THE PROBLEM OF “NORM” IN MODERN MEDICINE – TRENDS OF INDIVIDUAL RECONSTRUCTION OF THE HUMAN ORGANISM AND NEW OPPORTUNITIES OF RESEARCH IN THE CONTEXT OF ACADEMIC INTEGRITY

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Introduction. The concept of norm belongs to the basic concepts of medicine. Only a thorough knowledge of the norm allows for differentiating the presence of abnormalities in the structure and functions of organs and systems, providing the possibility of their early diagnosis and effective correction.

The aim of our work was to clarify factors influencing the formation of the concept of norm, trends in its study in medical practice and the probability of independent research results. The approach to norm as a constant cannot be applied unambiguously in today’s realities. Normative indicators differ significantly for different groups of people; exogenous and endogenous factors influence them. Clarifying the indicators of the individual norm became possible due to the latest methods of radiological examination. Are such examinations safe and objective, how necessary are they, and what is the practical significance of their results? Multidimensional statistics have been developing rapidly over the last decade. The individual variability of each organism leads to significant variations in numerical indicators within the sample, which may ultimately cause different researchers to obtain completely different results when using various statistical methods. How to prevent their misinterpretation, fabrication and falsification? Another scientific research problem is “subconscious” plagiarism, which is based on random imitation or coincidence of an idea or discovery. It is almost impossible to avoid it because every new invention appears due to using previous experience. Approaching the problem of norm in terms of the concept of individual variability, we consider it appropriate and reasonable to develop not only age but also regional, constitutional, somatotypical, etc. normative indicators for people of each sex, as well as the need for its recurrent updating, clarification and supplementation, taking into account new data obtained by using the capabilities of modern methods of examination, diagnosis, and statistical analysis.

Keywords: Individual norm, radiological examination methods, statistical analysis, academic integrity.
Introduction

The concept of norm traditionally belongs to the basic concepts of medicine [1-7]. The normal indicators and criteria underlie the protocols of examination, diagnosis and treatment of patients at all stages of medical support – from preventive or screening examinations to pathological conclusions. Only a thorough knowledge of the norm allows one to differentiate the presence of abnormalities in the structure and functions of organs and systems before the clinical manifestations of the disease, providing the possibility of early diagnosis and effective correction [8, 9]. Usually, norm is defined as a set of characteristics or indicators in the form of generally accepted average values with clearly defined permissible limits or certain features of the structure, shape or topography [1-7]. At the same time, those indicators that go beyond the defined normative are mostly considered pathological by default and need to be corrected accordingly.

The aim of our work was to clarify the factors influencing the formation of the concept of norm, trends in its study in medical practice and the probability of independent research results.

Materials and methods

The data of full-text publications of domestic and foreign scientific publications, selected by searching Scopus, Web of Science Core Collection and PubMed databases and by surfing the web using keywords, were processed, analyzed and systematized.

Results and discussion

According to several scientists, clinical experience, and the results of numerous theoretical studies show that the approach to norm as a constant value in today’s realities can't be applied unambiguously [3–7, 10]. Normative indicators can differ significantly for groups of people living in different areas and people of different ages, genders, races, constitutions, and somatotypes. They are significantly influenced by social factors, living and working conditions, adequacy of physical activity, diet and nutrition, etc. [8–11]. Physicians and ecologists emphasize that in recent decades, a significant impact on the individual morphofunctional features of the modern human body has environmental factors – total environmental pollution, large-scale man-made disasters, and harmful production [10, 12–15]. Another important factor that influences the dynamic change of normative indicators of the human body of modern men, in particular – in childhood, adolescence and young age, are the processes of acceleration and retardation, which, depending on the harmony of the flow, lead to temporary, prolonged or permanent peculiarities in a particular organism [13–19]. The results of numerous studies show that representatives of different social and ethnic groups, people living in various areas and with varying degrees of physical activity, have similar anatomical and physiological normative criteria, but these criteria are characterized by certain dynamic boundaries inherent in each group, determined by a set of certain features [20–22]. It should be considered that the size of groups of persons for whom these features can be regarded as normal is inversely proportional to the number of features that unite them. That is why marginal indicators, which are the norm for one body, can be pathological for another, which, for a combination of different numbers of exogenous and endogenous factors, will belong to another group of subjects [22].

Forming a joint base of normal indicators for the structure and function of the body requires a long time, as it is based on data obtained by anthropometric, morphometric, functional, laboratory studies, systematized descriptions of clinical cases and the results of numerous examinations. Today, the specification of the individual norm has become possible due to the latest achievements in modern medical diagnostics, in particular, such areas of lifelong minimally invasive study of the structure and function of the body, its anatomical, physiological, biochemical characteristics, which are provided by modern highly sensitive radiation and laboratory methods.

