SOME BIOLOGICAL, BEHAVIORAL AND SOCIAL ASPECTS OF THE PERFUMERY USE IN THE UKRAINIAN POPULATION SAMPLE (PART 2. EDUCATION LEVEL ASSOCIATIONS)

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The aim. *The study represents a continuation of the previous one, and provide various aspects related to the use of perfumery, which can be characterized by certain associations with the education level of Ukrainian consumers. Factors that have direct or indirect biological and medical significance and, accordingly, may have a potential impact on the safety of the perfume products use by humans, were selected for the analysis.*

Materials and methods. *The analysis included information about 124 individuals living in Ukraine. The respondents answered the questions of the questionnaire developed regarding some aspects of the perfumery use. The Pearson chi-squared (χ^2) test was used to analyze the relationships between qualitative characteristics.*

Results and discussion. *Most of the studied aspects related to the perfumes use demonstrate associations, caused by the dependence of the education level on age. The analysis revealed that individuals with any education most often (about half of the cases or more) choose a perfume based on its scent. The study showed that the majority of respondents believe that the price of a perfume depends on a combination of factors, namely the composition of the products, the brand and the cost of the packaging. More than 80 % of people, regardless of the education level, believe that the persistence of a perfume is definitely a sign of quality. The most common opinion among people of all education levels was that non-original perfumes can have a more negative effect on people's health than original products. The "lipstick effect" in relation to perfume products (demand for items of "affordable luxury" in times of economic crises and wars) was observed.*

Conclusions. *The study supplemented the previously found associations of age and some biological and behavioral aspects of perfume use among the population of Ukraine with data on the presence or absence of such associations in relation to the education level*

Keywords: *Perfumery, Ukraine, perfumery selection factors, education level, war, lipstick effect*

1. Introduction

According to a common idea, humans have a poorly developed olfactory system compared to other species of mammals. Such a hypothesis was developed in the 19th century, although it had no empirical evidence. It is now known, that the human olfactory bulb is actually quite large and contains the same number of neurons as in other mammals, which gives the human olfactory ability an excellent quality. Thus, a human being can distinguish a wide range of smells, can be olfactory more sensitive than rodents and dogs, and also can be under the significant influence of smells on behavior and emotional state [1]. Smells play a huge role in human life, affecting emotions, sexual arousal, perception of social status, etc. [2]. For a modern person, the use of artificially created smells, including those in the form of perfumes, has become an integral part of the life. In addition to the perfumes themselves, their packaging plays a significant role, which in some cases is considered as a separate art object and to which, like the perfumes themselves, modern methods of identifying the originality of origin are applied [3].

In a previous study, we analyzed the possible associations of some aspects related to the perfume use and respondents age [4]. This study is a continuation of our previous pilot study, but the emphasis is on identifying possible associations of these aspects with the education level of the study participants.

2. Materials and methods

The study participants were 142 people, including 124 females and 18 males aged 10 to 60 years and older. All of them lived in the city of Kharkiv and the Kharkiv region and were randomly selected. Due to the small percentage of male respondents, only female respondents were included in further analysis.

We developed a questionnaire [4] in a Google form, which was sent to the respondents to their email inboxes. The questionnaire contained 15 questions related to the attitude to perfumes, the respondents' awareness of perfumes composition, the content of harmful ingredients, the persistence of the smell, and the impact on human health. In addition, the questionnaire contained questions of a socio-demographic nature, namely: age, gender, place of residence, education. All respondents were familiarized with the objectives of the study and gave voluntary consent to participate in it in accordance with the requirements of the Declaration of Helsinki.

Each of the following questions of the questionnaire provided only one possible answer option.

The Pearson chi-squared (χ^2) test was used to analyze the relationships between qualitative features. The values of the number of freedom degrees df, the χ^2 criterion and the p-value were calculated. If the p-value was ≤0.05, a decision was made about the presence of statistical dependence between characteristics. The results of the questionnaire were introduced into an Excel database. Data processing was carried out in the Statistica 6.0 program.

