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ORIGINAL ARTICLE

A model of brick-and-mortar grocery retail store atmosphere and its moderation by interventions among young adults

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Abstract
The atmosphere of a brick-and-mortar store is gaining importance in the current digitalization and dynamic changes in consumer behaviour, with an emphasis on the young adult segment within retail research and practice. The theoretical basis brought the proposal of a model of store atmosphere containing sensory aspects, sales environment, and social environment. The key determinants of the perception of store atmosphere were identified as sex, region, household income, and frequency of use of loyalty programs. The model achieved a high level of validity and reliability. The primary research focused on young adults and identified key points of orientation of management practice in retail for generating a more favourable store atmosphere. We also identified and specified the effects of the studied determinants. It can be expected that women and low-income households will perceive the store atmosphere as a more important aspect of the shopping experience. Loyalty program users are prone to perceive sensory aspects of the store atmosphere. The results thus complement the retail-oriented knowledge base with the possibility of direct application and intervention in managerial and business practice.

Keywords Store atmosphere · Retail · Store atmosphere model · Sensory perception · Store environment

Introduction

The concept of store atmosphere is based on studies from the 1970s, when it was understood as the intentional creation of an environment that activates emotional customer responses for the purpose of shopping stimulation (Rayburn et al. 2022). In food retail, store atmosphere plays an important role, as it is an environment with high shopping intensity and relatively low intensity of planning of purchase decisions (Musasa and Tlapana 2023), which gives room for impulsive purchases created on the basis of store atmosphere (Barros et al. 2019).

Although several studies have developed this concept and emphasized its multidimensional nature (e.g., Errajaa, 2025; Zhou and Salleh Hudin 2025), only a few studies have shown an effort to measure the atmosphere of a brick-and-mortar food retail store, which represents a significant research gap that our paper seeks to fill. It is important to note that although the literature review provides some hints about the construct of the model and its possible determinants, there is no study that would empirically test these ideas and create a comprehensive overview specifically for young adults within the grocery store atmosphere.

Pal and Srivastava (2024) emphasise the need to understand the concept of sensory perception more in the context of multisensory perceptions. Barros et al. (2019) identified three factors of the store atmosphere: (1) atmospheric factors such as atmosphere, (2) design and (3) staff; however, it is necessary to emphasise that young adults perceive design in the context of current trends of minimalism, cognitive fluency, beauty penalty and efficiency more as a tool of efficiency and only subsequently as a tool of aesthetics, which must also be reflected in research in the field of retail (Chen and Liu 2023; Lekaj et al. 2023; Li 2025).

The young adult segment has significant specificities for which research is appropriate in this segment. This mainly concerns a change in consumer behaviour towards other segments when these consumers are more emotionally sensitive (Nekić 2023), less sensitive to price in the context of perceived values (Gomes et al. 2023), they use the

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digital environment more (Fergurson et al. 2021) and with a greater emphasis on the shopping experience (Bogicevic et al. 2024).

The post-digital era is characterised by the integration of digital technologies into everyday life to such an extent that the boundaries between online and offline environments are becoming increasingly blurred, which brings about the new concept of Phygital (Batat 2024b), the significance of which also intersects with the issues of sensory perception (Batat 2024a) and store atmosphere (Lecointre-Erickson et al. 2024). In the context of store atmosphere, this creates pressure on the efficiency and functionality of the design of the shopping atmosphere when the youth segment requires constant and up-to-date information and personalisation (Szocs et al. 2023). Brick-and-mortar thus has the potential to represent an important space for the young adult segment to gain an authentic shopping experience in a retail environment that is not fully reproducible in the online environment, as well as by creating a social dimension of shopping with an emphasis on emotions and experiences.

It is necessary to adapt the store atmosphere to the given segment when the store atmosphere can create an element of differentiation and thus bring a competitive advantage in a highly competitive market (Gleim et al. 2025). Young adults are a segment that is referred to as visual consumers (Pitman and Vallis 2025), which must also be reflected in the store atmosphere. Young adults also require more than just satisfying basic needs—they require a long-term relationship between the customer and the retailer, which can be helped by properly setting the store's sensory atmosphere (Gao et al. 2024; Errajaa and Bilgihan 2025; Tao et al. 2025).

The main objective of the presented paper is to create a model of the retail food store atmosphere and to examine moderation in more detail within the young adult's segment. In this context, we present a comprehensive base of potential elements of the retail food unit model as part of a literature review. The model used in the presented paper, unlike the classic models of store atmosphere, connects sensory perception with the efficiency of the retail unit. Although the store atmosphere is standardly analysed through human senses, it is necessary to understand it also on the basis of the social environment and the sales environment, which also affects the customer. The elements contained in these factors are also important when it is appropriate to focus on interactions with the customer within the store environment conditioned by operational and logistical activities of the operation, which are ultimately reflected directly in the formation of the psychological perception of the store atmosphere. The model thus partially limits aesthetic and design elements and emphasises the functional focus significant in the studied segment.

Theoretical background

Store atmosphere is a management tool that, based on cognitive and affective components of attitude aspects (Shahid et al. 2022; Shang et al. 2023), generates a shopping environment that is reflected in the shopping experience (Chatzoglou et al. 2022; Vadruccio et al. 2024). Store atmosphere is of considerable importance, especially in food retail, where products are poorly differentiated and have high purchasing intensity (Ham et al. 2021). The right store atmosphere can create added value for the customer (Munawaroh and Simon 2023), which also emphasizes its importance within business modelling (Kita et al. 2024). In this context, it is a non-financial support for profitability, which is often poorly measurable and quantifiable in practice (Julmi 2017). A well-set store atmosphere can also extend shopping time (Xue et al. 2023) and significantly increase impulsive purchases (Shah et al. 2021) but also indirectly contribute to customer loyalty (Yulisetiarini et al. 2024). The store atmosphere is a fundamental element in generating customer experience (Chen 2024), and its importance goes beyond the immediate sales effect and extends to building customer relationships, loyalty, and fidelity (Anggara et al. 2023). A properly set atmosphere increases customer evaluation of the store and creates space for positive word-of-mouth (Liao et al. 2023; Wiratama et al. 2022). In food retail, where competition is high, atmosphere can be a significant element of competitive advantage (Berčík et al. 2022).

