorants with Asthma Allergy Nordic label, DEN $M = \$6.50$, NOR $M = \$5.50$, SWE $M = \$4.22$, $\beta = 0.19$, SE $= 0.03$, $t(3011.64) = 7.34$, p

<0.001, and with the Nordic Swan label, DEN M = $8.17, NOR M = $5.85, SWE M = $5.09, β = 0.48, SE = 0.03, t(3011.64) = 18.35, p <0 .001. However, we found no statistically significant differences between the baseline and the Danish Consumer Council Rated A, DEN M = $6.26, NOR M = $4.79, SWE M = $3.66, β = 0.02, SE = 0.03, t(3011.64) = 0.65, p = 0.513. Contrary to the positive effects of labelling on WTP reported above, participants were willing to pay less for deodorants with Danish Consumer Council Rated C, DEN M = $5.47, NOR M = $4.52, SWE M = $3.52, β = -0.09, SE = 0.03, t(3011.64) = -3.55, p < 0.001, and also for the Ecocert Cosmos Organic, DEN M = $5.57, NOR M = $4.66, SWE M = $3.64 β = -0.05, SE = .03, t(3011.64) = -1.97, p = 0.049, than for the unlabelled deodorant.

4.2 Label Performance

All the models described below have the same random effects structures as described above, i.e., we added by-participant and by-country random slopes. We used WTB, WTR, WTE, and WTP as outcome variables (see below for more details) and described the predictors (fixed effects) before each analysis. Before the analyses, we scaled (z-scored) the WTP measures because each of the three countries studied used a different currency (i.e., we wanted to make the responses comparable across countries). In all the analyses presented herein, we opted not to classify labels as 'positive' or 'negative'. This was because our study adopted an inductive approach, focusing on examining the potential impacts of labels that are either commonly used or gaining traction in the three Nordic nations.

Table 2

Descriptive findings for five EDC-related labels, comparing positive signalling against negative signalling

Measure / Label type	Country	WTB M	WTB SD	WTP ($) M	WTP ($) SD	WTE M	WTE SD	WTR M	WTR SD	CBLE M	CBLE SD
EDC-related label: Positive signalling											
Asthma Allergy	Denmark	63.5	27.1	6.50	3.71	44.8	30.5	58.3	28.9	4.49	1.17
Nordic	Norway	58.1	25.5	5.50	3.17	40.3	27.8	52.7	26.0	4.19	1.08
	Sweden	62.4	26.1	4.22	2.23	42.3	28.9	58.0	27.3	4.33	1.19
Danish Consumer	Denmark	59.6	29.4	6.26	3.78	44.6	30.8	54.0	30.6	4.22	1.30
Council Rated A	Norway	46.5	27.2	4.79	3.14	32.7	27.9	41.8	28.3	3.60	1.24
	Sweden	45.9	29.2	3.66	2.11	33.2	29.3	44.0	29.0	3.56	1.30
Nordic Swan	Denmark	72.4	24.5	8.17	5.43	52.8	29.8	66.6	27.6	5.34	1.15
	Norway	68.1	24.4	5.85	3.25	47.7	28.3	62.0	27.6	5.19	1.21
	Sweden	71.6	23.2	5.09	3.01	51.1	28.8	66.5	24.9	5.33	1.14
Ecocert Cosmos	Denmark	48.0	29.0	5.57	3.77	36.1	30.8	43.3	29.1	3.64	1.43
Organic	Norway	44.7	28.4	4.66	3.02	32.3	28.9	40.5	29.1	3.54	1.33
	Sweden	46.4	29.2	3.64	2.16	36.6	31.0	43.5	31.5	3.60	1.46
Warning label: Negative signalling											
Danish Consumer	Denmark	47.7	29.4	5.47	3.82	34.5	31.0	43.6	29.8	3.87	1.34
Council Rated C	Norway	42.2	26.5	4.52	3.12	30.2	27.7	37.9	27.1	3.52	1.21
(warning)	Sweden	43.6	28.3	3.52	2.13	30.7	27.8	39.4	27.6	3.46	1.27

Note. WTR denotes willingness to recommend. WTB stands for the willingness to buy. WTE denotes willingness to pay extra. WTP ($) denotes willingness to pay in a local currency, converted to USD for readability. We used the following conversion rates determined by Google on 4/29/2023: 1 DKK = 0.1478 USD; 1 NOK = 0.0941 USD; 1 SEK = 0.0974. CBLE represents consumer-based label equity index.

