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THE INFLUENCE OF DISEASES ON THE BIOSTRUCTURE
OF ANCIENT POPULATIONS *

One of the most important factors determining the biostructure of human populations is their health condition. The role of diseases in the life of human communities was justly formulated by Ackerknecht (Angel [1969]) who wrote the following sentence: 'The pathology of society reflects its common living conditions, development, economics, in other words it is an important key for the study of the whole community'. For these reasons pathology plays also a significant role in paleodemographic investigations.

The relationship between the biostructure of ancient populations and their health conditions appears to be a very difficult problem of research. It is well known that the osseous material is very often incomplete and not all diseases leave permanent traces in the skeletal system. Usually, only chronic, long lasting diseases result in the appearance of such traces. Epidemic diseases, which are so important from the demographic point of view, escape our attention.

Studies on the relationship between the state of health and the biostructure were performed for example by Angel [1969, 1969a] mainly on osseous material being in a good state of preservation. The purpose of my work is an attempt to utilize poorly preserved skeletal material for the same type of studies.

My investigations are limited to four skeletal series. Two of them are abundant but the skeletal materials are in a bad state of preservation. One of them, from the late Neolithic period, consisting of 218 skeletons originated from Złota (Tarnobrzeg province), and the other one originating from the Middle Ages consisted of 573 skeletons and was found in Czersk (Warsaw province). The other two skeletal series from Middle Ages are small but the skeletal materials are in a good state of preservation. The first one consisting of 42 skeletons originated from

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Doktorce (Białystok province), and the other consisting of 55 skeletons was found in Suraż (Białystok province). The last group represents inhabitants of a medieval castle, the former groups represent country people.

The following demographic traits were studied: (1) number of persons, (2) average age of adult persons, (3) fraction of dying children (d_{0-14}), (4) potential reproduction coefficient (R_{pot}) indicating the proportional number of the total theoretically possible childbirths falling to the average couple of adult people, (5) biological state index (I_{bs}) indicating the part of parental generation which takes part in the reproduction of the next generation, and (6) net reproduction coefficient (R_0) demonstrating the ability of the particular groups to their quantitative increase. The above coefficients were calculated with some assumptions, for example that these populations were not Malthusian ones and that one woman bore 6 children on the average, and that the number of dying children was not lower than 40%. The two coefficients and biological state index are taken from Henneberg's papers [Henneberg 1974, 1975, 1976, 1977; Henneberg, Piontek 1975].

The health condition of the investigated populations was evaluated according to the frequency and quality of pathological changes which were apparent in the skeletal systems. The following six groups of diseases were found: (1) congenital defects (e.g. spina bifida, canalis sacralis apertus), (2) systemic changes (e.g. hyperostosis spongiosa cranii, osteoporosis), (3) inflammatory processes (otitis, osteomyelitis (osteitis) abscessus, tuberculosis), (4) degenerative and deformative changes (osteophthosis, spondylosis ankylopoetica, arthroses), (5) tumours and tumour-like changes (e.g. osteoma, ameoblastoma), and (6) posttraumatic changes.

The investigated skeletal materials were divided into four groups according to the percentage of preserved bones: 1 - 10%, 11 - 30%, 31 - 60%, and 61 - 100%.

Fertility seems to be one of the best indices of the health condition. It is characterized by the number of children and by the average age of adults. As can be seen from table 1, the best demographic structure is presented by the medieval population of Doktorce. Life expectation appears to be about 41 years, thus being 6 to 9 years longer than in other groups. The number of children in this group of people, about 44%, is also the most favourable one. The worst state of health was observed in medieval population from Czersk, whereas the neolithic population from Złota and the medieval population from Suraż are in the intermediate position (table 1).

The number of people with pathological changes does not reflect the real demographic structure. It could be presumed that the highest number of sick persons should be observed in the population of Czersk.

Table 1

Traite	Site			
	Złota Late Neolithic (village)	Doktorce XIV-XV AD (village)	Czersk XII-XIII AD (village)	Suraż XI-XIII AD (castle)
<i>N</i>	218	42	573	55
Age	33,8	40,8	31,5	34,0
<i>d</i> ₀₋₁₄	29,9	43,9	18,9	18,2
<i>R</i> _{pot}	0,60	0,68	0,57	0,61
<i>R</i> ₀	1,08	1,14	1,02	1,11
<i>I</i> _{bs}	0,36	0,38	0,34	0,37
% of pathological changes	27,1	47,6	44,2	81,8
Congenital defects	10	5	13	20
Systemic changes	8	40	14	17
Inflammatory changes	35	20	40	48
Degenerative and deformative changes	54	45	35	66
Tumours	6	—	3	2
Traumata	23	20	13	20
% of preserved bones				
0 - 10	54	35	50	7
11 - 30	21	26	25	12
31 - 60	16	13	12	27
61 - 100	9	26	13	54

However, it was found that the percentage of sick people in this group was even lower than that in the group from Doktorce (table 1). A detailed investigation demonstrated the existence of some relationship between the biostructure and the state of health of the investigated populations.

