Analysis of Factors Influencing the Purchase of Food Supplements: Attitudes of Pharmacists and Consumers

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Abstract

Background: The growing use of food supplements in Croatia requires evidence on what drives purchase decisions and how pharmacists view promotion and pricing. **Objectives:** To identify consumer and pharmacist determinants of supplement purchasing, map trust in information sources, and test sociodemographic and professional differences. **Methods/Approach:** Two online surveys were fielded in March–April 2025 (consumers N=701; pharmacists N=233). Descriptive statistics were complemented by one-way ANOVA (with Tukey HSD), Pearson χ^2 with Cramer's V, and Spearman correlations; robustness checks (Welch/Kruskal–Wallis) were applied. Given nine primary tests, results are treated as exploratory with emphasis on effect sizes and 95% CI. **Results:** Among consumers, price salience varies across education groups ($\eta^2 \approx 0.027$) while brand importance increases with income ($\eta^2 \approx 0.020$); trust clusters into professional sources (pharmacists/physicians; $\rho \approx 0.568$) versus media and digital sources ($\rho \approx 0.501$), with the latter more prominent among younger respondents. Younger consumers more often cite product quality/composition, and education relates to reliance on personal experience. Among pharmacists, perceived price impact varies by years of experience, and support for stricter promotion rules is higher in younger age groups ($V \approx 0.226$). **Conclusions:** Product quality and personal experience are central. Findings support segmented communication by age, education, and income, and clearer promotional standards.

Keywords: food supplements; consumer behaviour; pharmacists; price; brand; quality; trust; regulation

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Introduction

Food supplements are concentrated sources of nutrients or other substances with nutritional or physiological effects, intended to compensate for nutritional deficiencies, maintain adequate intake of specific nutrients, or support physiological functions (European Food Safety Authority [EFSA], 2025). It is important to emphasise that they are not medicines and are not used to treat or prevent diseases (Food Standards Agency [FSA], 2024).

Over the past two decades, the food supplements market has grown steadily in most countries. This growth has been driven by increased consumer demand, greater product diversity, rising health awareness, and lifestyle changes (Djaoudene et al., 2023; Malik & Tandon, 2024). In developed countries, it is estimated that approximately 30–50% of the adult population uses food supplements (Iłowiecka et al., 2022). Globally, the market was valued at USD 485.62 billion in 2024 and is expected to reach USD 704.28 billion by 2030, with a compound annual growth rate (CAGR) of 6.42% (Grand View Research, n.d.). Market growth is further supported by higher disposable incomes, increased life expectancy, and greater concern for personal health, with projections indicating that by 2050, one in five people worldwide will be over 60 years old (Kehoe et al., 2019; Seo et al., 2024).

Beyond market growth, many factors influence food supplement use. Previous studies link supplement consumption to nutritional deficiencies, reduced physical activity, and sedentary lifestyles (El Finou et al., 2023). Demographic and socioeconomic characteristics such as gender, age, education, and income shape purchase decisions. Health awareness, product knowledge, personal experience, availability, price, product quality and composition, marketing campaigns, and social influences also shape these decisions (Aditya et al., 2017; Jadhav et al., 2023; Mishra et al., 2023). From a distribution perspective, food supplements are available through a wide range of sales channels. These include pharmacies, drugstores, supermarkets, speciality stores, online platforms, independent retailers, and other direct sales channels (Nábrádi et al., 2020). This diversity in distribution ensures broad accessibility but also intensifies competition among manufacturers and suppliers.

Food Supplements Europe (2022), based on an Ipsos survey, reports that EU consumers most often use food supplements to maintain general health, strengthen immunity, increase energy, and support digestive health, while other motives are less common. Structurally, according to Mordor Intelligence (2025), vitamins accounted for the largest share of the European market in 2024 (33.21%), while probiotics and prebiotics are experiencing the fastest growth due to increased awareness of gut health. Regarding trust in information sources, research conducted for Food Supplements Europe showed that nearly two-thirds of EU consumers cite healthcare professionals (physicians and pharmacists) as their primary source of information (Vinciguerra, 2022). Changes in consumer habits, coupled with economic growth and improved public health, have increased the importance of marketing health and wellness-related products, including food supplements, which have had a significant impact on healthcare systems (Kejariwal et al., 2022). In this context of growing market complexity and diverse information sources, pharmacists play a crucial role in providing nutritional care. They frequently recommend appropriate food supplements and advise consumers on their correct and safe use, with recommendations grounded in the best available evidence (Bukic et al., 2021; Kelly et al., 2022). Pharmacists can also contribute to regulatory development and help consumers reduce the risk of excessive supplement use (Singla et al., 2023).

Despite the growing body of research on food supplement use, prior studies have typically examined either consumers or healthcare professionals separately, with

limited efforts to integrate both perspectives within a single empirical model. Moreover, research has rarely examined how sociodemographic characteristics, trust in information sources, and personal experience jointly shape consumer purchasing criteria and pharmacists' professional attitudes. This study contributes to the literature in three main ways. First, it simultaneously examines consumers and pharmacists within the same analytical framework, enabling a direct comparison of market and professional perspectives. Second, it integrates trust in information sources, sociodemographic characteristics, and perceived purchase factors into one model, rather than analysing these determinants in isolation. Third, it provides evidence from Croatia, a context that remains underrepresented in the international literature on food supplements. Building on this framework, the present study compares consumers' and pharmacists' attitudes toward food supplements. It examines how sociodemographic characteristics, trust in information sources, and personal experience shape the perceived importance of key purchase factors. It also tests hypotheses on trust patterns and differences in pharmacists' attitudes, thereby extending existing research by offering a more integrated perspective on food supplement decision-making.

The remainder of the paper is structured as follows. The next section reviews the relevant literature and develops the hypotheses. The methodology, results, discussion, and conclusion sections follow this.

Literature review

This section reviews the theoretical and empirical literature on consumer and pharmacist behaviour in the food supplements market. It focuses on the main determinants of purchase decisions and trust in information sources, namely price, manufacturer brand, product quality and composition, personal experience, and sociodemographic characteristics. Based on this, the study develops a conceptual model. On the consumer side, the perceived importance of price, manufacturer brand, product quality and composition, information sources, and personal experience is expected to be associated with purchasing behaviour. On the pharmacist side, the perceived importance of price and brand, together with support for stricter regulation of food supplement promotion, is expected to be associated with recommendation behaviour and related professional attitudes. In contrast to prior studies, which have generally examined consumers and healthcare professionals separately, this study brings these two perspectives together within a single analytical framework. Its contribution lies not only in testing established determinants, but also in integrating trust in information sources, sociodemographic characteristics, and perceived purchase factors across both consumer and pharmacist samples. Based on this model, the following hypotheses are formulated. Each hypothesis reflects a specific relationship identified in previous research. Given the multidimensional nature of the framework and the inclusion of both consumers and pharmacists, a broader set of hypotheses was specified to capture the relevant relationships more comprehensively.

Price sensitivity and the educational gradient

Price is a key factor in decisions to purchase food supplements, and high cost has repeatedly been identified as a barrier to use (Teoh et al., 2019). Price sensitivity is particularly pronounced at the first purchase, and consumers without prior experience are more likely to buy during promotions and discounts (Martinović et al., 2024). At the same time, willingness to pay increases when safety and efficacy are clearly demonstrated (Teoh et al., 2021). Supplement use is more common among individuals

with higher educational attainment and higher incomes (Cowan et al., 2018; Dickinson & MacKay, 2014; Kofoed et al., 2015; Kwon, 2023). Qualitative research further underscores price and commercial considerations as socioeconomic determinants of decisions related to supplements (Hoseini et al., 2021). Trend analyses document heterogeneity across subgroups, while consistently higher use is observed among the better educated (Dickinson & MacKay, 2014; Kantor et al., 2016; Radimer et al., 2004). Based on these findings, the researchers formulated hypothesis H1.