Whereas comparing the effects of specific labels on outcome variables was not the primary goal of this research, i.e., CBLE was our main predictor, Table 2 shows that there may be country-specific effects of label type. Further research is needed to confirm this prediction. As shown in the table, Denmark probably has the highest prices for deodorants among the three selected Nordic countries. Interestingly, there is no clear trend in WTP (in $) when comparing the warning label to all other labels.

4.3 CBLE Index as a predictor for label performance

We performed a similar analysis with CBLE Index as a predictor for label performance. Again, we used WTR, WTB, WTE, and WTP (z-scored) as dependent measures. As a main predictor, we added the consumer-based label equity index (CBLE). We controlled for type of

labelling (because the baseline deodorant was not labelled, it was excluded from the analysis), and an endocrine-disrupting chemical (EDC) awareness questionnaire index (as a control variable). We did not specify any interactions between the three variables. The results of these four models for each dependent measure are shown in Table 3 below. The main purpose of this analysis was testing whether CBLE was predictive of each of the dependent variables: WTB, WTP, WTE, and WTR while controlling for label type and an endocrine-disrupting chemical (EDC) awareness questionnaire index.

As shown in Table 3, CBLE was predictive of WTB, WTP, WTE, and WTR[1]. This positive association between CBLE and the outcome variables remained statistically significant despite the inclusion of covariates in the model (i.e., label type and EDC scale index).

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[1] As pointed out in Section 2.3, the positive effects predicted for positive signals should reverse the data separately for a warning label (Danish Consumer Council Rated C). Contrary to this prediction, the positive association between the CBLE index and the dependent measures WTE, WTB, WTP, and WTR remained significant when the data were partitioned for the warning label only, all ps <0.001.

Table 3

WTB, WTP, WTE, and WTR based on labels, CBLE, and EDC awareness

Predictor / Dependent variable	WTB Regression coefficient	WTP (z-scored) Std. regression coefficient	WTE Regression coefficient	WTR Regression coefficient
Intercept	-9.01 (-13.59; -4.43)***	-1.96 (-2.20; -1.72)***	-38.64 (-43.74; -33.55)***	-21.75 (-26.41; -17.08)***
CBLE	13.27 (12.65; 13.89)***	.18 (0.16; 0.19)***	10.93 (10.32; 11.55)***	13.82 (13.22; 14.41)***
Danish Consumer Council Rated A	-3.56 (-5.32; -1.81)***	-.08 (-0.13; -0.03)**	0.21 (-1.49; 1.91)	-2.29 (-3.97; -0.61)**
Danish Consumer Council Rated C	-7.28 (-9.06; -5.50)***	-0.16 (-0.21; -0.11)***	-2.76 (-4.48; -1.03)**	-6.08 (-7.78; -4.37)***
Ecocert Cosmos Organic	-5.16 (-6.94; -3.37)***	-.12 (-0.17; -0.06)***	0.63 (-1.09; 2.36)	-3.63 (-5.34; -1.93)***
Nordic Swan	-3.28 (-5.10; -1.46)***	.12 (0.07; 0.18)***	-2.34 (-4.11; -0.58)**	-4.43 (-6.18; -2.69)***
EDC scale	3.44 (2.29; 4.59)***	.35 (0.29; 0.41)***	9.06 (7.78; 10.34)***	4.88 (3.76; 5.99)***

Note. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

Brackets show 95% confidence intervals (CIs). Asthma Allergy Nordic is a reference category. Negative coefficients for the covariates (i.e., label type) are justified given that we used multiple regression, which by default estimates coefficients for each of the categorical variables (labels) separately, applying 'all other things being equal' logic.

4.4 The seven facets of CBLE as predictors

Although CBLE treated as an index (averaged) measure was positively associated with the dependent variables, it was unclear whether all facets of the construct were predictive of WTB, WTP, WTE, and WTR deodorants. Therefore, we conducted additional analysis separately for each of the seven facets of CBLE, i.e., Visibility, Awareness, Clarity, Design, Relevance, Credibility, and (Dis)honesty. Table 4 shows the descriptive results for each of the seven facets, based on the label tested and the consumers' country.