No branch of medicine today can be imagined without the use of radiological methods of examination and diagnosis – X-ray and ultrasound, computer and magnetic resonance imaging, which, while maintaining the integrity of the body, open the possibility of obtaining information about its internal structure, structural features of the examined organ or areas, their topography, localization and spread of the pathological process. Numerous researchers confirm that computed tomography (CT) and magnetic resonance imaging (MRI) in the modern clinic are the most important diagnostic methods that have a pronounced anatomical basis and are part of the group of diagnostic methods of in vivo imaging [20, 21, 23–25 ]. Here, the question arises: what is the possibility and feasibility of using these examination methods for screening, collecting lifelong objective data on the structure of various parts of the modern human body in general and its complex anatomical structures, in particular, for the purpose of developing new, as well as updating and clarifying existing normative indicators, especially morphological ones. Can such examinations be considered safe and objective? How necessary are they? What is the practical significance of their results?
Of course, CT has certain disadvantages, the most significant of which are sufficiently high doses of radiation, which cannot be avoided by performing many tomograms of the examined area, which, according to some researchers, makes it impossible to conduct an examination without significant clinical indications and is associated with substantial risks for examined persons. This examination aims to obtain expected or planned results which does not comply with the principles of scientific integrity. According to most modern scientists, tomographs of recent generations, which presuppose making a series of images, have significantly minimized radiation exposure compared to devices of previous generations [9, 20, 24]. In any case, the radiation exposure received by the patient during computed tomography is largely justified by the large amount of important and early diagnostic information, which is of prior significance for the clinic and the patient, the importance of which is often hard to re-evaluate [9, 10, 19, 21, 28, 29]. The advantages of modern digital methods of radiological examination include the ability to study not only structural and linear but also physical (qualitative) characteristics of the examined tissues by determining their density (for this purpose, the X-ray attenuation scale or Hounsfield scale is used). It provides no image distortion, allows linking the image to one patient and archiving, creating unique fixed databases, which ensures dynamic monitoring of the patient [9, 19, 26–30].

Considering different points of view on the safety and informativeness of the patient’s examination under the current conditions, a retrospective study of a series of tests from the archives of medical centers and clinics of CT diagnostics seems to be quite a compromise. The main problem with this approach is the lack of clearly formed groups of respondents according to specific criteria (age, gender, area of residence, etc.), which significantly complicates and prolongs the study. To determine the normative indicators, groups should be formed, which include only healthy people, i.e. those who do not have diagnosed pathologies or specific complaints related to the examined somatotype at the time of the examination and apply for screening and preventive examination [9, 19, 21, 25–27]. In fact, such samples of processed archival data of computer tomogram series obtained during the examination of persons grouped according to different criteria (sex, age, residence area, physique, somatotype, etc.) allow obtaining new, often unpredictable, but only necessary information on the studied indicators. In recent years, the results of tomographic studies obtained by processing archival data of computed tomography clinics allowed morphologists and clinicians to get new, often unique data, determine significantly higher rates of mineralization of the skull in women than in men, identify patterns of age dynamics of morphometric and qualitative indicators of complex bone and cartilage structures of the maxillofacial area and spine in people of different ages, demonstrate the variability of the paranasal sinus structure, gallbladder and extrahepatic bile ducts, heart, lungs, bronchi, large vessels, brain structures, etc. (Figure 1–6) [8, 9, 15, 18–21, 23–33].

![Figure 1. Alveolar arch of the upper jaw in the form of oval (A); semicircle (B); ellipse (C); trapeze (D); square (E) (Dakhno L., Masna Z., 2022) [9]](image1)

![Figure 2. Different levels of lordosis of the cervical spine: low level of lordosis with signs of hyperlordosis (A), a middle level of lordosis (B), high level of lordosis with signs of hypolordosis (C) (according to Adamovych O., Kryvko Y., 2021) [19]](image2)
Figure 3. Maxillary sinus in the form of trapeze (A); square (B); circle (C); oval (D); rectangle (E), and triangle (F) (Cherkes M., Masna Z., 2022) [28]

Figure 4. The frontal sinuses are mushroom-shaped (A), bulb-shaped (B), bean-shaped (C), and trapezoidal (D). (Vasiliv M.-A. L., Masna Z.Z., 2022) [26]

Figure 5. Gallbladder in the form of pear (A); spindle (B); rectangular (C); and boomerang (D) (Zubko L. 2018)
Of course, the data obtained are often hard to explain, and it is unknown how to interpret them [34]. The status of a healthy patient raises many questions – the normality of the structure of a particular organ or area cannot be a sign of the entire body’s health and vice versa. It is also controversial that the main criterion of norm is the person’s clinical health because the category of clinically healthy people includes people with chronic and recurrent diseases in remission [35]. So, how should the indicators of healthy subjects be interpreted: as normal for a given person, for a particular group of people, or as a preclinical manifestation of pathology, the development of which can and should be prevented? Do the identified differences from the existing standard normative indicators constitute changes that require correction, a variant of the norm characteristic for a group formed according to certain characteristics, a manifestation of the body’s adaptation to certain conditions or its individual variability? Do they need observation, correction, or treatment?