H1. *Consumers' mean ratings of the importance of price when choosing food supplements vary across education groups.*

Socioeconomic determinants of brand loyalty

Brand loyalty plays a fundamental role in understanding consumer behaviour (Damaschi et al., 2025). Brand loyalty is manifested in the intention to repurchase a preferred product in the future and is grounded in consumers' positive attitudes toward that brand (Klopotan et al., 2016). Educational attainment and household income are associated with food supplement use (Alhashem et al., 2022). On average, food supplement users are more educated and have somewhat higher incomes than nonusers (Dickinson & MacKay, 2014). In health-oriented food categories, perceived quality and financial value have been confirmed as the primary drivers of positive brand image and brand loyalty (García-Salirrosas & Escobar-Farfán, 2024). All dimensions of perceived value significantly influence brand image and loyalty, with brand image mediating these relationships, and perceived financial value further contributing to loyalty (Annikmah & Indrawati, 2025). When choosing food supplements, consumers place high weight on evidence of safety and effectiveness (Teoh et al., 2021). Higher-income consumers are more likely to remain with a premium brand and less likely to switch to other brands because status value and looser budget constraints facilitate consistent choices (Phiri, 2007). Brand loyalty among lower-income consumers is both context- and category-dependent (Costa Filho et al., 2021). Based on these findings, we formulated hypothesis H2.

H2. *Consumers' mean ratings of the importance of the manufacturer's brand when choosing food supplements vary across monthly household income groups.*

Information sources and patterns of trust

Consumers' selection of food supplements relies heavily on sources they perceive as credible. Research consistently shows high consumer trust in pharmacists and physicians (Andrzejewska et al., 2022; Bergmo et al., 2023; te Paske et al., 2023). Physicians and pharmacists play a central advisory role, and in Europe, purchases predominantly take place in pharmacies and other specialised channels (D'Alessandri, 2024; Germany Trade & Invest [GTAI], 2021; Synadiet, 2024; Vinciguerra, 2022). At the same time, media and digital sources, including influencers, strongly shape attitudes toward food supplements. Media coverage often highlights benefits, while influencers build credibility through personal recommendations, though this may increase the risk of inaccurate claims (Melero-Bolaños et al., 2025; Pilgrim & Bohnet-Joschko, 2019; Ricke & Seifert, 2025). Overall, these findings suggest that trust clusters around professional sources (physicians/pharmacists) and media and digital sources, with cross-country differences in reliance on online sources (Forman & Sriram, 2025). Based on these findings, we formulated hypotheses H3 and H4.

H3. *Consumers' trust in pharmacists is associated with their trust in physicians as sources of information on food supplements.*

H4. *Consumers' trust in media sources is associated with their trust in influencers and social media as sources of information on food supplements.*

Composition and quality in supplement choice by age and education

Consumers choosing food supplements typically place the greatest importance on product composition and quality, particularly the product's intrinsic attributes (Ankiel et al., 2021; Martinović et al., 2024). Use is more common among individuals with higher levels of education, stronger financial standing, and greater health consciousness. In addition, overall prevalence increases with age (Dickinson & MacKay, 2014; Kantor et al., 2016; Mishra et al., 2023; Nábrádi et al., 2020). Age and education are linked to decision-making patterns, with younger individuals seeking information more frequently, while the largest share of users comprises middle-aged and older adults (Council for Responsible Nutrition, 2019; Fravel et al., 2023; Galman et al., 2024; Jadhav et al., 2023; Kantor et al., 2016). Decisions are further influenced by health literacy and previous experience with the product (Ang et al., 2023; Aufegger et al., 2021; Intarakamhang & Prasittichok, 2022; Martinović et al., 2024). Based on these findings, we formulated hypotheses H5 and H6.

H5. *The proportion of consumers who cite product quality and composition as a purchase factor varies across age groups.*

H6. *The proportion of consumers who cite personal experience as a purchase factor varies across education groups.*

Attitudes and practices of pharmacists

When recommending food supplements, pharmacists often consider price as an important criterion in counselling. Some respondents interpret a higher price as a signal of greater quality and are therefore more inclined to recommend higher-priced brands (Xin et al., 2024). In practice, recommendations often align with consumers' financial means (Gregório et al., 2023). Analytical studies confirm that selling price and consumer expectations are among the key factors shaping recommendations (Tarhan & Arslan, 2022). Evidence suggests that experience influences the criteria used in recommendations. Less experienced pharmacists are therefore expected to place greater emphasis on price, whereas more experienced pharmacists tend to rely more on professional sources (Bukić et al., 2021; Tarhan & Arslan, 2022; Xin et al., 2024). Consumer requests, manufacturer reputation, and product quality information also influence food supplement choice (Welna et al., 2003). Pharmacy practice commonly reports requests for specific brands (Brunelli et al., 2022; Welna et al., 2003). The cited studies provide little basis for expecting a systematic pattern by work experience. Surveys of healthcare professionals indicate that product composition, manufacturer, and price are commonly tracked as core elements when making recommendations (Strocka et al., 2024). Age-related differences in willingness to recommend have been observed, suggesting that age and experience shape how brand value is assessed (Balkanska-Mitkova et al., 2022). Pharmacists' personal use and work experience are associated with their recommendations (Bukić et al., 2021). Younger respondents show greater scepticism and a stronger need for additional education, linked to stronger support for tighter control of food supplement promotion and clearer regulation (Kwan et al., 2006; Stayduhar et al., 2023; Strocka et al., 2024). The literature also reports support for strengthening the regulatory framework and clearer rules for food supplement promotion (Kwan et al., 2006), and some respondents perceive food supplement promotion and packaging similarly to medicines, further arguing for more precise regulation and standardised education (Brunelli et al., 2022; Strocka et al., 2024). Based on these findings, we formulated hypotheses HF1, HF2, and HF3. To

distinguish between the two respondent groups, consumer-related hypotheses are labelled H1–H6, whereas pharmacist-related hypotheses are labelled HF1–HF3.

HF1. *Pharmacists with fewer years of work experience give higher mean ratings to the impact of price on consumers' food supplement choices than pharmacists with more experience.*

HF2. *Pharmacists report similar frequencies of consumer requests for specific food supplement brands across work-experience groups.*

HF3. *Support for stricter regulation of food supplement promotion varies across pharmacists' age groups, with stronger support expected among younger pharmacists.*

The literature points to distinct questions about how consumers choose food supplements and how pharmacists perceive those choices. For consumers, the hypotheses link education and income to the importance of price and brand, examine how trust in information sources is related, and assess whether the purchase factors consumers cite vary by age or education. For pharmacists, the hypotheses concern how reported perceptions of price and brand requests vary with work experience and how support for stricter promotional rules varies with age. The two perspectives frame the survey design and the analyses described in the next section.

Methodology

Research Approach

The study used two separate online surveys with different target populations: consumers and pharmacists. A quantitative online survey was conducted in Croatia between March and April 2025 using structured questionnaires administered via SurveyMonkey. A non-probability convenience sampling approach was used. Snowball sampling was additionally applied through personal and professional networks and public posts (email, WhatsApp, Facebook, Instagram). For the consumer sample, a sample size calculation was used only as an indicative benchmark for the targeted number of respondents (Qualtrics, 2024). However, because non-probability convenience sampling was used, the sample is not representative of the Croatian population. Therefore, the findings should be interpreted as applying only to the study sample. The questionnaires included items on demographics, purchasing patterns, key purchase factors (price, brand, quality, and personal experience), information sources, and attitudes toward promotion. Consumers rated the importance of price and the manufacturer's brand on separate five-point Likert scales (1 = not important at all, 5 = extremely important). The target population for the consumer survey consisted of adults aged 18 years and older residing in Croatia. All respondents reported purchasing or using food supplements. The pharmacist sample included pharmacy graduates or pharmacy technicians employed in community pharmacies or specialised stores in Croatia. According to the Croatian Health Statistics Yearbook published by the Croatian Institute of Public Health (Hrvatski zavod za javno zdravstvo, 2026), Croatia has approximately 3,330 pharmacists and 3,241 pharmacy technicians. These figures should nevertheless be interpreted as approximate because fully up-to-date data may not be available. They nevertheless provide contextual reference for the obtained sample size. Regarding generalizability, the consumer sample was predominantly female and included very few respondents aged 65 years or older. Pharmacist responses predominantly originate from private pharmacies; therefore, the results should be interpreted with caution and cannot be generalised to the broader population.