Table 4

Descriptive results for each of the seven facets, based on the label tested and the consumers'
country

Measure / Label type	Country	Visibility		Awareness		Clarity		Design		Relevance		Credibility		Honesty	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
EDC-related label: Positive signalling															
Asthma Allergy	Denmark	4.03	1.68	4.22	1.98	4.76	1.61	4.48	1.61	4.06	1.81	4.59	1.55	5.26	1.65
Nordic	Norway	3.80	1.54	3.72	1.81	4.28	1.63	4.35	1.40	4.03	1.68	4.26	1.46	4.87	1.64
	Sweden	3.84	1.60	3.91	1.95	4.53	1.74	4.57	1.53	3.94	1.73	4.48	1.60	5.08	1.61
Danish Consumer	Denmark	3.64	1.69	3.86	1.98	4.56	1.74	4.15	1.79	4.06	1.85	4.42	1.71	4.88	1.85
Council Rated A	Norway	3.21	1.69	2.78	1.75	3.92	1.76	3.48	1.71	3.16	1.73	3.70	1.63	4.94	1.54
	Sweden	3.08	1.75	2.76	1.91	4.08	1.76	3.51	1.76	3.18	1.76	3.59	1.69	4.75	1.61
Nordic Swan	Denmark	5.51	1.37	5.37	1.56	5.35	1.53	5.19	1.61	5.62	1.43	5.56	1.80	5.51	1.37
	Norway	5.23	1.52	4.93	1.74	5.55	1.40	4.96	1.57	4.67	1.65	5.29	1.42	5.72	1.62
	Sweden	5.39	1.42	5.03	1.68	5.75	1.31	5.15	1.49	4.75	1.69	5.46	1.43	5.73	1.66
Ecocert Cosmos	Denmark	3.25	1.82	3.16	2.05	3.75	1.89	3.70	1.85	3.44	2.00	3.57	1.74	4.64	1.75
Organic	Norway	3.15	1.66	2.94	1.86	3.79	1.83	3.50	1.73	3.17	1.85	3.44	1.71	4.79	1.62
	Sweden	3.21	1.90	2.92	1.97	3.77	1.95	3.84	1.94	3.05	1.86	3.62	1.79	4.79	1.62
Warning label: Negative signalling															
Danish Consumer	Denmark	3.37	1.80	3.55	1.99	4.01	1.92	3.73	1.88	3.36	1.83	3.55	1.69	4.75	1.84
Council Rated C	Norway	3.24	1.64	2.89	1.82	3.71	1.75	3.24	1.68	3.02	1.70	2.89	1.64	4.96	1.54
(warning)	Sweden	3.10	1.75	2.70	1.89	3.89	1.75	3.34	1.77	2.93	1.74	2.70	1.74	4.79	1.62

Note. The responses for (dis)honesty have been recoded to show honesty values. Therefore, those who rated a label high on this scale believed the label to be honest.

We also added several covariates to the model: the averaged score of the endocrine-disrupting chemical (EDC) awareness questionnaire (continuous variable), participants' age (continuous variable), gender (categorical variable), average monthly income (continuous variable; z-scored), education level (categorical variable), information about where they primarily bought deodorants (categorical variable), and label type (categorical variable).

As Table 5 shows, all seven facets of CBLE were positively associated with willingness to buy (WTB) and willingness to recommend (WTR). Further, within this model, we found positive associations between willingness to pay extra (WTE) and the following five facets of CBLE: Visibility, Awareness, Design, Relevance, and Credibility. However, Clarity and (Dis)honesty were not statistically associated with WTE. Moreover, only three facets of CBLE were positively related to willingness to pay (WTP) in a local currency (z-scored): Design,

Relevance, and Credibility. The remaining facets, i.e., Visibility, Awareness, Clarity, and

(Dis)honesty, were not statistically associated with this dependent measure. Table 5 also shows

the remaining results of this model not reported in the hypothesis development section. Table 6

presents a summary of the results in relation to the hypotheses derived from the Coderre et al.

(2022) scale, and the control variables in terms of our expectations based on previous findings.