3. Results

For a more correct statistical analysis, the respondents were further divided into three educational groups: "the lowest education level", "the middle education level" and "the highest education level". The individuals with the "the lowest education level" included those who had incomplete secondary education (still in the process of studying at school). The individuals with "the middle education level" included persons who had complete secondary education (completed school), secondary special education (completed college, school or technical school) and incomplete higher education (completed only 3 courses of a higher educational institution. "The highest education level" included only complete higher education (presence of the appropriate diploma). The distribution results are presented in Table 1.

Table 1

Distribution of respondents by education level in different age groups

Education level	Age group			
	The youngest	The middle-aged	The oldest	Total
The lowest education level, n	36	0	0	36
%	100	0	0	100
The middle education level, n	1	17	16	34
%	3	50	47	100
The highest education level, n	0	20	34	54
%	0	37	63	100
Total, n	37	37	50	124
%	30	30	40	100

Note: Statistics. χ^2=121.82; df=4; p<0.001

It can be observed, that among persons of the youngest age group (from 10 to 17 years old), the only possible education was an incomplete secondary education (only 36 persons and 100 %, respectively). Among persons of the middle age group (from 18 to 39 years), there were approximately equal numbers of those who had the middle and the highest level of education (46 % and 54 %, respectively). At the same time, there were almost twice as many people with the highest level of education among people in the older age group (from 40 years and older). Thus, it is possible to trace the association between the age and the education level of the respondents, namely, the older a person is, the more likely it is that he/she is more educated. Such an association may be somewhat prognostic when the various factors, included in the analysis, are analyzed and indicate that age associations may actually reflect the association of the trait with the education level.

Regarding the place of residence, most of the study participants, regardless of the education level, lived in a large city (Kharkiv). Thus, in all education groups, there were more than 90 % of such individuals, and people with the lowest education level were characterized by a higher urbanization degree (no person lived in a village). For convenience, we united residents of urban-type settlements and villages into one group (Table 2).

Table 2

Places of residence of study participants with different education levels

Education level	Places of residence		
	City	Urban-type settlements and villages	Total
The lowest education level, n	35	1	36
%	97	3	100
The middle education level, n	31	3	34
%	91	9	100
The highest education level, n	50	4	54
%	93	7	100
Total, n	116	8	124
%	94	6	100

Note: Statistics. χ^2=1.20; df=2; p=0.55

In relation with the large representation of various professions of the study participants (and the complexity of their grouping, respectively), the analysis by professional affiliation was considered inappropriate. Thus, the professions (or relevant professional groups) of the respondents, which are given in this study only for descriptive purposes, were as follows: school students, university students, school teachers and university lecturers, kindergarten teachers, nurses and doctors, designers, lawyers, economists, managers, commodity experts, social

service inspectors, tax officers, salespeople, seamstresses, hairdressers, stewards, cooks and other food workers, veterinarians, engineers, researchers, freelancers, private entrepreneurs, housewives, pensioners and people who temporarily did not have a job.

It should be noted, that when we found a small number of answers for certain categories in different groupings, we conducted an additional grouping of categories, which will be seen later in the analysis of specific aspects.

Thus, all further analysis was conducted only for females, taking into account their education level (the three indicated groups), depending on whether the previous analysis was made with or without grouping of certain response categories.

In the results, we included mainly those relationships (associations) that demonstrated the effect of statistical significance or could be fixed at the level of stable trends. In some cases, such statistical significance was not observed, and the results were descriptive in nature, as evidenced by their p-values.

3. 1. Associations of education level and factors related to perfume use
3. 1. 1. The factor that mainly affects the choice of perfumery

A preliminary analysis demonstrated that people with any education most often (about half of the cases or more) choose a perfume based on its scent. The brand of the perfume product among all the mentioned factors of choice also plays a role, but already much less important. That is why we further combined all factors into 3 groups, namely a specific scent, brand, and others (price, composition, purpose of use, advertising, experience of acquaintances, and the effect of spontaneity) (Table 3).