Data were processed in Microsoft Excel and IBM SPSS Statistics 26.0. The analyses included descriptive statistics, one-way ANOVA with Tukey HSD post hoc tests, Pearson's χ^2 tests with Cramer's V, and Spearman rank-order correlations. ANOVA was used for education and income comparisons, while χ^2 tests examined categorical associations. For the pharmacist sample, one-way ANOVA addressed HF1 and HF2, and Pearson's χ^2 addressed HF3. Assumptions were checked prior to analysis. Although some non-normality was observed, ANOVA was considered sufficiently robust, and Levene's test was non-significant. Robustness checks (Welch's ANOVA; Kruskal–Wallis) were applied where appropriate. Note that the number of observations varies across correlations due to pairwise deletion of missing values. Statistical significance was set at $p < 0.05$. Nine primary tests were pre-specified (H1–H6; HF1–HF3). P-values were not adjusted for multiple testing; therefore, interpret the findings as exploratory, with emphasis on effect sizes and 95% confidence intervals. Findings are presented together with effect sizes and confidence intervals to provide a broader interpretation of the results. No additional multiplicity adjustments were applied beyond this exploratory framing. When expected counts were low (≥20% of cells with expected values <5 or any cell <1), Fisher–Freeman–Halton exact tests were used (Monte Carlo, B = 10,000; fixed seed = 2,000,000). In such cases, exact results were prioritised over asymptotic ones.

Sample characteristics

As shown in Table 1, the 701 surveyed consumers were predominantly female (71.6%), with age concentrated in middle adulthood (36–50 years: 45.2%; 26–35: 22.3%), and fewer respondents aged 18–25 (10.6%), 51–65 (20.5%), and >65 (1.4%). Most participants were employed (79.5%). Education was relatively high (graduate degree 39.1%; high school 35.7%; undergraduate 15.7%; master's/doctorate 8.8%). Household income clustered in the middle ranges (€800–€1,400: 31.1%; €1,401–€2,000: 31.1%; €2,001–€3,000: 16.7%). Overall, the sample reflects an economically and educationally active population.

Table 1
Sociodemographic profile of consumers participating in the study

Variable	Category	N	(%)
Gender	Male	194	27.7%
	Female	502	71.6%
	Prefer not to say	5	0.7%
Age	18–25	74	10.6%
	26–35	156	22.3%
	36–50	317	45.2%
	51–65	144	20.5%
	>65	10	1.4%
Work status	Employed	557	79.5%
	Self-employed	62	8.8%
	Students	57	8.1%
	Unemployed	5	0.7%
	Retired	14	2.0%
	Other	6	0.9%
Highest level of education	Elementary school	5	0.7%
	High school	250	35.7%
	Undergraduate degree	110	15.7%
	Graduate degree	274	39.1%
	Master's degree/Doctorate	62	8.8%

Monthly income	Less than €800	54	7.7%
	€800–€1,400	218	31.1%
	€1,401–€2,000	218	31.1%
	€2,001–€3,000	117	16.7%
	More than €3,000	49	7.0%
	Prefer not to say	45	6.4%

Source: Authors' work

The study included 233 pharmacists employed in pharmacies and speciality stores. The sample was predominantly female (87.1%), with most respondents falling within the 26–50 age range (26–35: 37.3%; 36–50: 46.8%). Work experience clustered at 11–20 years (33.9%) and >20 years (24.9%). The vast majority worked in private pharmacies (85.8%), with smaller shares in Public (state) pharmacies (9.4%) and hospital pharmacies (0.4%). One objective was to assess perceived consumer awareness before counselling, on a 1–5 Likert scale; the mean was 3.06. Pharmacists viewed manufacturers' marketing as the most influential factor in purchasing, followed by recommendations from pharmacists and physicians; influencers came next, while family/friends had less impact. Requests for a specific brand were reported often (74.7%), sometimes (24.0%), rarely (0.9%), and always (0.4%). The perceived influence of price had a mean of 3.59. Table 2 summarises the pharmacists' sociodemographic profile.

Table 2
Sociodemographic profile of pharmacists (N = 233)

Variable	Category	N	(%)
Gender	Male	28	12.0%
	Female	203	87.1%
	Prefer not to say	2	0.9%
Age	18–25	11	4.7%
	26–35	87	37.3%
	36–50	109	46.8%
	51–65	20	8.6%
	>65	6	2.6%
Years of work experience	< 1 year	12	5.2%
	1–5 years	53	22.7%
	6–10 years	31	13.3%
	11–20 years	79	33.9%
	> 20 years	58	24.9%
Pharmacy type (work setting)	Hospital pharmacies	1	0.4%
	Public (state) pharmacies	22	9.4%
	Private pharmacies	200	85.8%
	Other	10	4.3%

Source: Authors' work

The results first describe purchasing habits and priorities among consumers, then examine group differences in price and brand ratings, correlations between trust ratings, and the purchase factors reported by age and education. The pharmacist results begin with a description of professional perspectives, followed by comparisons by work experience and age. Effect sizes and confidence intervals, where available, accompany the tests to help assess the magnitude and precision of the observed patterns.

Results

Consumers' attitudes towards food supplements

The results show that consumers most often purchase food supplements several times a year (43.1%) or once a month (37.0%). Pharmacies are the most frequently reported place of purchase (56.6%). Online pharmacies account for 21.5%, supermarkets and drugstores for 15.6%, and direct purchases from manufacturers for 6.3%. The most commonly purchased product categories are vitamins and minerals, probiotics and prebiotics, proteins and amino acids, and herbal preparations. Products for joint health, energy, or weight loss are purchased less frequently. The main reasons for using food supplements are general health and disease prevention. Other reasons include specific needs such as pregnancy, immunity support, or sports activities. On a Likert scale from 1 to 5, the average importance rating for brand is 3.43. When purchasing in pharmacies, respondents rated a clearly communicated price as most important (4.30). This was followed by professional advice (4.12) and comprehensive service (4.04). A detailed breakdown of key factors, motivations, and purchase frequency is provided in Table 3 (multiple responses allowed).

Table 3
Factors, motivations, and purchase frequency for food supplements among consumers

Variable	Category	N	(%)
Main factors influencing the decision to purchase food supplements (1)	Product quality and composition	449	64.1%
	Brand/manufacturer	168	24.0%
	Personal experience with the product	366	52.2%
Main reasons for using food supplements (2)	General health and disease prevention	580	82.7%
	Recommendation from a physician/pharmacist	116	16.5%
	Recommendation from family or friends	89	12.7%
	Specific health needs	305	43.5%
Frequency of purchasing food supplements	At least once a week	19	2.7%
	Once a month	259	36.9%
	Several times a month	93	13.3%
	Several times a year	302	43.1%
	Once a year or less frequently	28	4.0%

Note: (1) and (2) Multiple responses allowed; totals may exceed 100% (N = 701).
Source: Authors' work

The most frequently used information sources are Google and manufacturers' websites. Social media, forums, and blogs follow these. YouTube reviews, influencers, and podcasts are less commonly used, while a small share of respondents report not using digital sources at all. Trust is highest in physicians (3.98) and pharmacists (3.90). It is moderate for family and friends (3.59) and lowest for media and digital sources (2.65–2.18). The preferred information mode is direct advice from pharmacists at the point of purchase, then social media/online portals and brochures; TV/radio are mid-ranked, while email/SMS are the least chosen. Marketing campaigns sometimes influence purchasing decisions for 46.1% of respondents, whereas 40.9% reported no influence. Pharmacist advice sometimes changes consumer opinions for 61.9% of respondents, often for 17.1%, and not at all for 12.7%.