The key theoretical basis for identifying and evaluating the elements of store atmosphere is the Stimulus–Organism–Response (S–O–R) model (Mehrabian and Russell 1974), which requires identifying inputs (stimuli) that act on the customer (organism) and result in a customer reaction (response). The store atmosphere thus has a multi-level functionality, ensuring shopping comfort for the customer (Putri et al. 2025), creating store identity, and generating positive emotions (Barros et al. 2019; Park et al. 2025) with an emphasis on customer retention (Khan et al. 2022). It is important to identify the key elements and potential dimensions of store atmosphere in which the theory diverges. For example, the study by Marso and Idris (2022) identifies exterior, interior, layout & design, while Barros et al. (2019) lists dimensions such as environment/design, layout, music, lighting, and staff/social.

The young adult segment is characterised by a strong orientation towards efficiency and pragmatic shopping (Ang 2024; Skallerud 2025), which increases the importance of the functional dimensions of the store atmosphere. Based on the adaptation of the S–O–R model, it can be assumed that stimuli in the form of a clear layout of the sales space, logical categorisation of products and a clear orientation system directly influence the cognitive processing of the

environment by the customer, thereby reducing the level of frustration and increasing the perceived comfort of shopping (Yang et al. 2022). In the context of modelling the atmosphere of brick-and-mortar food stores for the young adult segment, there is a shift from the traditional hedonic perception of atmospheric elements towards an irrational interpretation (Ribeiro Coimbra et al. 2023), which needs to be incorporated into a functional model concept. The store atmosphere becomes a system of stimuli that are designed to optimise the shopping process, improve the customer's orientation in space and provide relevant information supporting rational decision-making.

The atmosphere in the store basically represents all the sensations to which the customer is exposed during the purchase, which emphasizes the influence of sensory aspects (Joy et al. 2023; Spence 2022). In this context, it mainly concerns sensory elements, including perception by sight, hearing, smell, touch, and taste, but also their combination (Pal and Srivastava 2024). The sensory aspect of the store atmosphere can be described as highly important, as it creates emotions (Pal et al. 2025), serves as an element of food product evaluation (Ruiz-Capillas and Herrero 2021), and thus directly influences consumer decision-making (Kim et al. 2021).

The physical space of the store itself also plays an important role in the atmosphere (Shahid et al. 2022), where customers prefer cleanliness and easy orientation (Bonfanti et al. 2023; Zájác et al. 2021). The placement of the assortment in stores is key in food retail, where the logical sequence of category management brings it together with merchandising, bringing sales support and purchase stimulation in the context of improving the environment in the operation (Basu et al. 2022; Wu et al. 2024) and therefore the store atmosphere. Similarly, the availability of parking spaces increases the attractiveness of the operation (Merten and Kuhnimhof 2023; Zhuang and Chung 2024).

The social aspect of the retail store atmosphere, which is created by employees through their approach, expertise, and willingness to help, as well as other customers who complete the social environment in cooperation with sensory aspects (Lin et al. 2025), can also be significant. Store employees are creators of the credibility of the retail unit (Park and Yi, 2023) and can also act as influencers in the context of recommendations within fresh produce, such as counter goods (Matthews et al. 2020).

Based on the above, it can be stated that the store atmosphere model contains three factors, namely sensory aspects, sales environment, and social environment. However, the significance of the individual elements is questionable. We therefore created a research question RQ1: How can the significance of the store atmosphere elements be characterized within the proposed model in the studied cohort?

Several socio-demographic determinants can affect the atmosphere of a store (Rodrigues et al. 2021), including in the context of its elements (Yang et al. 2022). From a sensory perspective, women have a higher level of attention for these stimuli (Gao and Shen 2024). Women also exhibit more hedonic behaviour (Juanim et al. 2024), which reflects their higher demands for visual and auditory merchandising (Banik and Gao, 2023). Differences in sensory perception are therefore expected to stem from regional expectations (Campo et al. 2025; Chatterjee et al. 2024). Expectations of the atmosphere of a store from the perspective of sensory perceptions are also theorized to be influenced by income group (Arce et al. 2021; Vilnai-Yavetz et al. 2021), where it can be expected that households with lower incomes will be more oriented towards price than towards sensory stimulation (Mushtaq and Salar 2022). From the perspective of retail space, differences in perceptions of sex, region, and household income can be expected (Formánek and Sokol 2022; Kosiba et al. 2020). Men tend to perceive shopping as a mission, where optimizing sales space is an element of shopping efficiency (Kol and Levy 2023). Consequently, low-income households are expected to be less influenced by merchandising elements, as they are primarily price-oriented (Daniel 2020). The social environment in the context of cognitive and affective elements of attitudes within the store atmosphere can be perceived differentially in the context of sex (Kim and Lee 2021), region (Van Den Berg et al. 2021), and household income (Carter et al. 2023). For higher-income consumers, shopping increasingly becomes a leisure-oriented and socially embedded activity (Pettersen et al. 2023; Saidi et al. 2026) In general, research focused on regional differences and geographic segmentation suggests differences in consumer perceptions within retail, with an emphasis on cultural norms, degree of urbanization, and spatial distribution (Dimitrova et al. 2016; Krishen and Petrescu 2019; Lu et al. 2023). Loyalty program users are more loyal, which we argue translates into a stronger perception of the sensory aspects of the store atmosphere resulting from shopping habits (Shahid et al. 2022; Vilnai-Yavetz et al. 2021). It can be assumed that with a higher frequency of loyalty program use, lower flexibility in accepting changes in the store environment can also be expected (Saad et al. 2022). A high frequency of loyalty program use indicates a relationship with the store with support and acceptance from its employees (Curatman et al. 2022; Ge et al. 2021).