Table 3

Factors that mainly influence the choice of perfumery

Education level	Factor			
	Brand effect	Certain scent	Other	Total
The lowest education level, n	2	23	11	36
%	6	64	30	100
The middle education level, n	6	19	9	34
%	18	56	26	100
The highest education level, n	14	26	14	54
%	26	48	26	100
Total, n	22	68	34	124
%	18	55	27	100

Note: Statistics. $\chi^2=6.22$; $df=4$; $p=0.18$

Thus, there is no significant association between specific factors of perfume choice and education level. In the preliminary study of the relationship between age and the factors of perfume choice, we found that although people, regardless of age, are also more likely to focus on a certain fragrance, still, in older age groups, the focus on brand perfumes is increasing, but this association had a statistically significant pattern [4]. In the current research, it is also possible to trace, that with an increase in the education level, the role of the brand factor increases, but only at the level of the trend. Similar results may have a common explanation: since education and age are associated with each other, higher age and, accordingly, a higher education level may indicate greater financial freedom in choosing higher quality products, including perfumes.

3. 1. 2. Respondents' subjective perception of factors influencing the price of perfume products

The study demonstrated that the majority of respondents believe that the price of a perfume depends on a combination of factors, namely the composition of the products, the brand and the cost of the packaging. It should be noted, that this is the opinion of individuals regardless of their education level (Table 4).

Table 4

Factors that affect the price of perfumes accordingly to the study participants opinion

Education level	Factor			
	Product composition	Brand	Combined role of composition, brand and packaging	Total
The lowest education level, n	6	5	21	32
%	19	15	66	100
The middle education level, n	5	8	16	29
%	17	28	55	100
The highest education level, n	6	13	30	49
%	12	27	61	100
Total, n	17	26	67	110
%	15	24	61	100

Note: Statistics. $\chi^2=2.12$; $df=4$; $p=0.71$

3. 1. 3. Scent persistence as a possible aspect of perfume quality

Since a highly desired consumer characteristic of perfumes is their persistence, which is usually associated with perfume quality, our questionnaire included a question on whether the study participants consider this characteristic to be an indicator of high quality. Possible answers were yes, no, more yes than no, and I don't know.

The grouped distribution for the most frequent answer options is given in Table 5, from which it can be seen, that a significant majority of our sample agrees with the widespread opinion that high-quality perfumes are perfumes with a persistent scent. Thus, more than 80 % of people, regardless of the education level, believe that the persistence of a perfume is certainly one of the signs of quality.

Table 5

Persistence of perfume odor as an indicator of their quality in the respondents' perception

Education level	Persistence of perfume odor is an indicator of quality		
	Yes or more yes than no	No	Total
The lowest education level, n	27	4	31
%	87	13	100
The middle education level, n	27	5	32
%	84	16	100
The highest education level, n	43	11	54
%	80	20	100
Total, n	97	20	117
%	83	17	100

Note: Statistics. $\chi^2=0.84$; df=2; p=0.66

It should be noted, that indeed, the persistence of the odor is considered a factor of the quality of perfumery products. At the same time, it should be remembered, that the persistence depends on the type of product and the corresponding content of aromatic substances. The product, issued by the same brand, but in different concentrations, will have different stability. It is quite obvious, that the smell of a particular perfume with an aromatic content of about 30 % will be the most persistent, while a cologne with an aromatic content of about 1 % will be the least persistent. At the same time, both products can be high-quality or low-quality. The persistence of the odor can depend on a number of factors, including stabilizing ingredients and skin characteristics of the individual who uses a certain fragrance [5].

It is also known, that the stability of the smell is provided by amber-woody molecules, which can be found in perfumes of different price categories and different manufacturers. Mostly, they are large synthetic molecules that remain on the surface of the skin or on the cloth for a long enough time. They are characterized by a pleasant aroma and contribute to the fact that the whole composition leaves a longer sillage. Examples of such molecules are ambroxan and similar compounds [6, 7], Iso E Super® [8], etc.

3. 1. 4. Perceptions of the impact on human health of fake and original perfumes by respondents with different education levels

Counterfeiting is a common problem, particularly in the cosmetics industry and in the case of expensive perfumes. This encourages the development and improvement of methods for analyzing the authenticity of both the perfume itself and its packaging. For example, instant methods based on ion chromatography and gas chromatography have proven themselves well. The results showed that counterfeit perfumes generally had lower levels of ethanol and higher levels of chlorides compared to the original product [9].