Differences in the perceived importance of price when purchasing food supplements across education levels (H1)

A one-way ANOVA indicated a significant effect of education on the perceived importance of price, $F(4, 694) = 4.729$, $p = 0.001$, $\eta^2 \approx 0.027$, 95% CI [0.005, 0.050]. Although Shapiro–Wilk tests indicated non-normality (all ps < 0.001), Levene's test was non-significant, $F(4, 694) = 0.966$, $p = 0.426$. Given the large sample size, ANOVA was considered sufficiently robust. As a non-parametric robustness check, a Kruskal–Wallis test also indicated significant differences across education levels ($H(4) = 14.358$, $p = 0.006$), and the overall pattern of statistically significant contrasts was unchanged. Table 4 shows that mean price importance was highest among respondents with a high-school education ($M = 3.34$, $SD = 0.987$) and lowest among those with elementary education ($M = 2.00$, $SD = 1.732$).

Table 4

Mean perceived importance of price by respondents' education level (N=699)

Education level	M (mean)	SD (standard deviation)
0 – Elementary school	2.00	1.732
1 – High school	3.34	0.987
2 – Undergraduate degree	3.16	1.036
3 – Graduate degree	3.21	0.972
4 – Master's degree/Doctorate	2.87	0.983
Total	**3.21**	**1.005**

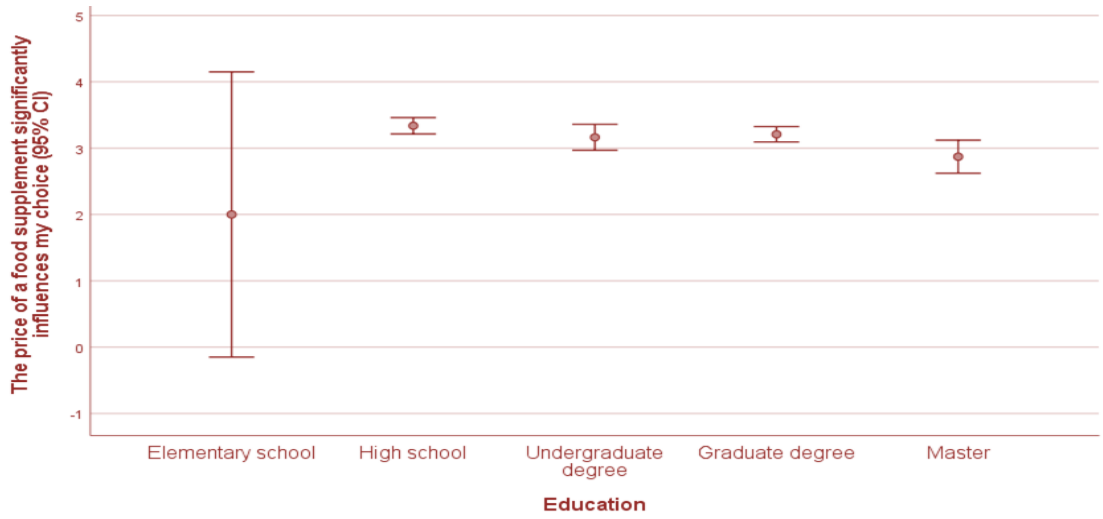
$F(4, 694) = 4.729$, $p = 0.001$, Levene's test $p = 0.426$, Shapiro–Wilk $p < 0.001$, $\eta^2 \approx 0.027$

Source: Authors' work

A robustness check using Welch's ANOVA confirmed the effect, $F(4, 29.40) = 3.314$, $p = 0.023$. Post hoc Tukey HSD tests showed that respondents with elementary education rated price significantly lower than those with secondary education ($p = 0.025$; 95% CI [−2.57, −0.11]). Respondents with an undergraduate degree also rated price significantly higher than those with a master's or doctoral degree ($p = 0.009$; 95% CI [0.08, 0.85]). Differences among the remaining education groups were not statistically significant.

Figure 1

Mean importance of food supplement price by respondents' education level (95% CI) *(1)*



Note: (1) Tukey HSD: High school > Elementary school ($p = 0.025$); Undergraduate (College) > Master's degree/Doctorate ($p = 0.009$).

Source: Authors' work

Figure 1 illustrates the group means with 95% confidence intervals. However, the estimate for the elementary education group (N = 5) should be interpreted with caution because it is based on a very small subsample.

Differences in the perceived importance of the manufacturer's brand when purchasing food supplements across income levels (H2)

A one-way ANOVA showed a significant effect of monthly income on the perceived importance of the manufacturer's brand, $F(4, 651) = 3.366$, $p = 0.010$, $\eta^2 \approx 0.020$ (small); 95% CI [0.001, 0.041]. Although Shapiro–Wilk tests indicated non-normality across income groups (all ps < 0.001), Levene's test was non-significant, $F(4, 651) = 0.219$, $p = 0.928$, supporting the homogeneity-of-variance assumption. As a non-parametric robustness check, a Kruskal–Wallis test also indicated significant differences across income levels, $H(4) = 11.560$, $p = 0.021$; the overall pattern of statistically significant contrasts (reported below) was unchanged. Table 5 shows mean brand importance increasing with income from 2.98 in the <€800 group to 3.73 in the >€3,000 group.

Table 5

Mean perceived importance of the manufacturer's brand by respondents' income level (N=655)

Monthly income level	M (mean)	SD (standard deviation)
1 – Less than €800	2.98	1.251
2 – €800–€1,400	3.44	1.068
3 – €1,401–€2,000	3.44	1.051
4 – €2,001–€3,000	3.48	1.080
5 – More than €3,000	3.73	1.076
Total	**3.43**	**1.089**

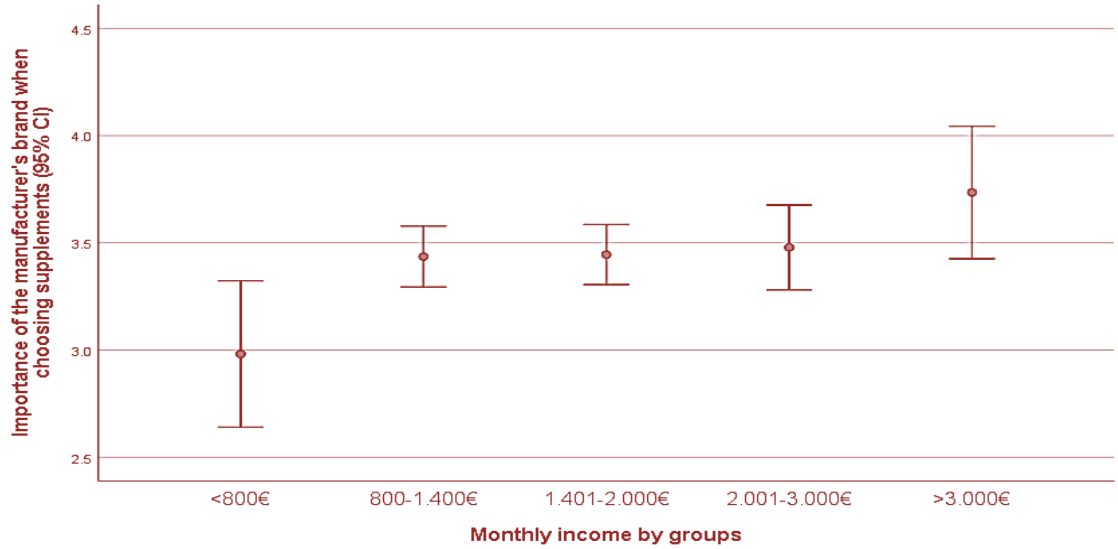
$F(4, 651) = 3.366$, $p = 0.010$, Levene's test $p = 0.928$, Shapiro–Wilk $p < 0.001$, $\eta^2 \approx 0.020$

Source: Authors' work

However, given the large group sizes, ANOVA was considered sufficiently robust. A robustness check using Welch's ANOVA produced consistent results, $F(4, 180.69) = 2.741$, $p = 0.030$. Post hoc Tukey HSD tests showed that respondents earning <€800 rated brand importance significantly lower than all other income groups (vs €800–€1,400: $p = 0.046$, 95% CI [−0.90, 0.00]; vs €1,401–€2,000: $p = 0.040$, 95% CI [−0.91, −0.01]; vs €2,001–€3,000: $p = 0.042$, 95% CI [−0.98, −0.01]; vs >€3,000: $p = 0.004$, 95% CI [−1.34, −0.17]). Figure 2 displays the group means with 95% CI.