Based on the above, we created research question two: RQ2: How do the selected determinants affect the significance of the elements of store atmosphere in the studied cohort?

To support the above research question and provide a comprehensive answer, we formulated the following

statistical hypotheses (be formulated in their alternative form in the context of a statistical test) on a theoretical basis:

H1a: The median of the factor sensory aspects in the female population is significantly different from the median in the male population.

H1b: The median of the factor sales environment in the female population is significantly different from the median in the male population.

H1c: The median of the factor social environment in the female population is significantly different from the median in the male population.

H2a: At least one median in the context of regions is statistically significantly different between the compared groups in the factor of sensory aspects.

H2b: At least one median in the context of regions is statistically significantly different between the compared groups in the factor sales environment.

H2c: At least one median in the context of regions differs statistically significantly between the compared groups in the social environment factor.

H3a: At least one median in the context of income groups differs statistically significantly between the compared groups in the sensory aspects factor.

H3b: At least one median in the context of income groups differs statistically significantly between the compared groups in the sales environment factor.

H3c: At least one median in the context of income groups differs statistically significantly between the compared groups in the social environment factor.

H4a: At least one median in the context of frequency of use of loyalty programmes differs statistically significantly between the compared groups in the sensory aspects factor.

H4b: At least one median in the context of frequency of use of loyalty programmes differs statistically significantly between the compared groups in the sales environment factor.

H4c: At least one median in the context of the frequency of use of loyalty programmes differs statistically significantly between the compared groups in the social environment factor.

Since its nature is quite complex, we also created hypotheses that have the character of statistical hypotheses to support the research question. We recorded the model framework in Fig. 1.

As we can see, there are four hypotheses reflecting four potential determinants in the context of three elements of store atmosphere (12 sub-hypotheses).