As a rule, the composition of perfumes is analyzed by one method, and the composition of glass bottles is analyzed by another method. In a recent study, a laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) method was developed for glass classification using perfume bottles produced at different production facilities, namely, in Germany, India, Peru and Poland. By means of this minimally invasive method, it was possible to detect fake bottles without opening them. In total, during the development of the method, it was possible to record 63 elements. After statistical evaluation, 15 (Li, Na, Al, Ti, V, Co, Rb, Sr, Mo, Ba, La, Ce, Pr, Er and Pb) marker elements were identified, which are important for distinguishing different origins of glass. Using LDA, it was possible to distinguish six different production sites from four different countries with a prediction accuracy of 100 % [3].

The most common opinion among people of all education levels was that non-original perfumes can have a more negative effect on people's health than original products. That is why we combined the results of the most frequent answers (Table 6). At the same time, it is possible to notice the presence of a statistically significant relationship between the perception of respondents on this issue and their education level. Thus, with the increase in the education level, fewer and fewer females believe that fake perfumes are more harmful than original ones. Thus, among people with the lowest education level, opinions about the more negative impact of fake perfumes on health were widespread among 86 % of females. Among people with the middle education level, 65 % of females held this opinion, and only 55 % of females with the highest education level believed that fake perfumes are worse than original ones in terms of the effect on the human body.

Table 6

Comparison of fake and original perfumes regarding the subjective potential impact on human health

Education level	Fake perfumes are more dangerous than original ones		
	Yes or more yes than no	No	Total
The lowest education level, n	25	4	29
%	86	14	100
The middle education level, n	15	8	23
%	65	35	100
The highest education level, n	21	17	38
%	55	45	100
Total, n	61	29	90
%	68	32	100

Note: Statistics. $\chi^2=7.30$; $df=2$; $p=0.03$

It should be understood, that although fake products can theoretically contain more dangerous substances for humans, original perfumes can also have a negative effect on the body. For example, this was demonstrated in rats, in which both original and fake perfumes had the same effect on the induction of the inflammatory process, which was marked by an increase in the number of mast cells in various organs and tissues after exposure to perfumes of different origins [10].

3. 1. 5. Awareness of the impact of synthetic components of perfume products among people of different education levels

Most of the participants in our study believed that synthetic perfume ingredients are more harmful than natural ones. When examining the results in a grouped manner, a statistically significant association between the education level and a negative attitude towards synthetic components was observed (Table 7). Thus, the highest percentage of negatively disposed individuals is found among people with the lowest education level (91 %), the lowest one was found among persons with the highest education level (61 %).

It can be seen, that with an increase in the education level, people become more tolerant to the presence of unnatural components in perfumery products.

It is interesting, that other authors previously established a relationship between the education level of cosmetic products consumers in general and the risk of developing allergic reactions. Thus, a clear relationship was found between a lower education level and a weak understanding of the labeling of cosmetic products, namely the possibility of the allergens presence in it, which can lead to the occurrence of adverse reactions in susceptible persons [11].

Table 7

Distribution of respondents depending on the negative attitude towards synthetic perfumery ingredients

Education level	Subjective perception of the harmfulness of synthetic perfumery ingredients on the human body		
	Harmful	Safe	Total
The lowest education level, n	21	2	23
%	91	9	100
The middle education level, n	17	4	21
%	81	19	100
The highest education level, n	22	14	36
%	61	39	100
Total, n	60	20	80
%	75	25	100

Note: Statistics. $\chi^2=7.36$; $df=2$; $p=0.03$

3. 1. 6. Attitudes towards the possibility of purchasing perfumes in difficult periods

Since the research was conducted precisely during the times when active military operations are taking place on the territory of Ukraine, it was interesting to study the attitude of people to the purchase and, accordingly, use of "affordable luxury" items during such periods, to which we can well include perfumes.

As it is known, a similar effect of increasing demand for expensive lipstick brands has been historically observed, well studied and even has an appropriate name as the "lipstick effect". The "lipstick effect" is that people will still buy small "luxuries" even during an economic downturn. Consumers, being in a depressed state, can af-

ford such purchases, which has a calming effect and is an adaptive coping mechanism for difficult situations.