Table 5

The results from the model with each of the seven facets of CBLE, background variables and

labels

Dependent variable / Predictor	WTB Regression coefficient	WTP (z-scored) Std. regression coefficient	WTE Regression coefficient	WTR Regression coefficient
Intercept	-0.02 (-9.01; 8.97)	-1.45 (-1.90; -1.00)***	-24.08 (-33.63; -14.52)***	-5.51 (-14.10; 3.09)
CBLE (visibility)	1.14 (0.51; 1.77)***	0.00 (-0.02; 0.02)	0.75 (0.14; 1.37)*	0.93 (0.33; 1.53)**
CBLE (awareness)	0.91 (0.33; 1.48)**	0.00 (-0.02; 0.02)	0.98 (0.42; 1.54)***	1.18 (0.64; 1.73)***
CBLE (clarity)	1.02 (0.45; 1.59)***	0.00 (-0.02; 0.02)	-0.08 (-0.63; 0.47)	1.09 (0.55; 1.63)***
CBLE (design)	3.05 (2.47; 3.63)***	0.07 (0.05; 0.09)***	3.35 (2.78; 3.91)***	3.11 (2.56; 3.66)***
CBLE (relevance)	2.98 (2.39; 3.57)***	0.05 (0.04; 0.07)***	3.85 (3.28; 4.43)***	3.79 (3.22; 4.35)***
CBLE (credibility)	2.39 (1.73; 3.05)***	0.03 (0.01; 0.05)*	0.98 (0.34; 1.62)**	2.21 (1.59; 2.84)***
CBLE ([dis]honesty)	1.42 (0.94; 1.91)***	0.02 (-0.00; 0.03)	0.44 (-0.04; 0.92)	0.91 (0.45; 1.38)***
EDC awareness(scale)	2.76 (1.45; 4.07)***	0.26 (0.20; 0.33)***	7.10 (5.71; 8.48)***	3.51 (2.27; 4.74)***
Age	-0.15 (-0.23; -0.08)***	-0.01 (-.001; -0.00)**	-0.18 (-0.27; -0.10)***	-0.16 (-0.23; -0.08)***
Monthly income (z-scored)	0.32 (-0.97; 1.60)	0.13 (0.06; 0.20)***	0.67 (-0.71; 2.04)	0.27 (-0.94; 1.49)
Gender (male)	-0.25 (-2.56; 2.07)	0.02 (-0.10; 0.14)	-0.70 (-3.17; 1.76)	-2.30 (-4.48; -0.13)*
Education (high school)	1.95 (-4.02; 7.93)	0.11 (-0.20; 0.42)	4.49 (-1.89; 10.88)	1.01 (-4.63; 6.64)
Education (vocational training)	4.75 (-1.52; 11.02)	0-.16 (-0.48; 0.17)	3.84 (-2.83; 10.51)	3.47 (-2.41; 9.36)
Education (professional degree)	-0.42 (-12.65; 11.81)	0.09 (-0.54; 0.72)	4.12 (-8.90; 17.14)	-2.78 (-14.27; 8.70)
Education (some college)	3.54 (-2.62; 9.71)	-0.06 (-0.38; 0.26)	5.46 (-1.11; 12.03)	1.28 (-4.52; 7.08)
Education (BA degree)	3.86 (-2.00; 9.71)	-0.01 (-0.31; 0.29)	3.78 (-2.46; 10.02)	0.42 (-5.09; 5.92)
Education (MA degree)	4.88 (-1.55; 11.31)	0.03 (-0.31; 0.36)	7.29 (0.44; 14.13)*	0.25 (-5.79; 6.29)
Education (PhD)	0.16 (-11.88; 12.21)	-0.10 (-0.73; 0.52)	0.51 (-12.32; 13.34)	-4.97 (-16.29; 6.34)
Primary place of buying deodorants (cosmetics store)	-2.56 (-5.51; 0.40)	0.34 (0.18; 0.49)***	4.87 (1.71; 8.03)**	-0.17 (-2.96; 2.61)
Primary place of buying deodorants (pharmacy)	-0.49 (-3.73; 2.75)	0.48 (0.31; 0.64)***	4.51 (1.06; 7.95)*	0.59 (-2.46; 3.63)
Primary place of buying deodorants (other)	-6.36 (-11.39; -1.34)*	-0.06 (-0.32; 0.20)	-2.42 (-7.77; 2.93)	-4.49 (-9.21; 0.23)
Label (Danish Consumer Council Rated A)	-3.65 (-5.50; -1.79)***	-0.08 (-0.13; -0.02)**	0.10 (-1.68; 1.89)	-2.42 (-4.18; -0.65)**
Label (Danish Consumer Council Rated C)	-6.70 (-8.59; -4.82)***	-0.14 (-.20; -0.09)***	-2.13 (-3.95; -0.32)*	-5.57 (-7.37; -3.78)***
Label (Ecocert Cosmos Organic)	-5.65 (-7.52; -3.78)***	-0.12 (-.18; -0.06)***	0.10 (-1.70; 1.91)	-4.23 (-6.02; -2.44)***
Label (Nordic Swan)	-2.07 (-4.03; -0.12)*	0.17 (0.11; 0.23)***	-0.75 (-2.64; 1.13)	-2.96 (-4.83; -1.10)**