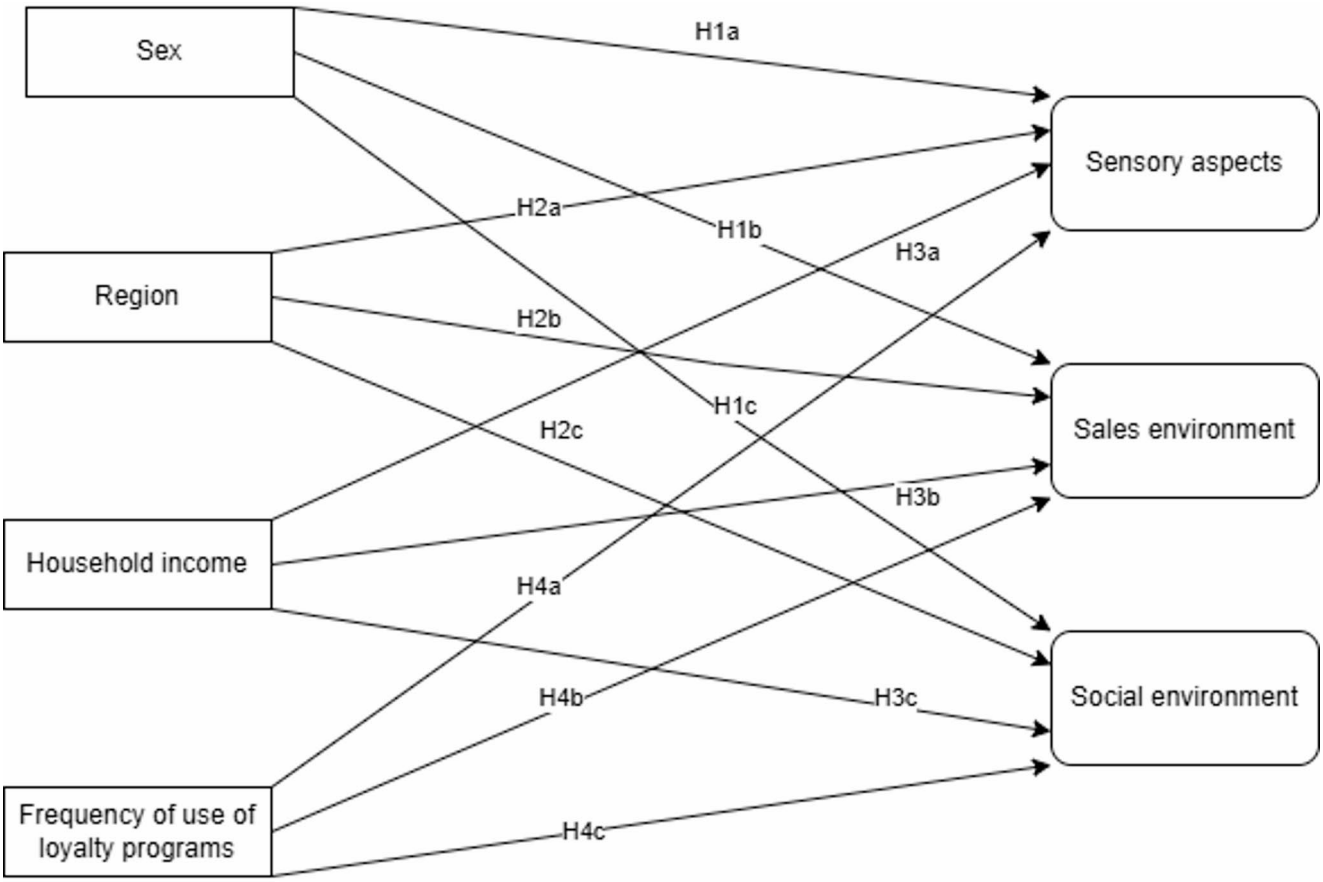

Fig. 1 Theoretical model framework. *Source*: Own processing

Methods and methodology

Participants

The article is based on a quantitative primary survey conducted within the population of young adults in Slovakia. Slovakia represents a post-socialist economy marked by the dynamic development and transformation of retailing (Križan et al. 2016), while capturing the cultural and socio-economic context of Central Europe (Kita et al. 2024). This type of environment is thus characteristic of post-socialist countries that are transitioning to a Western European value-for-money model with regional specificities. Slovakia thus serves as a model country, the results of which may have adaptive and intervention possibilities within other countries with similar characteristics. The survey was conducted both online and in print in an effort to ensure a sufficient number of relevant respondents in the context of the formulated population. From the point of view of the sample, it is a focused sample, which was also obtained using the snowball sampling method, while our effort was to ensure its representativeness from the perspective of the population. As follows from the definition of the population, when creating the sample, we focused on the segment of young adults who are characterized by the age of 18 to 29 years (Friedman et al. 2024). The segment of young adults is important from the point of view of forming long-term consumer habits. It can also be stated that it represents a significant share of the digital market and represents a key purchasing power for the future (Kita et al. 2023). The research was conducted in the first and second quarters of 2025. We also focused on their Slovak nationality, as different national groups can exhibit different consumer behaviour (Čvirik 2021). The survey was attended by 51.2% (244) men and 48.8% women (233), which indicates representativeness from the sex perspective of the surveyed segment based on data from the Statistical Office of the Slovak Republic (Statistical Office of the Slovak Republic, 2024). From the perspective of the regional distribution of respondents, representation from all regions can be stated. Within the household income, we generated four income groups (Naumann 2018), with 28.1% of respondents having an income up to €999, 34% of respondents having an income from €1000 to €1999, 19.5% of respondents having an income from €2000 to €2999, and 18.4% of respondents having an income above €3000. All respondents indicated a willingness to engage in the poll. The respondents were not financially paid. All respondents verified that the information provided was accurate and expressed their sense of reality without bias. Participants were guaranteed anonymity. Participants consented to the processing of data for scientific reasons. Participants were not given a time constraint for answering the questionnaire. In the context of the nature of the sample, acceptable external validity can be expected from the perspective of the sample. After cleaning the data and considering the population criteria, we obtained a base of 477 respondents, which indicates that the maximum statistical error (with a 95% confidence probability) is around 4.4%.

Measurement framework

Based on the theoretical overview, we identified three potential factors (dimensions) that need to be incorporated into a measurement tool focused on the atmosphere in a retail food unit. Specifically, these are sensory aspects, sales environment, and social environment. Individual factors included an importance rating on a five-point bipolar scale from "not at all important" to "very important." A pilot study was conducted on a convenience sample ($n=30$ respondents) in order to assess the validity of the items and the understanding of the items; therefore, after the survey, participants were confronted with the understanding of the items as well as the clarity of their answers. Items for individual factors were mixed to minimize the risk of bias. All respondents understood the investigated indicators equally or very similarly, for example, they associated the cleanliness of the premises with hygiene and visual cleanliness. The factors achieved high Cronbach alpha values (>0.8), which could, however, be due to both the low number of indicators in some cases and the low number of respondents. The structure of the individual indicators was therefore also maintained in the main research. A total of thirteen items represented the three identified factors of store atmosphere (Table 1).

We tested our proposed model using confirmatory factor analysis (CFA). Bartlett's test of sphericity ($x^2=3.426$; df=78) and Measure of Sampling Adequacy (overall=0.881) indicate the suitability of factor analysis (Shrestha 2021; Han et al. 2024; Srücü et al., 2024). We recorded the CFA results oriented to factor loadings in Table 2.

As can be seen from Table 2, the estimates (λ) are at a relatively high level, and the standard errors are low, which represents a good basis. As we can see, all estimates are significant. We also added 95% confidence intervals, with none of the lower values being below 0.4 (Hair 2010). Modification indices were also examined based on cross-loadings (cutoff=10), and connections were identified, but they were not of interpretative significance. Based on the variables, we understand factor 1 as sensory aspects, which include store scent, store lighting, store temperature, store music and store colours, which reflect specific aspects of sensory perception. Factor 2 represents the sales environment, which combines store layout clarity and uniformity, product availability, ease of store navigation, reasonable

Table 1 Measurement framework. *Source*: Own processing based on sources

Factor	Indicator	CODE	Support / sources
Factor 1	Store scent	Q_1	(Dörtyol 2021; Giacalone et al. 2021)
	Store lighting	Q_2	(Hemalatha et al. 2022; Khan et al. 2022)
	Store temperature	Q_3	(Calvo-Porral and Lévy-Mangin 2021; Monoarfa et al. 2023)
	Store music	Q_4	(Esfidani et al. 2022; Srivastava 2023)
	Store colours	Q_5	(Behera et al. 2023; Motoki et al. 2021)
Factor 2	Store layout clarity and uniformity	Q_6	(Florea et al. 2025; Khan et al. 2022)
	Product availability	Q_7	(Brandtner et al. 2021; Rinaldi et al. 2022)
	Ease store navigation	Q_8	(Khosrawi-Rad et al. 2025; Wu et al. 2022)
	Reasonable number of check-outs (including self-service)	Q_9	(Behera et al. 2023; Cui et al., 2021)
	Store cleanliness	Q_10	(Anggara et al. 2023; Mfundi Ndengane et al. 2021)
	Parking and store accessibility	Q_11	(Merten and Kuhnimhof 2023; Shukla et al. 2025)
Factor 3	Other customers in the store environment	Q_12	(Eroglu et al. 2022; Thomas et al. 2025)
	Employees (sales staff)	Q_13	(Deitz et al. 2021; Shah et al. 2021)

number of checkouts (including self-service), store cleanliness and parking and store accessibility, which create the environment of the sales unit in the context of its processes. The last third factor is social environment and focuses on other customers in the store environment and employees (sales staff). We displayed the model in Fig. 2.