The "lipstick effect" was first noted by Leonard Lauder, chairman of The Estée Lauder Companies Inc. For example, after the terrorist attacks on September 11, 2001, there was an 11 % increase in demand for lipstick. Later, during the economic downturn of 2008, the Estée Lauder company again noted the increase in sales of its lipstick. A similar situation was described during the Great Depression, when sales of cosmetic products increased, and the economy was going through very difficult times [12].

Most of the participants in our study were of the opinion that in difficult times it is absolutely necessary to

pamper yourself with perfume. This attitude is widespread among respondents regardless of the education level, no statistically significant associations are observed (Table 8). According to the increase in the education level, such individuals were 71 %, 52 % and 54 %, respectively.

Table 8

"Lipstick effect" (relative to perfume) among study participants

Education level	Attitudes towards the purchase of perfumes in difficult times		
	Negative	Positive	Total
The lowest education level, n	8	20	28
%	29	71	100
The middle education level, n	13	14	27
%	48	52	100
The highest education level, n	18	21	39
%	46	54	100
Total, n	39	55	94
%	41	59	100

Note: Statistics. χ^2=2.76; df=2; p=0.25

A certain parallel can be drawn between the military actions in modern Ukraine, which are associated with the general destabilization of the economic situation, and the recent situation of the Covid-19 pandemic, which has reached global proportions. So, in particular, in the USA, in the specified period, online sales of cosmetic products and personal care products increased compared to the period before Covid-19. Such a demand was evident in relationship with the need to move to an online work format and the important role of appearance, in particular, the state of the face, in the absence of filters in platforms, such as Zoom. Mass lockdowns, in particular, in many US states, have led to the fact that hospitals and cosmetic clinics have suspended the provision of many cosmetic services. Nevertheless, in connection with this, people began to independently purchase care products and even carry out procedures that previously required the participation of a specialist on their own. This desire did not even stop the fact that in many cases it led to complications of home cosmetic procedures and the need for further online consultations [12].

It can be added, that the need to look good, in which both cosmetics and perfumes play a significant role, is an important biological adaptation. Scientists explain this behavior of females by the fact that increasing the desire to use products that improve attractiveness for partners increases the probability of increasing partners' resource in such difficult times, surviving and leaving offspring [13].

However, the idea of other scientists should be presented, which is no less logical, also aimed at increasing competitiveness, but not at the expense of direct biological explanations, but through mediated social associations. Thus, the phenomenon of increased desire and use of appearance-enhancing items during economic crises is not based solely on females, motivation to look better in order to increase their attractiveness to financially stable partners. Evidence has been found that during economic recessions, the increased economic anxiety, experienced by females, translates into an increased desire to use appearance-enhancing items to attract romantic partners, while creating a favorable impression of oneself in the workplace, as both strategies can help females to become financially secure. Females with high economic concern were also found to choose to improve their professional appearance more often than their romantic attractiveness, suggesting that their motivation to obtain resources through work dominates their motivation to obtain resources through a partner [14].

Limitations of the study. The study is of a pilot nature, some results have the nature of trends, and not statistically proven hypotheses.

Prospects for further research. In our future research, we plan to expand the sample to include males, as well as conduct an analysis taking into account other demographic and social factors, not just age and education level.

4. Conclusions

Most of the studied aspects related to the use of perfumes show associations, caused by the dependence of the education level on age. The analysis demonstrated that people with any education most often (about half of the cases or more) choose a perfume based on its scent. The study showed that the majority of respondents believe that the price of a perfume depends on a combination of factors, namely the composition of the products, the brand and the cost of the packaging. More than 80 % of people, regardless of the education level, believe that the persistence of a perfume is definitely a sign of quality. The most common opinion among people of all education levels was that non-original perfumes can have a more negative effect on people's health than original products. The "lipstick effect" in relation to perfume products (demand for "affordable luxury" items in times of economic crises and wars) is shown.

Conflict of interests

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results, presented in this article.

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Data availability
Data will be made available on reasonable request

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