Note. *p < 0.05; **p < 0.01; ***p < 0.001. Brackets show 95% confidence intervals (CIs). Reference categories are as follows: gender: female; education: below high school; primary place of buying deodorants: grocery stores; label: Asthma Allergy Nordic.

Table 6

Summary of results in relation to hypotheses and control variables for positive labels

Hypotheses	Expected	WTB	WTP ($)	WTE	WTR
H1 Visibility	(+)	Supported	Not supported	Supported	Supported
H2 Awareness	(+)	Supported	Not supported	Supported	Supported
H3 Clarity	(+)	Supported	Not supported	Not supported	Supported
H4 Design	(+)	Supported	Supported	Supported	Supported
H5 Relevance	(+)	Supported	Supported	Supported	Supported
H6 Credibility	(+)	Supported	Supported	Supported	Supported
H7 (Dis)honesty	(-)	Supported	Not supported	Not supported	Supported

Control variables	Expected	WTB	WTP ($)	WTE	WTR
EDC Awareness	Increased awareness increases label performance	Supported	Supported	Supported	Supported
Age	Label performance increases with the consumers' age	Contradictory	Contradictory	Contradictory	Contradictory
Income	Higher income increases label performance	Not supported	Supported	Not supported	Not supported
Gender:	Males show lower WTB/WTP/WTE/WTR	Not supported	Not supported	Not supported	Supported
Retailing type	Consumers purchasing deodorants in cosmetics stores show higher WTB/WTP/WTE/WTR	Not supported	Supported	Supported	Not supported
Education	Higher education increases label performance	Not supported	Not supported	Not supported*	Not supported

Note: * In the case of respondents whose highest level of degree was MA, WTE was higher than of those whose highest level of degree was below high school.

5 Discussion and conclusions

The results show that deodorants with labels high in CBLE can outperform unlabelled deodorants (baseline), in terms of willingness to pay (answering RQ3). However, when asked to indicate how much they were willing to pay (WTP) in their national currency (this variable was z-scored by the country for the analysis), they only wanted to pay more for Asthma Allergy Nordic and Nordic Swan deodorants than for an unlabelled (baseline) deodorant. On the contrary, consumers showed a lower WTP for deodorants with Danish Consumer Council Rated C and Ecocert Cosmos Organic than for a deodorant without any labelling. There was no statistically significant difference in WTP between the baseline deodorant and deodorant with the Danish Consumer Council Rated A label.

Consistent with our predictions, the seven-item consumer-based label equity (CBLE) measure adapted from Coderre et al. (2022) showed positive associations with all these dependent measures (answering RQ1), indicating the effectiveness of this brief instrument in predicting consumers' propensity to purchase labelled products across specific product categories (the original 26-item scale was developed for food labels, specifically; for details, see Coderre et al., 2022). Consumers' awareness of endocrine-disrupting chemicals was also positively associated with all dependent measures (answering RQ5), indicating the potential importance of educating consumers about EDCs in products.

Regarding the Nordic Swan label, the results correspond with the findings of Bjørner et al. (2004), revealing a significant effect of this general label on Danish consumers' brand choices and willingness to pay for toilet paper. The Nordic Swan label has a long tradition in Scandinavia, and many consumer products carry this label. The findings, therefore, point in the direction of stronger effects for more general labels (The Nordic Swan, see Table 2), everything

else kept constant, as they have overall more opportunities to build up label equity than those explicitly designed to communicate safety in relation to EDCs (such as Kemiluppen, answering RQ4).