From Fig. 2, it can be concluded that there is a correlation between the factors, which is logical in the context of their interpretation. We identified a moderately strong positive relationship between sensory aspects and the sales environment ($r=0.498$; 95% CI=<0.43–0.566 >), we identified a strong positive relationship between sensory aspects and the social environment ($r=0.672$; 95% CI=<0.572–0.772 >), and we also identified a strong positive relationship between the sales environment and the social environment ($r=0.58$; 95% CI=<0.457–0.704>). We also verified the quality of the model based on quality indicators (additional fit measures), with CFI 0.982, TLI=0.977, RMSEA=0.052, and SRMR=0.068, which indicates the quality and acceptability of the model. We verified the reliability of the factors using Coefficient ω and AVE, whereby for Coefficient ω we consider a value above 0.6 as acceptable and for AVE we consider a value above 0.4 as acceptable (Cheung et al. 2024; Jiang et al. 2024). It can be stated that the factors achieve an acceptable level of reliability measured on the basis of coefficient ω (factor 1=0.869; factor 2=0.867; factor 3=0.627; total instrument=0.913). Average variance extracted (factor 1=0.579; factor 2=0.549; factor 3=0.469) indicates convergent validity, which indicates that the construct is well-represented by its indicators. Based on the above, we will work with the model to meet the research objectives. Validity was examined with the help of the Heterotrait-monotrait Ratio of correlations (HTMT). While values up to 0.85 are expected (Chan and Lay 2018), the values we measured ranged within factor 1 and 2 at the level of 0.468, within factors 1 and 3 at the level of 0.701 and in the case of factors 2 and 3 at the level of 0.517. From the above, discriminant validity can be stated. We use regression factor scores to quantify individual factors. In this context, individual factors can be characterised in the R language in lavaan syntax by the equations:

Table 2 Factor loadings CFA. *Source*: Own processing

Factor	Indicator	Std. estimate (λ)	Std. Error	z-value	*p*	95% Confidence Interval	
						Lower	Upper
Sensory aspects	Q_1	0.786	0.024	32.92	<0.001	0.74	0.833
	Q_2	0.868	0.02	43.26	<0.001	0.829	0.907
	Q_3	0.793	0.027	29.71	<0.001	0.741	0.845
	Q_4	0.673	0.031	21.39	<0.001	0.612	0.735
	Q_5	0.662	0.035	18.93	<0.001	0.594	0.731
Sales environment	Q_6	0.745	0.039	19.2	<0.001	0.669	0.821
	Q_7	0.767	0.032	24.06	<0.001	0.704	0.829
	Q_8	0.756	0.037	20.62	<0.001	0.684	0.828
	Q_9	0.716	0.035	20.37	<0.001	0.647	0.785
	Q_10	0.904	0.024	37.91	<0.001	0.857	0.951
	Q_11	0.532	0.051	10.45	<0.001	0.432	0.632
Social environment	Q_12	0.489	0.047	10.42	<0.001	0.397	0.581
	Q_13	0.872	0.044	19.89	<0.001	0.786	0.958

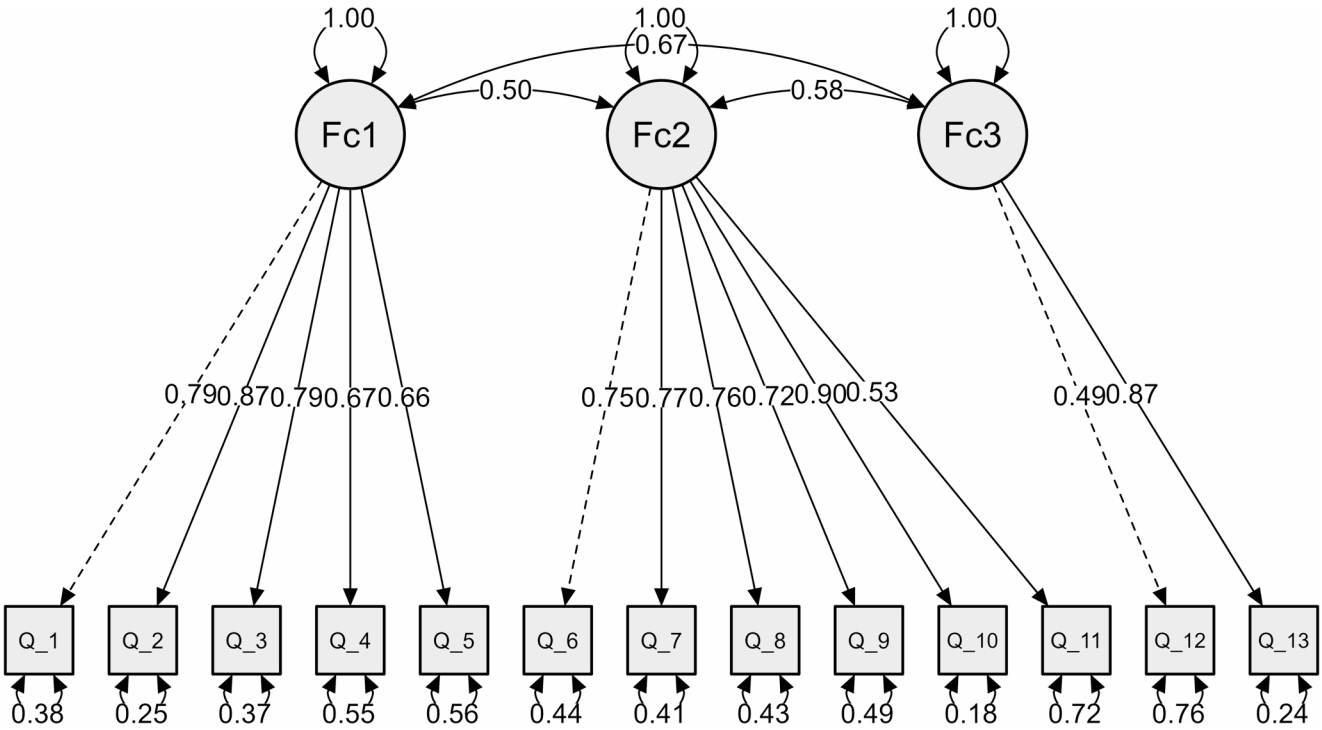

Fig. 2 Visualization of the CFA-based model. *Source*: Own processing in R (package lavaan)