The mean values indicate that brand importance is lowest among respondents with the lowest income (M = 2.98, SD = 1.25) and increases across higher income groups, reaching its maximum among those earning more than €3,000 (M = 3.73, SD = 1.07). This pattern suggests that the manufacturer's brand becomes more important as income rises, potentially reflecting greater purchasing power and a stronger association between the brand and quality among higher-income consumers.

Figure 2
Mean importance of manufacturer's brand by income level (95% CI) [1]

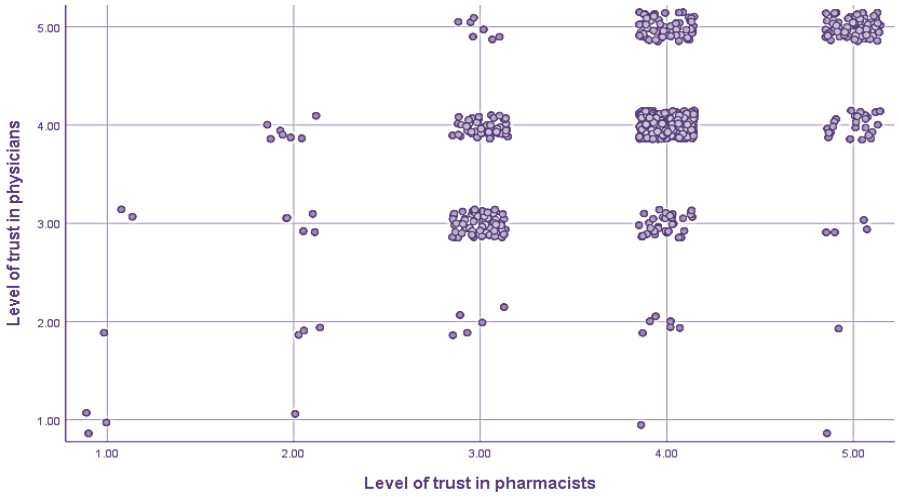


Note: (1) Tukey HSD: <€800 lower than all other income groups; ps shown in text
Source: Authors' work

Relationship between trust in pharmacists and trust in physicians as sources of information on food supplements (H3)

A Spearman rank-order analysis showed a statistically significant, moderately strong positive correlation between trust in pharmacists and trust in physicians as sources of information on food supplements (Spearman's ρ = 0.568, n = 701, p < 0.001, 95% CI [0.516, 0.616]). Respondents who report higher trust in pharmacists also tend to report higher trust in physicians, indicating consistent reliance on professional medical authorities. Figure 3 illustrates this association; the concentration of points toward the upper-right corner illustrates the positive correlation.

Figure 3
Trust in physicians versus trust in pharmacists (Spearman's ρ = 0.568, n = 701, p < 0.001)



Note: Both variables are measured on a 1–5 Likert scale; overlapping points can occur because the scales are discrete.
Source: Authors' work

Relationship between trust in media and digital sources of information on food supplements (H4)

Furthermore, trust in media sources and trust in digital sources of information on food supplements are positively and moderately strongly correlated (ρ = 0.501, n = 701, p < 0.001, 95% CI [0.443, 0.555]), as shown in Table 6.

Table 6
Spearman rank-order correlations among trust in information sources about food supplements (N = 701)

Source of trust	Pharmacists	Physicians	Friends, colleagues, and family	Media (TV, online portals)	Influencers and social media
Pharmacists	1.000	0.568*	–0.020	0.140*	–0.039
Physicians	0.568*	1.000	0.101*	0.123*	0.032
Friends, colleagues, and family	–0.020	0.101*	1.000	0.155*	0.145*
Media (TV, online portals)	0.140*	0.123*	0.155*	1.000	0.501*
Influencers and social media	–0.039	0.032	0.145*	0.501*	1.000

Note: * p < 0.05 (two-tailed)
Source: Authors' work

Respondents who trust media sources are also more likely to trust digital sources of information. This correlation suggests a shared pattern in source perception: a general openness to information that does not necessarily originate from professional circles.

Differences in the importance of product quality and composition when purchasing food supplements across age groups (H5)

Pearson's χ^2 test showed a significant association between age and whether respondents cited product quality and composition as a purchase factor, $\chi^2(4) = 12.761$, p = 0.013, Cramer's V = 0.135 (small; 95% CI [0.000, 0.199]). Table 7 reports the counts and percentages by age group.

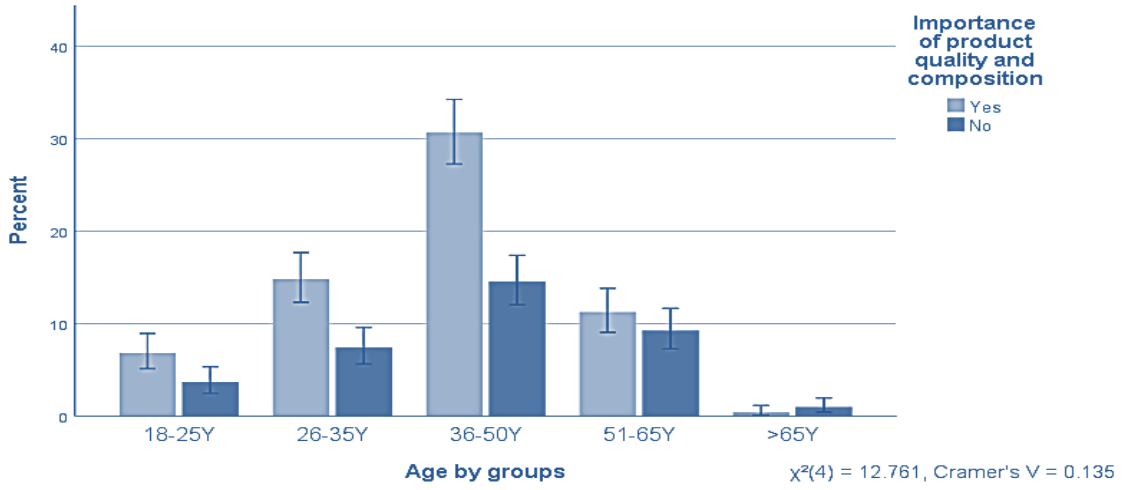
Table 7
Frequency of reporting product quality and composition as a purchase factor by age group

Product quality and composition	18–25	26–35	36–50	51–65	65+
Not reported	26 (35.1%)	52 (33.3%)	102 (32.2%)	65 (45.1%)	7 (70.0%)
Reported	48 (64.9%)	104 (66.7%)	215 (67.8%)	79 (54.9%)	3 (30.0%)

$\chi^2(4) = 12.761$; p = 0.013; Cramer's V = 0.135, 95% CI [0.000, 0.199]*
*Note: *1 cell (10.0%) had expected counts < 5 (minimum expected = 3.59), so the asymptotic Pearson χ^2 p-value may be biased. We therefore report the Fisher–Freeman–Halton exact test (Monte Carlo, B = 10,000, seed = 2,000,000), p = 0.013 (99% CI [0.010, 0.016]); for comparison, Monte Carlo p-values were 0.010 for Pearson's χ^2 (99% CI [0.008, 0.013]) and 0.016 for the likelihood-ratio χ^2 (99% CI [0.013, 0.019]).*
Source: Authors' work

Respondents in younger age groups (18–50 years) more frequently reported product quality and composition as key purchase factors (64.9%–67.8%), whereas this share was markedly lower in the oldest group (>65 years; 30.0%). In the 51–65 group, the proportion also dropped (54.9%), with the highest proportion recorded among respondents aged 36–50. Figure 4 illustrates these proportions by age group; error bars show 95% CI.