5.1 Research contributions

This current paper contributes in multiple ways to the limited body of research that currently exists on the topic of using certifications in retailing to assist consumers in avoiding endocrine-disrupting chemicals. It also reveals its importance for retailing. The data confirms that consumers' awareness about EDCs is positively linked to label performance (WTB, WTP, WTE, and WTR) when the product has a label related to EDCs and that all labels tested led to an improvement in consumer value, demonstrating their potential for deriving commercial value.

The findings document that consumers were more willing to buy, pay, pay extra, and recommend products with sustainability or health labels with higher scores on items belonging to the three constructs (Label Familiarity, Informational Value, and Trust) put forward by Coderre et al. (2022), answering RQ2.

Label familiarity (Visibility, Awareness, Clarity) were not related to WTP, rejecting hypotheses H1b, H2b, and H3b. They were found to be related to WTB, WTE, and WTR, with the exception of WTE and clarity, rejecting hypothesis H3c and accepting H1a, H1c, H1d, H2c, H2d, H3a, and H3d. The lack of correlation with WTP could be because of lack of relevance, further backed up by the statistical relationship between the two variables belonging to informational value (Design and Relevance). Hypotheses H4a-d and H5a-d, for Design and Relevance, were all accepted. A consumer can be familiar with a label, but if the label is not relevant to them the WTP may not increase since attributes matching consumers' values increases the likelihood of consumers paying attention to a label (Ghvanidze et al., 2017; Zepeta

et al., 2013). The third and last category, trust, consists of Credibility and (Dis)honesty. WTP

and WTE in the case of (Dis)honesty were not supported, but all others were.

This adds to the previous literature on CBLE (e.g., Coderre et al., 2022; Sigurdsson et al.,

2023), by showing that this construct, which was initially developed to assess food products (i.e.,

CBFLE), can be used to measure label performance in other product categories (i.e., deodorants).

Furthermore, comparing the effects of more general environmental and health labels with labels

explicitly designed to communicate safety in relation to harmful chemicals showed more effects

for general labels with higher CBLE. Shortening the 21-item Coderre et al.'s (2022) scale

showed that a seven-item scale can deliver the same outcome as the longer version, making it

more suitable for experimental work. The CBLE index for the selected labels was positively

associated with WTB, WTP, WTE, and WTR in the context of personal care products,

demonstrating the value of the Coderre et al. (2022) scale outside the context (food) for which it

was primarily developed. Furthermore, the consumer-based label equity seems to be a

unidimensional construct, at least when measured with the newly developed instrument, as

evidenced by high correlations across the seven items used in our study. However, to confirm the

unidimensionality of this instrument, further research is needed in which labels are not

manipulated between participants to ensure that the interpretation of results is not affected by

spurious correlations stemming from the effects of the labelling.

Interestingly, the association between three of the dependent variables (i.e., WTB, WTE,

and WTR) and predictors was stronger in the case of our newly developed seven-item measure

of CBLE than in the case of the EDC scale, as shown by the regression coefficients and

nonoverlapping confidence intervals in Table 2 between these two predictors (both measures had

the same response formats, so their regression coefficients can be compared). Therefore, if

researchers are interested in examining the effects of various EDC labelling schemes on these purchase-related variables, the seven-item CBLE measure may be a more appropriate choice than the instrument capturing awareness about EDCs.

Lastly, the data shows that the effects of labelling on consumption-related outcomes are generalizable across Scandinavian countries despite differences in the local market presence of these labels.

5.2 Practical implications

Earlier studies have reported low awareness of EDCs (see, e.g., Kelly et al., 2020). Rouillon, et al., (2017), building on semi-structured interviews with 300 pregnant women in France, found a mean score for knowledge of EDCs of 42.9 ± 9.8 out of 100. Our research also follows this for general Scandinavian consumers, as the average score on the EDC index was 3.72 on a seven-point scale (equivalent to 53 out of 100). Label performance increases with higher EDC knowledge, which is encouraging for partners in the value chain to collaborate on increased awareness. This points toward an opportunity to inform consumers further about the risks associated with EDCs, further increasing the label performance. Our practical recommendations follow these lines: educating consumers, utilizing labels more effectively, and avoiding warning labels for risks that are not well known and/or have a relatively low CBLE.