$$Factor1 =\sim 0.786 * Q_1 + 0.868 * Q_2 + 0.793 * Q_3 + 0.673 * Q_4 + 0.662 * Q_5$$

$$Factor2 =\sim 0.745 * Q_6 + 0.767 * Q_7 + 0.756 * Q_8 + 0.716 * Q_9 + 0.904 * Q_10 + 0.532 * Q_11$$

$$Factor3 =\sim 0.489 * Q_12 + 0.872 * Q_13$$

In the paper, we also use a number of descriptive methods with an emphasis on measures of location and variability (Fulk 2023) for the characterization of mass phenomena. In the work, we use elements of inductive statistics to examine differences. In the context of the typology of variables and their characteristics, we use non-parametric tests to examine differences, namely the Mann-Whitney U test and the Kruskal-Wallis test (Okoye and Hosseini 2024) and their effect size (Metsämuuronen 2025). We use the Mann-Whitney U test when examining differences within two groups (in our case, sex). We also quantify the effect size in the form of Rank-Biserial Correlation, which helps us determine the strength of a given effect of a variable, with |r_{rb}| ≈ 0.10 considered a small effect, |r_{rb}| ≈ 0.30 considered a medium effect, and |r_{rb}| ≈ 0.50 considered a large effect (Ordak 2023). The Kruskal-Wallis test is used when comparing more than two groups. The test result provides information about the (non)existence of differences, at least between two groups. The effect size of this test is quantified using rank ε^2 (equivalent to η^2), with $\varepsilon^2 \approx 0.01$ considered a small effect, $\varepsilon^2 \approx 0.06$ considered a medium effect, and $\varepsilon^2 \approx 0.14$ considered a large effect (Ordak 2023). In the case of confirmation of the alternative hypothesis (existence of differences at least between two groups), a pairwise examination using Dunn's Post Hoc Comparisons with Bonferroni correction (Barnett et al., 2022) follows. In this context, it is worth noting that even non-parametric testing has its limits, and although it is suitable for small samples in the context of the size of observations within individual groups, where the minimum number is considered to be 10 individuals, more sophisticated solutions show that at $\alpha = 0.05$ and the required power = 0.80, the minimum size was calculated to be approximately 20–25 observations (Dwivedi et al. 2017; Nahm 2016). The R language, version 4.3.2, was used for statistical analysis.

Results

RQ1: How can the significance of the store atmosphere elements be characterized within the proposed model in the studied cohort?

In the first step, we focused on the descriptive characteristics of the studied elements within the individual factors. The results of the descriptive statistics were recorded in Table 3.

As the results indicate, respondents perceived the music in the store (Q_3) as the least important, followed by the colours used in the store (Q_4). On the contrary, product availability (Q_7) and easy orientation in the store (Q_8)

Table 3 Descriptive statistics for individual store atmosphere elements. *Source*: Own processing

Indicator	Valid	Median	Mean	Std. Dev.
Q_1	477	4	3.256	1.259
Q_2	477	3	3.136	1.19
Q_3	477	3	3.187	1.211
Q_4	477	2	2.767	1.189
Q_5	477	3	2.876	1.209
Q_6	477	4	4.143	0.968
Q_7	477	5	4.35	0.971
Q_8	477	5	4.275	0.986
Q_9	477	5	4.199	1.073
Q_10	477	4	4.153	1.067
Q_11	477	4	4.002	1.109
Q_12	477	3	3.086	1.27
Q_13	477	4	3.698	1.127

The average value and standard deviation are only indicative due to the ordinal nature of the variable

are generally considered to be highly important within the sample. The initial results of the analyses already indicate a high orientation towards the elements of the sales environment. To quantify the individual factors, we used a factor regression score, which is abstract since the score is usually standardized. As follows from the limits of factor quantification, their absolute evaluation is not possible, but at least a comparative conclusion can be drawn based on the average and median. The results of descriptive statistics for the factor scores indicate that the most important factor within the median value appears to be sales environment, and the lowest significance is within the sensory aspect.

RQ2: How do the selected determinants affect the significance of the elements of store atmosphere in the studied cohort? Within the determinants, we identified four potential factors based on the literature, namely, sex, region, household income, and frequency of use of LP. In the context of the presented formulation and complexity of the research question, it can be stated that groups of hypotheses have been created that ensure its comprehensive answer, with the group of hypotheses H1 focusing on the sex effect, the group of hypotheses H2 focusing on the residence-region effect, the group of hypotheses H3 focusing on the income effect, and the group of hypotheses H4 focusing on the frequency of use of loyalty programmes.

To investigate sex as a potential determinant, we formulated three hypotheses (for three factors). After considering all assumptions, we chose the Mann-Whitney U test as the most appropriate test and recorded the results in Table 4.

Table 4 Results of the Mann-Whitney U test for sex. *Source*: Own processing

Hypothesis	Factor	U	*p*	Rank-Biserial Correlation
H1a	Sensory_ aspects	22.406	6.330×10^{-5}	0.212
H1b	Sales_environment	21.576	5.321×10^{-6}	0.241
H1c	Social_environment	23.794	2.085×10^{-3}	0.163

The results confirm the existence of differences between men and women in the perceived importance of all factors at the alpha significance level (0.05). In the context of the effect size measured on the basis of Rank-Biserial Correlation, a moderately strong effect of differences can be stated, which underlines the significance of the determinant sex. Based on the positive assessment, it can also be stated that women have a higher level of perceived importance for all factors, which is also indicated by the average score.

The region appeared to be the second possible determinant of the perceived atmosphere of a retail food unit. After considering all assumptions, we chose the Kruskal-Wallis Test as the most appropriate test and recorded the results in Table 5.