Interpretations may differ, but, in our opinion, the primary and most important is the proclamation of obtained data, in particular, if they differ from the generally accepted indicators of norm [2, 4–7]. However, the analysis of research results publications shows that works that report negative and doubtful results are less often published and cited, although their importance is paramount to improving the quality of science [36].

The history of medicine has never been simple. Especially today, in the time of globalization, hypodynamics and mass ecological catastrophes, in the time of non-infectious pandemics that change the world and human beings [37, 38]. These are new realities and challenges in our lives, the quality of which, despite everything, we must preserve and improve. To understand the problem, you need information that cannot be ignored.

Based on the above, we share and support the position of those scientists who believe it is impossible today not to consider the fact that concepts of norm and health remain relative [1, 3, 4, 6, 7, 10, 11, 13, 35, 39]. It is known that an open arterial circle of the brain is a pathology, but for dolichocephalus, it is one of the variants of the norm; it is known
that the oblique position of the cardiac axis is normal, but for asthenics, the vertical heart is a variant of the norm, and for hypersthenics, it is horizontal [40]. And how to consider the quality of mineralized tissues – bones and teeth – utterly different from the norm in young residents of many endemic regions, in particular highlands, as an early manifestation of osteopenia that needs to be corrected, or group norm, which when present, still makes people feel absolutely healthy and allows them to live to a very old age? [41, 42]

The mathematical analysis allows us to see and evaluate the body’s structure as a norm and against the background of individual variability entirely differently. Over the last decade, multidimensional statistics have been intensively developed, including cluster analysis. The vast majority of modern statistical packages, such as SAS, Statistica, SPSS, software environment R, allow multidimensional analysis. Such programs are successfully used in various fields of medicine and biomedical science [43, 44]. Cluster analysis is interesting and promising in terms of interpretation of the norm of different organs at the cellular level, as it allows to position the structural features of organs differently, taking into account their function and location and based on the results of statistical processing of morphometric data [44–46]. The use of the k-means method, the mvoutlier package of the R software environment and the Ward hierarchical tree clustering method allowed to identify clusters of cells of the hepatic lobe, transitional epithelium of the bladder, etc., with certain metric, functional and topographic characteristics [47–50].

Any research should be conducted following the principles of academic integrity. Studies devoted to academic integrity, adequate scientific communication, and counteracting plagiarism manifestations offer various options for solving the current problems of modern scientific works. In this context, morphometric studies at different structural levels deserve the most attention, taking into account the data of CT, MRI and ultrasound examinations, as well as statistical data processing. The individual variability of each body leads to significant variations in digital indicators within the sample, resulting in entirely different results obtained by various researchers using different statistical methods. Obviously, all such results have a right to exist, but only if the author of the study clearly states the methods of statistical data processing and the prescribed algorithm for their implementation, which will prevent their misinterpretation [51].

Another problem of scientific research is subconscious plagiarism, which is based on random imitation or coincidence of an idea or discovery, which is almost impossible to avoid because each new invention appears as a result of previous experience and is characterized by natural and logical conclusions based on previously published works [52]. Today, the results of numerous independent studies have shown that the study of isolated parts of the body, outside their relationship with each other and with the general peculiarities of the body as a whole, does not determine the true idea of its anatomical peculiarities and health condition [4–7, 32]. Clarification of signs of the individual norm should combine the study of the body’s external features (race, sex, age, physique), residence areas of examined persons, the influence of external factors, occupation, exercising, diet, etc. and such features, as the structure, size, position and topography of internal organs, the quality of body tissues. Various authors note that it is not always possible to determine the relationship between external features and the peculiarities of the structure and position of internal organs. The less the body is studied in groups of people with a specific set of features, the more difficult it is to determine the features of its norm for members of this group. That is why, today, detailed studies of the features of all structures of the human body should be conducted using the capabilities of modern diagnostic equipment to clarify the trends of its individual reconstruction [9, 25–27, 31, 37, 39, 53].

In conclusion: Approaching the problem of the norm in terms of the concept of individual variability, we consider it appropriate and reasonable to develop not only age-based but also regional, constitutional, somatotypological, etc. standards of structural and functional indicators for people of each sex, as well as the need for periodic updates, clarifications, and additions, considering new data obtained by using the capabilities of modern highly informative methods of examination, diagnosis and statistical analysis in compliance with the principles of academic integrity.
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