Figure 4
Reporting product quality and composition as a purchase factor by age group (%, 95% CI)



Source: Authors' work

Differences in the role of personal experience in food supplement purchases across education levels (H6)

Pearson's χ^2 test showed a significant association between education level and reporting personal experience as a purchase factor, $\chi^2(4) = 13.098$, $p = 0.011$, Cramer's $V = 0.137$ (95% CI [0.000, 0.201]). Table 8 presents the counts and percentages within each education group, with the highest proportions observed among undergraduate and graduate-degree respondents (58.2% and 58.0%), lower among high school (46.0%) and master's (43.5%) degree respondents, and the lowest among elementary school (20.0%) respondents.

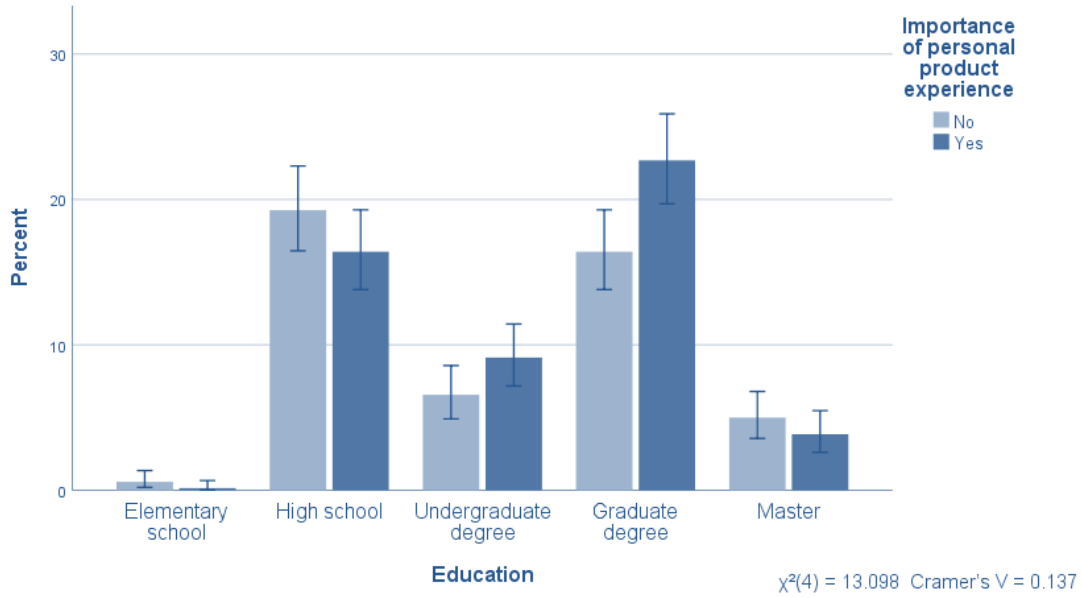
Table 8
Frequency of reporting personal experience as a factor in purchasing food supplements by respondents' education level

Personal experience	Elementary school*	High school	Undergraduate degree	Graduate degree	Master's degree/ Doctorate
Not reported	4 (80.0%)	135 (54.0%)	46 (41.8%)	115 (42.0%)	35 (56.5%)
Reported	1 (20.0%)	115 (46.0%)	64 (58.2%)	159 (58.0%)	27 (43.5%)

$\chi^2(4) = 13.098$; $p = 0.011$, Cramer's $V = 0.137$, 95% CI [0.000, 0.201]
Note: * Two cells (20.0%) had expected counts < 5, both in the education = 0 column (Not reported = 2.39; Reported = 2.61). As this is at the acceptable threshold, the chi-square test results should be interpreted with caution.
Source: Authors' work

Respondents with higher education (college and graduate degrees) most frequently reported personal experience (58.2% and 58.0%), whereas this proportion was markedly lower among those with elementary education (20.0%). Notably, respondents with a master's or doctoral degree showed a lower proportion (43.5%), which may indicate a greater tendency to rely on professional knowledge rather than personal impressions. Overall, respondents with higher education levels were more likely to incorporate their own experience into the decision-making process. Figure 5 visualises these proportions by education level; error bars show 95% CI.

Figure 5
Reporting personal experience as a purchase factor by education level (%, 95% CI) (1)



Note: (1) Percentages are within education level; small cell sizes in the elementary group - interpret with caution.
Source: Authors' work

Pharmacists' attitudes towards food supplements

Pharmacists perceived manufacturers' marketing campaigns as the most effective promotional strategy (73.4%), followed by recommendations from pharmacists (43.4%) and physicians (35.6%), while influencer recommendations ranked lower (27.0%). Most pharmacists recommend food supplements daily (88.4%), with another 10.7% doing so several times a week. Customers often arrive requesting a specific brand (74.7%; sometimes 24.0%). When making recommendations, pharmacists most often relied on personal experience, followed by manufacturer/distributor training, their own research, the experience of other professionals, and promotional materials from manufacturers. The average rating for the influence of pharmacists' recommendations on purchase decisions was 3.82. The statement that pharmacists should be more involved in consumer education received an average score of 4.14; the statement that pharmacist recommendations significantly influence purchase decisions scored 3.97; and the statement that pharmacists play a key role in education scored 4.04. Statements related to marketing campaigns received lower scores (consumers purchase solely due to marketing: 3.65; marketing has a greater impact than expert recommendations: 3.17), while promotions and discounts in pharmacies scored 3.92. The statement that consumers are well informed before

coming to the pharmacy received the lowest score (3.02). Regarding the regulation of promotion, 44.6% mostly agreed with the need for stricter regulation and 36.9% fully agreed. Table 9 reports the full distributions of responses.

Table 9
Pharmacists' perceptions and practices related to food supplements (N = 233) (1)

Variable	Category	N	(%)
Influence on consumers' decisions to purchase food supplements	Pharmacist recommendation	101	43.4%
	Physician recommendation	83	35.6%
	Influencer recommendation	63	27.0%
	Marketing campaigns	171	73.4%
	Other	18	7.7%
The frequency with which consumers request a specific brand of food supplements based on experience	Rarely	2	0.9%
	Sometimes	56	24.0%
	Often	174	74.7%
	Always	1	0.4%
Average frequency of recommending food supplements to consumers	Daily	206	88.4%
	Several times a week	25	10.7%
	Several times a month	1	0.4%
	Several times a year	1	0.4%
	Once a year or less frequently	0	0.0%
Perceived influence of price on consumers' decision to purchase food supplements	Rarely	8	3.4%
	Sometimes	99	42.5%
	Often	106	45.5%
	Always	20	8.6%
Attitudes toward stricter regulation of food supplement promotion	Absolutely not	3	1.3%
	Mostly not	33	14.2%
	Not sure	7	3.0%
	Mostly yes	104	44.6%
	Absolutely yes	86	36.9%

Note: (1) Multiple responses allowed; percentages may exceed 100%.
Source: Authors' work

In the open-ended responses, pharmacists emphasised the need for stricter, more up-to-date regulation of supplement quality, including more frequent checks of product stability and the accuracy of declared ingredients; a professional, transparent, and ethical approach to patients; and adjusting recommended doses to actual user needs.