The test results (Table 5) indicate that there are significant differences between at least two regions in the studied country within the studied population. The effect size in the form of rank ε^2 represents a small effect. We examined the pairwise differences in more detail using Dunn's post hoc comparisons with Bonferroni correction. Within the first factor (sensory aspects), the results did not show significant differences between pairs of regions, which indicates that even if there is an assumption of differences between regional groups, it is not possible to statistically accurately determine which pairs of groups differ. The second factor (Sales_environment) showed differences between the Nitra region and the Banská Bystrica region (p_{bonf}=2.197×10^{-2}), while consumers from the Nitra region will perceive the sales environment as a less important factor compared to the presented regions. Within the third factor (Social_environment), the Banská Bystrica region showed significant differences, especially compared to the Nitra region (p_{bonf}=2.698×10^{-3}), the Trnava region (p_{bonf}=1.804×10^{-2}), and the Žilina region (p_{bonf}=9.159×10^{-4}), while it can

Table 5 Results of the Kruskal-Wallis test for the region. *Source*: Own processing

Hypothesis	Factor	Statistic	df	*p*	Rank ε^2	95% CI for Rank ε^2	
						Lower	Upper
H2a	Sensory_aspects	15.54	7	2.968×10^{-2}	0.033	0.017	0.083
H2b	Sales_environment	21.24	7	3.433×10^{-3}	0.045	0.026	0.11
H2c	Social_environment	26.32	7	4.418×10^{-4}	0.055	0.029	0.117

Table 6 Results of the Kruskal-Wallis test for household income. *Source*: Own processing

Hypothesis	Factor	Statistic	df	*p*	Rank ε²	95% CI for Rank ε²	
						Lower	Upper
H3a	Sensory_aspects	12.27	3	6.504×10^{-3}	0.026	0.008	0.072
H3b	Sales_environment	15.2	3	1.652×10^{-3}	0.032	0.009	0.077
H3c	Social_environment	10.75	3	1.317×10^{-2}	0.023	0.007	0.058

Table 7 Results of Kruskal-Wallis test for frequency of use of LP. *Source*: Own processing

Hypothesis	Factor	Statistic	df	*p*	Rank ε²	95% CI for Rank ε²	
						Lower	Upper
H4a	Sensory_aspects	14.27	3	2.555×10^{-3}	0.03	0.01	0.074
H4b	Sales_environment	4.78	3	1.886×10^{-1}	x	x	x
H4c	Social_environment	4.852	3	1.830×10^{-1}	x	x	x

be expected that the given factor would be given higher importance in the Banská Bystrica region. Other pairwise differences were not demonstrated in the context of the methodology used.

Subsequently, we examined household income, and after considering all assumptions, we chose the Kruskal-Wallis Test as the most appropriate test and recorded the results in Table 6.

Table 6 indicates the existence of the effect of household income within at least two groups, but the effect size (rank ε²) indicates a significantly small effect. We examined the pairwise differences more closely using Dunn's post hoc comparisons with Bonferroni correction. Consumers with household income up to 999€ were different from the other groups, both in the case of the group with an income from 1000 to 1999 (p_{bonf}=2.741×10^{-2}) and the group with an income from 2000 to 2999 (p_{bonf}=2.478×10^{-2}), but not from the group with a household income over 3000€ (p_{bonf}=5.057×10^{-2}), and it can be stated that the group with a household income up to 999€ considers sensory aspects to be more important than the other groups. In the context of the second factor, consumers with a household income of up to €999 were different from the group with an income of €1000 to €1999 (p_{bonf}=4.350×10^{-4}) and also different from the group with a household income of over €3000 (p_{bonf}=1.911×10^{-3}), with the group with an income of up to €999 again considering the sales environment as highly important. Within the framework of the third factor, we identified differences only within the group of consumers with an income of up to €999 and the group with a household income of €1000 to €1999 (p_{bonf} = 1.328×10^{-2}), with consumers in the group with an income of up to €999 showing a higher level of importance of this factor. Other pairwise differences were not demonstrated in the context of the methodology used.

The possible influence of frequency of use of LP was also investigated, and after considering all assumptions, we chose the Kruskal-Wallis Test as the most appropriate test and recorded the results in Table 7.

The results indicate that the frequency of use of LP has no influence within the sales_environment and social_environment factors, but a low influence effect can be identified within the sensory aspects. It is within the sensory aspects that consumers who used LP at least had, unlike those who used LP partially (p_{bonf}= 1.660×10^{-2}) or significantly (p_{bonf}= 4.232×10^{-3}), significantly different perceptions of the importance of this factor, while attributing a lower level of importance to it.

Discussion

The article works with a model that was proposed on the basis of theoretically acquired knowledge, which achieved a high level of validity and reliability. Respondents perceived music as the least important, and this result may be influenced by several elements (RQ1). The young adult segment may have significantly differentiated musical perceptions (Čvirik 2024), when standard music in a food retail unit may seem inadequate in the context of their preferences (Davies et al. 2022). Product availability as an element perceived as the most important in the creation of the store atmosphere points to the fact of the rapid dynamics of young people's lives (Zhao et al. 2021). The element of the social aspect and functional aspects of the store appeared to be the most significant (Chan and Li 2022).

When examining the influence of possible determinants (RQ2), we identified that there are significant sex effects on the perception of store atmosphere elements. This may be due to the fact that women may prefer empathetic communication with store employees, while men may be more time-efficient (Chen et al. 2025; González et al. 2021). Women also have different sensory perceptions than men, including from the perspective of elements of the sensory spectrum (Schirmer et al. 2022). These perceptual differences may

be reflected in the perception of store atmosphere factors. Given that the results indicate a higher perceived importance in the context of store atmosphere, businesses oriented to this target group should also focus more on setting the atmosphere in the store. Regional differences point to the need to adapt store atmosphere elements in individual regions. There may be several reasons, including economic aspects, where consumers in regions with lower average wages or higher unemployment may place greater emphasis on prices than on sensory or sales aspects (Levrini and Jeffman Dos Santos, 2021). The Banská Bystrica region is located in the centre of Slovakia, which gives it room for high cultural diversity (Yin et al. 2023), which could also be reflected in the importance of the social environment within the store atmosphere. From the perspective of income, the group with the lowest income achieved the highest perceived importance among all factors. This may be due to the difficult acquisition of financial resources and their efforts to spend them in a good store atmosphere in the context of some added value (Trude et al. 2022). For them, shopping represents a more significant financial and emotional expense, and they perceive shopping as an experience. The frequency of LP use can be considered a significant factor in the sensory aspect of the store atmosphere, where consumers who frequently and significantly use LP have accustomed sensory perceptions in their stores, which may be a learned behaviour based on remembered expectations from regular visits to an identical store or one chain providing LP (Yang et al. 2021).

