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CALCULATION OF WEIGHT INDICATORS OF THE IMPORTANCE OF USING ODORIVECTORS FOR THE PURPOSE OF FORMALIZING OLFACTOMETRY DIAGNOSIS

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ABSTRACT

One of the most difficult non-formalized tasks of medical diagnostics is an olfactometric study. Therefore, in this article an attempt is made to standardize the results of diagnosis of olfactory analyzer disorders. For the development of the integral indicator of olfactory sensitivity in order to formalize the diagnostic data on the basis of the method of increasing the objectivity of alfakometric studies, weighting coefficients were determined based on the method of attribution of points. A questionnaire was prepared for our study. The expert opinion of nine experts on the degree of importance of each odorant during the conduct of an olfactometric study on a scale of one to ten was taken into account. The level of expertise of the working group experts was also assessed. The obtained weighting factors will be useful in developing decision support systems in diagnostics of the olfactory analyzer.

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Introduction. Uncertainty in medical practice is becoming a major problem on the way to a precise diagnosis, since it prevents you from choosing the best solution and, consequently, can cause a poor response. [1]. There are various approaches to creating medical diagnostic systems, for example, expert systems that deal with unformalized tasks that require a non-standard approach. One of the most difficult non-formalized tasks of medical diagnostics is an olfactometry study.

There are many methods for assessing olfactory disturbances, among which are the most popular sniffing sticks test, the University of Pennsylvania Smell Identification Test (UPSIT) and others [2], but the main difference is the number of used odorivectors, which makes formalization of olfactory abnormalities difficult. Therefore, it seems advisable to propose an integral criterion for assessing olfactory disturbances. The choice of odorivectors in olfactory tests is also due to a geographic factor: olfactory stimuli should be easily detected by the subjects. Another aspect for effective olfactometry research is the use of objective measurement tools, lack of objectivity is a disadvantage of the most popular tests (UPSIT, Sniffing sticks test, etc.).

Taking into account the above, it seems necessary to develop an integral indicator of olfactory sensitivity in order to formalize diagnostic data in the development of decision support systems based on a method for increasing the objectivity of olfactometry research [3-5], with the help of which it is possible to perform objective investigations of respiratory and olfactory disorders and it fully meets the requirements.

Results of the study. It is necessary to make a determination of the importance of the selected private indicators (the degree of sense of the odorivectors), in other words, the weight coefficients used in the integral functions. One of the most common ways of determining weighting factors is the method of expert assessments (attribution of points). In contrast to the ranking method, experts here, depending on the importance of the indicator, set points from 0 to 10, and it is allowed to estimate the importance of the indicator by fractional values, as well as the same indicators can be assigned the same points. The level of competence of the experts of the working group (M) must meet the following condition:

$$0,67 \le M \le 1,00 \tag{1}$$

Moreover, the value of M is calculated by the following formula:

$$M = \frac{1}{m} \cdot \sum_{j=1}^{m} K_j, \tag{2}$$

where K_j – is the j-th expert's level of competence,
m – is the number of experts in the working group.
In order to evaluate the level of competence (K_j) of each j-th expert (j = 1, m) by the authors [6], it is proposed to use the following equation:

$$K_j = \frac{1}{5} \sum_{i=1}^{5} K_{ij} \tag{3}$$

Expression (3) includes five generalized Kij indicators taken into account in assessing the level of competence of the j – expert, while ($0 \le K_{ij} \le 1$).

K_{1j} – takes into account professional qualifications, seniority and experience;
K_{2j} – takes into account the level of awareness in the field of scientific publications;
K_{3j} – takes into account, on the basis of self-esteem, the desire for professional growth, the ability to work in the team, as well as discipline and organization;
K_{4j} – takes into account the personal qualities of the expert given to him by colleagues experts;
K_{5j} – takes into account the level of coordination of the expert's actions with the members of the formed working group when performing the test assignment.

To determine the weight coefficients of odorivectors in developing the integral indicator of olfactory sensitivity, the expert opinion of nine experts on the degree of importance of each odorous substance during the conduct of an olfactometry study was taken into account. The level of competence of the experts of the working group is M = 0,88, which satisfies condition (1), hence the formed group is competent.

Experts in the field of otorhinolaryngology were offered questionnaires, where it was proposed to put points from 1 to 10 in terms of the importance of using odorivectors (1 - tincture of valerian, 2 - acetic acid, 3 - ammonia) to detect olfactory disturbances. Where 1 point is not important, 5 is of average importance, 10 is very important. Then we measured the weight of each indicator counted by each expert.

According to the method of attributing points [7]:

$$r_{ij} = \frac{n_{ij}}{\sum_{j=1}^{m_i} h_{ij}} \tag{4}$$

where r_{ij} – the weight of the j-th indicator, determined by the i-th expert, h_{ij} – the score of the i-th expert, exhibited to the j-th indicator, m – the number of indicators. Finally, the weight coefficients of the indicators are determined by the formula:

$$w_j = \frac{\sum_{j=1}^{n} r_{ij}}{\sum_{j=1}^{m} \sum_{i=1}^{n} r_{ij}} \tag{5}$$

where n – the number of experts.
Calculation of weight coefficients by the method of assigning points is given in table 1.
The weights take the following values:

$$w_1 = \frac{5,927}{9} = 0,659$$

$$w_2 = \frac{2,603}{9} = 0,289$$

$$w_3 = \frac{0,471}{9} = 0,052$$

Table 1 – Determination of weight coefficients by the method of attributing points

Experts	Score points			Sum	Weights of indicators		
	n_{i1}	n_{i2}	n_{i3}		r_{i1}	r_{i2}	r_{i3}
1	10	10	5	25	0,400	0,400	0,200
2	10	8	0	18	0,556	0,444	0,000
3	10	5	0	15	0,667	0,333	0,000
4	9	3	1	13	0,692	0,231	0,077
5	10	2	0	12	0,833	0,167	0,000
6	10	3	1	14	0,714	0,214	0,071
7	10	1	0	11	0,909	0,091	0,000
8	9	5	1	15	0,600	0,333	0,067
9	10	7	1	18	0,556	0,389	0,056
				Sum	5,927	2,603	0,471

The small value of odorivector weighting factor 3 (ammonia) does not mean that this indicator should not participate in the integral assessment of olfactory sensitivity. Ammonia alcohol is informative only when there are no indices when testing for tincture of valerian and acetic acid, that is, with anosmia, but the olfactory-taste sensitivity remains functioning.

Conclusions. Thus, the level of competence of the experts of the working group was assessed, the weighting factors (by the method of attributing scores), the sensations of three odorivectors were determined by the method of increasing the objectivity of olfactometric studies to determine the integral index of olfactory sensitivity with the support of decision-making in olfactometric diagnosis.

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