Differences in pharmacists' perceptions of the impact of price on consumer decisions about food supplements across work experience levels (HF1)

A one-way ANOVA showed a statistically significant difference in the assessed impact of price on consumers' decisions across pharmacists' work-experience groups, $F(4, 228) = 4.139$, $p = 0.003$, $\eta^2 \approx 0.068$ (small–medium). Although Shapiro–Wilk tests indicated non-normality across groups (all p-values < 0.01), Levene's test was non-significant, $F(4, 228) = 1.889$, $p = 0.113$, supporting the assumption of homogeneity of variance; given the sample sizes, ANOVA was considered sufficiently robust. A robustness check using Welch's ANOVA produced consistent results, $F(4, 61.357) = 4.249$, $p = 0.004$. As a non-parametric robustness check, a Kruskal–Wallis test also indicated significant differences across work experience groups, $H(4) = 15.341$, $p =$

0.004; the overall pattern of statistically significant contrasts (reported below) was unchanged. Table 10 shows that mean ratings of the impact of price on consumer decisions decrease with years of professional experience, from 3.85 (1–5 years) to 3.43 (>25 years; overall M = 3.59).

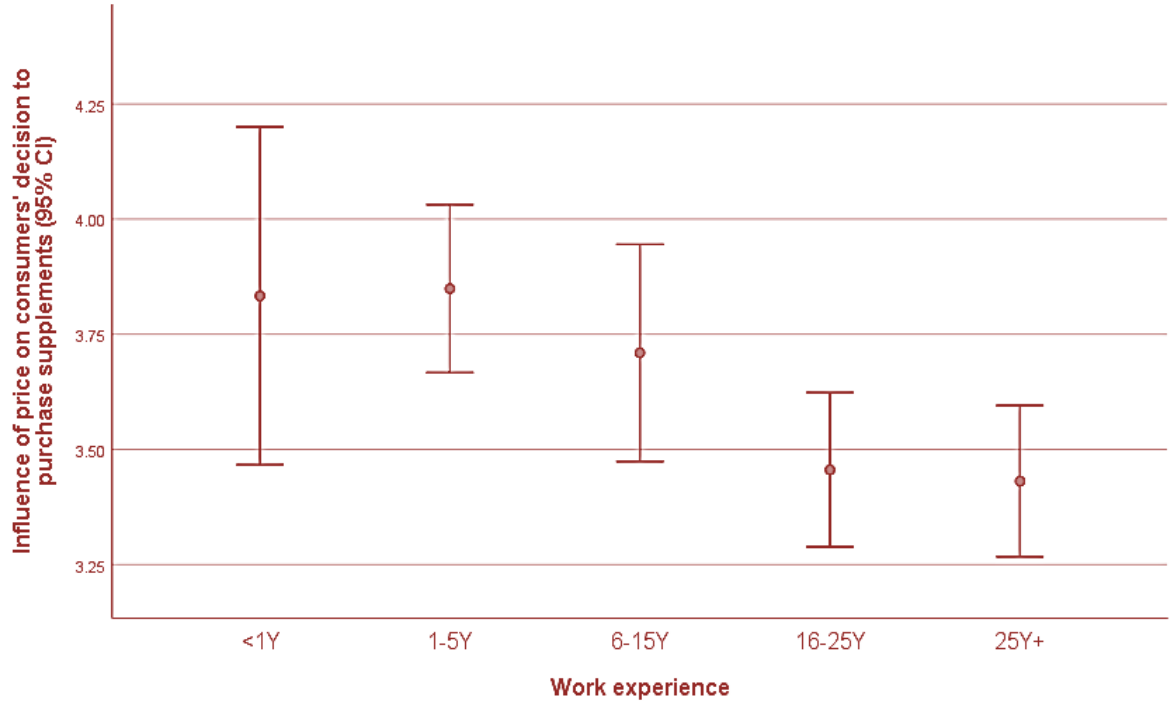
Table 10
Mean assessment of the impact of price on consumers' decisions by work-experience level

Work-experience level	M (mean)	SD (standard deviation)
1 – Less than 1 year	3.83	0.577
2 – 1 to 5 years	3.85	0.662
3 – 6 to 15 years	3.71	0.643
4 – 16 to 25 years	3.46	0.748
5 – More than 25 years	3.43	0.624
Total	**3.59**	**0.696**

Note: $F(4, 228) = 4.139$, $p = 0.003$, Levene's test $p = 0.113$, Shapiro–Wilk $p < 0.001$, $\eta^2 \approx 0.068$
Source: Authors' work

Post hoc analysis using Tukey HSD showed that pharmacists with 1–5 years of work experience rated the impact of price on consumer decisions significantly higher than those with 16–25 years ($p = 0.011$–0.016, 95% CI [0.05, 0.74]) and those with >25 years ($p = 0.008$–0.012, 95% CI [0.06, 0.77]). Differences among the remaining groups were not statistically significant. Overall, the results suggest that younger pharmacists place greater importance on price, while more experienced professionals place less importance on it. Figure 6 displays the group means with 95% CI.

Figure 6
Mean perceived impact of price by work-experience group (95% CI)



Source: Authors' work

Differences in pharmacists' perceptions of the frequency of requests for a specific brand of food supplements across work experience levels (HF2)

A one-way ANOVA showed no statistically significant difference in the assessed frequency of requests for a specific brand across pharmacists' work-experience groups, $F(4, 228) = 1.610$, $p = 0.173$, $\eta^2 = 0.028$ (small). As a non-parametric robustness check, a Kruskal–Wallis test likewise did not detect differences across work-experience groups, $H(4) = 5.979$, $p = 0.201$, consistent with the ANOVA. Table 11 presents the group means and standard deviations (range ≈ 2.67–2.87).

Table 11
Mean frequency of requests for a specific brand by work-experience group

Work experience	M (mean)	SD (standard deviation)
1 – Less than 1 year	2.67	0.651
2 – 1 to 5 years	2.70	0.662
3 – 6 to 15 years	2.87	0.568
4 – 16 to 25 years	2.69	0.466
5 – More than 25 years	2.81	0.587
Total	**2.74**	**0.586**

Note: $F(4, 228) = 1.610$, $p = 0.173$, $\eta^2 = 0.028$
Source: Authors' work

Although the differences were not statistically significant, pharmacists with 6–15 years and more than 25 years of experience reported slightly higher demand for specific brands than less experienced pharmacists. However, these differences were small and not statistically confirmed.

Association between pharmacists' age and their attitudes toward stricter regulation of food supplement promotion (HF3)

Pearson's χ^2 test of independence showed a statistically significant association between pharmacists' age and their attitude toward the need for stricter regulation of food supplement promotion, $\chi^2(16) = 47.797$, $p < 0.001$, Cramer's $V = 0.226$ (95% CI [0.141, 0.288]), indicating a small to medium effect. The highest proportion of 'Absolutely yes' responses was in the 18–25 group (45.5%) and the 26–35 group (42.5%), whereas 'Mostly yes' peaked in the 26–35 group (48.3%) and among those over 65 (50.0%). Negative responses (Mostly no/absolutely not) were most common in the 36–50 (20.2%) and 51–65 (25.0%) groups and absent in the youngest group. This pattern suggests a generational difference, with younger pharmacists expressing more substantial support for stricter regulation. Table 12 presents the cross-tabulation by age (see table note for exact-test results).