Theoretical and managerial contributions

From a theoretical perspective, the model contains similar dimensions as in the study by Barros et al. (2019), but we delve deeper into the operational environment and sensory aspects. We also delve deeper into the social environment, including not only staff but also other customers. We thus create a new theoretical concept of the model that appears realistic in empirical research. We focus on the at-risk segment of young adults, thereby expanding the knowledge base in this specific segment. The presented study operates with the key requirement of this segment - functionality. Verification of potential mediators brings a shift in theoretical knowledge that can be applied both in management practice and in research and in expanding the education of future managers in the areas of segmentation, market analysis, and marketing analysis, which can increase the value of their education (Petrescu et al. 2024).

The findings thus advance not only science but also management practice with possible management interventions with an emphasis on differentiation from the competition, targeting, and creating the right store atmosphere for the target market. The right store atmosphere can prolong shopping and bring higher sales for retail food units. In this context, the management's orientation to the functional elements of the retail environment is important, with an emphasis on the optimisation of logistics processes, strategic retail layout and spatial management. It is possible to use the concept of customer journey management for a deeper understanding. In the context of managerial decision-making, the results provide evidence of the need for a differentiated marketing strategy by sex, with an emphasis on higher expectations in the female segment. It is also appropriate to recommend regional adaptation of retailing concepts within the design of the store or specific marketing activities orientated towards customer service and social interactions. The high significance of factors in the low-income household segment points to the need to generate price-sensitive strategies that will be supported by clarity, accessibility and positive social interaction. Although the importance of loyalty programmes for retail management is undeniable, it has limits in the context of the perception of the store atmosphere with an emphasis on the greater rationality of the concept than the emotional element. To support the emotional aspect of loyalty programmes, the element of gamification can be used by creating a phygital environment or increasing the emotional experience of shopping.

The paper also brings benefits from the perspective of research and practice in the field of business analytics. The study extends the theory of consumer behaviour in the retail team by quantifying how variables (gender, region, income, and loyalty programme use) do not only serve as segmentation criteria but also function as moderators of sensitivity to the identified factors of the model. Since customers are product availability (Q_7) and ease of orientation (Q_8), analytical teams should redirect the most important from sensory marketing to customer movement analytics (e.g., path-to-purchase tracking and shopping marketing), shelf optimisation, and merchandising. From the perspective of business analytics, we emphasise the need for a spatial analytical approach when retail chains do not want to find a nationwide strategy. Analytics must be localised, and management must adapt investments to the atmosphere of a specific region. The finding that the frequency of loyalty programme use affects the perception of sensory aspects represents a great opportunity for CRM analytics.

Limitations and future research

The paper also has certain limitations, focusing only on young adults. Although this group is key from the perspective of the future direction of retail, it would be appropriate to examine other groups of respondents. This limitation can be removed by future research, which would also focus, for

example, on the vulnerable group of consumers—seniors. A generational approach could also bring comparative possibilities and demonstrate possible differences in the context of perception of store atmosphere. We also focus only on one country, but this provides a basis for international comparison, which again represents an opportunity for future research. In this paper, we examine four determinants in more detail, but the literature also provides other possible determinants, which would be appropriate to explore in future research and thus create a conceptual framework. To better understand the changes, it would be appropriate to create a longitudinal design that would explore trends and changes over time in more depth.

Conclusion

The article focuses on generating a perceptual model of the atmosphere of brick-and-mortar retail food stores from the perspective of young adults and possible mediators of perceptions. Based on the theory, we identified three key elements of the store atmosphere, namely sensory aspects, sales environment, and social environment. We empirically tested the theoretical model. The basis for our survey was 477 respondents who met the criteria of the studied population. The CFA results indicated a reliable and valid model. It can also be stated that the elements of the store atmosphere model are interconnected in a certain context, which requires complexity in examining the store atmosphere. We have shown that the aspects of the sales environment are important in the studied cohort with an emphasis on functionality. We also examined the effects of sex, region, household income, and frequency of loyalty programme use. We tested the set of sex-orientated hypotheses (H1) using the Mann-Whitney test. Region (H2), household income (H3) and frequency of loyalty programme use were examined using the Kruskal-Wallis test. The results indicate that sex has a significant effect on the context-sensor aspects ($p = 6.330 \times 10^{-5}$), sales environment (5.321×10^{-6}) and social environment (2.085×10^{-3}), with women having a higher level of perception of the importance of the elements of the store atmosphere. From a regional perspective, we also identified differences in the perception of the store atmosphere; however, from an effect size perspective, it is only a small or moderate effect. Household income also appears to be a significant determinant (with a small effect size), with low-income groups (up to €999) attributing significant importance to store atmosphere. The effect of LP use was only evident within the sensory aspects ($p = 2.555 \times 10^{-3}$; Rank $\varepsilon^2 = 0.03$) of store atmosphere, with higher LP use indicating higher perceived importance of store atmosphere. In the discussion, we focus on both the possible causes of these results and their implications for academic and managerial practice. Limitations are also highlighted, offering opportunities for further research.

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Data availability The data is not available. It contains sensitive and confidential information about companies, consumers and managers that could be misused.

Declarations

Conflict of interest The authors declare that they have no known conflict of interests or personal relationships that could have appeared to influence the work reported in this paper.

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