Increasing awareness and knowledge: Retailers could launch campaigns intended to increase awareness of the risks associated with EDCs and possibly work with interest groups and the government. Kelly et al., (2020) explored EDC awareness with six focus groups in Northern Ireland, consisting of 34 participants. They recommended a quantitative study using a larger sample, in line with what we have done in the current research using a representative sample from Scandinavia. Kelly et al., (2020) mentioned that some of those who were familiar with

EDCs had learned about the danger from social media posts. We think that could be an efficient communicational channel that should be tested., building the content around the conceptual model in Figure 1 and the seven factors, especially testing out design, relevance, and credibility of the labels – as they were significantly related with all four dependent variables.

Utilize labels effectively: The data illustrates that labelled products (The Nordic Swan and Asthma Allergy Nordic) outperformed unlabelled products in terms of WTP. The Nordic Swan looked particularly promising (see Table 2), especially in Denmark as an example, where WTP for a deodorant with the Nordic Swan label was 43.33% higher than for the baseline (no label), in line with the high CBLE. Executives, policy makers and researchers should closely watch successful labels. The Nordic Swan has a generalized strategy – being seen on different products in different industries – giving consumers more opportunities to learn about it. Unlabelled products had higher WTP than some of the labels, so executives need to be careful (see section 4.1). Managers should carefully choose labels that resonate with their target audience. The Nordic Swan tended to score highest on the seven facets (see Table 3), scoring high on the CBLE index and in terms of label performance. The data indicates that the general approach is stronger than a narrow approach, as we observe in the case of the Nordic Swan in this study, which outperformed labels with a narrower approach.

Avoid misleading labels: Warning labels (such as the Danish Consumer Council C rating, intended to protect the consumer) can backfire if consumers are not well aware of what the label communicates and those labels can then unintentionally mislead consumers. It had the same WTP attached to it as the Ecocert Cosmos Organic. The Danish Consumer Council C scored low on awareness (as seen in Table 4; however, as label equity rises, WTP increases.

5.3 Limitations and future research

The Danish Consumer Council Rated A and C labels were used outside their normal context as part of this research. Unlike the Asthma Allergy Nordic, the Nordic Swan, and the Ecocert Cosmos Organic, the Danish Consumer Council Rated A and C labels are linked to a specialized service from the Danish Consumer Council that consumers can use to check for EDC (website and app). In general, this means that a consumer who uses the app (Kemiluppen) to scan the barcode of a product to check for EDC already has some knowledge about the labels and of EDCs, and can also access more information while using the app. However, the A rating has already started appearing in online stores next to product images, but consumer education is needed to increase the label's CBLE and, thus, its performance. Furthermore, labels adding negative information (warning labels, such as the C rating by the Danish Consumer Council) are interesting and deserve studies dedicated to exploring their CBLE and connections to label performance.

We found that over 40% of participants recruited via Qualtrics failed simple attention check questions. Therefore, our methodological contribution is – aside from questioning the ways of measuring WTP and other aspects of label performance (see above) – proposing a several-step approach to ensuring data quality. Specifically, we encourage other researchers who use crowdsourcing platforms to use at least one 'captcha' question and embed one or two questions in the main body of the questionnaire to ensure that participants indeed read instructions. Further, we showed that the results obtained from WTB, WTE, and WTR measures are largely similar; hence, to maintain the cost-effectiveness of research designs that marketing practitioners seek, studies assessing the effects of labelling on consumption-related responses may use only one of these measures. The age and gender ratio of our respondents corresponds

well with the national averages, however, the average income of the sample was lower than the national averages. That is something to take notice on for further studies. Focusing exclusively on the Scandinavian countries Denmark, Sweden, and Norway was deliberate. We therefore advise against generalizations without further studies. These nations are advanced when it comes to adopting and enforcing comprehensive labeling standards, making them particularly fertile ground for our research questions and a good benchmark. The insights derived are both significant and actionable for policymakers and stakeholders within this context. Furthermore, it presents an avenue for future studies to expand this research to other geographical- and cultural contexts, broadening the understanding of CBLE for EDC related labels.

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