Table 12
Pharmacists' attitudes toward the need for stricter regulation of food supplement promotion by age

Do you think there should be stricter regulations regarding the promotion of food supplements?	18–25 years	26–35 years	36–50 years	51–65 years	>65 years	Total

Absolutely yes	5 (46.0%)	37 (43.0%)	36 (33.0%)	6 (30.0%)	2 (33.0%)	86 (37.0%)
Mostly yes	3 (27.0%)	42 (48.0%)	47 (43.0%)	9 (45.0%)	3 (50.0%)	104 (45.0%)
Mostly no	0 (0.0%)	6 (7.0%)	22 (20.0%)	5 (25.0%)	0 (0.0%)	33 (14.0%)
Absolutely not	0 (0.0%)	1 (1.0%)	1 (1.0%)	0 (0.0%)	1 (17.0%)	3 (1.0%)
Not sure	3 (27.0%)	1 (1.0%)	3 (3.0%)	0 (0.0%)	0 (0.0%)	7 (3.0%)
Total (N)	**11 (100%)**	**87 (100%)**	**109 (100%)**	**20 (100%)**	**6 (100%)**	**233 (100%)**

Note: $\chi^2(16) = 47.797$; $p < 0.001$; Cramer's V = 0.226, 95% CI [0.141, 0.288]*
Note: *17 cells (68.0%) had expected counts < 5 (minimum expected = 0.08), so the asymptotic Pearson χ^2 *p*-value may be biased. We therefore report the Fisher–Freeman–Halton exact test (Monte Carlo, B = 10,000, seed = 2,000,000), p = 0.010 (99% CI [0.007, 0.013]); for comparison, Monte Carlo p-values were 0.004 for Pearson's χ^2 (99% CI [0.002, 0.005]) and 0.011 for the likelihood-ratio χ^2 (99% CI [0.008, 0.014]).
Source: Authors' work

Across the two surveys, consumer ratings of price and brand varied by education and income, respectively, and trust ratings were correlated within the two pairs of information sources examined. Consumers' reporting of product quality and composition varied with age, while their reporting of personal experience varied with education. Among pharmacists, ratings of the impact of price varied across work-experience groups, and support for stricter promotion rules varied by age. The comparison of brand-request frequencies across work-experience groups was inconclusive. The discussion considers these exploratory findings in relation to prior research on supplement choice and pharmacy practice.

Discussion

The findings generally support the proposed hypotheses and align with previous research on food supplement use and health-related consumer behaviour. The results indicate that product quality and composition are key determinants of food supplement purchasing behaviour. The age-related pattern for product quality and composition supports H5, and the association between education and reliance on personal experience supports H6. These findings are consistent with previous research showing that consumers prioritise intrinsic product attributes such as composition and quality (Ankiel et al., 2021; Martinović et al., 2024). It also aligns with studies highlighting the role of personal experience in supplement choice (Ang et al., 2023; Aufegger et al., 2021; Intarakamhang & Prasittichok, 2022a, 2022b; Martinović et al., 2024). In addition, prior research emphasises the importance of formulation transparency and verified ingredients in shaping consumer trust (Teoh et al., 2021). The data suggest that younger consumers more often cite product quality and composition as important purchase factors, while education is associated with the likelihood of relying on personal experience. Price and brand were also relevant factors, but their importance varied across sociodemographic groups. Price ratings varied across education groups (H1), while respondents in the lowest household income group gave the manufacturer's brand lower importance ratings than the other income groups (H2). These patterns are consistent with evidence on price salience in supplement choice (Teoh et al., 2019) and with broader findings on how perceived quality/value and

income relate to brand loyalty (Annikmah & Indrawati, 2025; García-Salirrosas & Escobar-Farfán, 2024; Phiri, 2007). Trust in information sources exhibited a clear structure: trust in professional sources such as pharmacists and physicians was mutually correlated ($\rho \approx 0.57$), supporting H3 and reflecting high confidence in healthcare professionals reported elsewhere (Andrzejewska et al., 2022); te (Paske et al., 2023; Vinciguerra, 2022). Trust in media and digital sources was also interrelated ($\rho \approx 0.50$), forming a distinct cluster of media and digital information sources that is more prominent among younger respondents, supporting H4 and aligning with prior reports on media and influencer impact (Melero-Bolaños et al., 2025; Pilgrim & Bohnet-Joschko, 2019; Ricke & Seifert, 2025). Among pharmacists, patterns varied by work experience: less-experienced pharmacists placed greater emphasis on price (HF1 supported). This is consistent with evidence that price is a salient counselling criterion often tailored to consumers' means (Gregório et al., 2023; Tarhan & Arslan, 2022; Xin et al., 2024).

Although brand-specific requests are frequently described in pharmacy practice (Brunelli et al., 2022; Welna et al., 2003), the cited literature does not report comparisons of their frequency by pharmacist tenure; the present comparison was inconclusive, as the omnibus test used for HF2 did not assess equivalence across work-experience groups. Support for stricter regulation of promotional activities was higher in younger age groups (HF3 supported), consistent with calls for more explicit rules and ongoing education (Kwan et al., 2006; Stayduhar et al., 2023; Strocka et al., 2024). Analysing consumers and pharmacists within the same study enabled direct comparison of perceptions and revealed generational differences within the pharmacy profession. Overall, the findings support most of the proposed hypotheses and indicate that personal experience and trust in professional sources significantly influence outcomes alongside elements of the conventional marketing mix (Bukić et al., 2021; Kelly et al., 2022).

This study contributes to the literature in several ways. First, it moves beyond the dominant single-actor approach by integrating consumer and pharmacist perspectives within a single analytical framework. This enables a direct comparison between market demand and professional judgement in the context of food supplements. Second, the study jointly analyses trust in information sources, sociodemographic characteristics, and perceived purchase factors, which previous research often examines separately. In doing so, it identifies two distinct dimensions of trust, namely professional sources and media and digital sources, thereby providing a clearer understanding of how consumers perceive different information sources. Third, the findings highlight the importance of sociodemographic segmentation in shaping the relative importance of price, brand, and experiential factors, contributing to a more nuanced understanding of consumer decision-making in health-related markets.

From a practical perspective, the findings suggest that communication strategies should be tailored to different consumer segments, particularly by age, education, and income. The strong reliance on pharmacists and physicians underscores the importance of strengthening pharmacist-led counselling and ensuring clear, evidence-based information is available at the point of purchase. Furthermore, the identified differences in attitudes toward promotion support the need for clearer and more standardised regulatory guidelines for food supplement marketing.

Conclusion

This study examined the determinants of food supplement purchasing in Croatia from the perspectives of consumers and pharmacists. It analysed food supplement

decision-making across both market demand and professional counselling within a single analytical framework. Product quality and composition, personal experience, and professional recommendations were identified as the main determinants of purchasing behaviour, while the relevance of price and manufacturer brand varied across education and income groups. Trust in information sources revealed two dimensions: professional sources and media and digital sources, with the latter being more prominent among younger respondents. Among pharmacists, the perceived importance of price varied according to work experience, with higher ratings among less experienced pharmacists. Younger pharmacists also expressed stronger support for stricter promotional rules. These findings support segmented communication strategies, stronger pharmacist-led counselling, and more transparent promotional guidelines. The sample composition constrains generalizability. In the consumer sample, women accounted for 71.6% of respondents, while individuals aged ≥65 represented only 1.4%, limiting the representation of older age groups. The online non-probability sample and self-reported measures may have introduced response bias, and the cross-sectional design precludes causal inference. The findings should therefore be interpreted as exploratory, with emphasis placed on effect sizes and 95% confidence intervals. For HF3 (age × regulation), an exact test was used because of sparse cells, increasing uncertainty around the estimated effect magnitude.

Overall, the study contributes to a more integrated understanding of food supplement purchasing behaviour by combining consumer and pharmacist perspectives within an integrated framework. Future research should examine these relationships using probability-based samples and longitudinal or experimental designs. It could also incorporate objective behavioural data, such as pharmacy records, to complement self-reported measures.

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