Among the neolithic population of Złota the congenital defects are limited to one case of missing neural arch in single vertebra, two cases of vertebral block, one case of palatal cleft and one case of canalis sacralis apertus. The systemic processes were observed only in a form of generalized osteoporosis. In two cases of them the corpus vertebrae was flattened. Among the subjects with inflammatory diseases, one case of tuberculosis and one case of osteitis (osteomyelitis) were found but most often the inflammatory changes were observed in the mastication organ (62%). Several cases of inflammatory diseases (28%) could not be exactly identified. The degenerative and deformative changes were observed mainly in the vertebral column (61%), the other cases in this group were identified as arthroses associated mainly with the aging processes. Among the group with traumatic changes, the most

frequently observed cases (50%) were fractures of long bones and ribs. Traumatata of cranium constitute 40% in this group. It is noteworthy that about 36% of persons suffered from several diseases, for example the degenerative changes were accompanied by inflammatory processes or fractures.

In the medieval population the number of congenital developmental defects and systemic changes was found to be significantly higher. Particularly in the group from Doktorce a significant number of systemic changes was observed. It is of interest that hyperostosis spongiosa cranii, observed mainly in children, constitutes 87% of these changes but they are not significant (1° according to Hengen's classification [Hengen, 1971]). Among the subjects with traces of inflammatory processes, two cases of otitis (?), one case of caries, and one unidentified case were found. Significant percentage (45%) of degenerative and deformative changes appears to be associated with age. Only in one case there was a serious spondylitis ankylopoetica. The fractures were observed mainly in long bones. About 30% of Doktorce population suffered from several diseases.

The highest number of serious diseases was found in the group from Czersk. Among the subjects with congenital disorders, as many as 20% consists of spina bifida and canalis sacralis apertus, also one case of hydrocephalus was found. In the group with systemic disorders, hyperostosis spongiosa cranii was noted in 69% of subjects classified to this group, but these changes make 1° according to Hengen's classification. In 15.7% generalized osteoporosis and one case of osteomalatio (?) was observed. Among the subjects with inflammatory processes, one or two (?) cases of tuberculosis, seven cases of osteitis (osteomyelitis), and two other not exactly identified cases were found. In the mastication organ, changes like caries and abscesses were found in 76% of subjects. The degenerative and deformative changes in 24% of cases were localized in the joints, in 61% in vertebral column, and in 13% in joints and vertebral column. In 17% of cases many serious changes were found such as spondylitis ankylopoetica and Bechterev's disease. Among the subjects with tumours, one case of ameloblastoma was found [Gładkowska-Rzeczycka, 1978]. The traumatata were observed mainly in long bones and ribs (62%) and very often in cranium (25%). In 15% of cases very complicated traumatic changes were observed. About 18% of people from Czersk suffered from several diseases.

The highest number of subjects with apparent pathological changes was found in the population of the fortified city Suraz. However, most of these diseases were rather not dangerous. Among the serious diseases in 17% of subjects, hyperostosis spongiosa cranii was observed. Also in this group, like in the above series, these changes were not significant (1° acc. to Hengen's classification). The most serious were the cases

of lepra [Gładkowska-Rzeczycka, 1976], tuberculosis and meningioma (?). On the other hand, significant number of mastication organ disorders were observed in this group (60%). In the group with congenital defects, primarily missing neural arch in single vertebrae and one case of canalis sacralis apertus were found. The degenerative and deformative processes were mainly limited to insignificant changes in vertebral column. About 73% of inhabitants of Suraz suffered from several diseases.

It can be concluded from the above results that even the poorly preserved but abundant skeletal material could be utilized for studies on the influence of pathological conditions on the biostructure of ancient population.

As we know, the difficulty in the interpretation of obtained results depends not only on the state of the preservation of skeletal material, but also on the lack of historical and archaeological information. In the investigations of the relationship between the biostructure and the state of health, next to the pathological factors also the ecological, social, economical and even political conditions should be taken into account. It seems to be possible that the high frequency of diseases in the population of Suraz may be associated with the defensive function of the castle. Probably the population was often exposed to additional disadvantages which could induce the pathological processes in the mastication organs (defective diet), degenerative and deformative changes in the vertebral column (excessive hard work), or anaemia (defective diet and hygiene).

Undoubtedly, much more could be elucidated after obtaining more information concerning the history of these objects.

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WPLYW CHOROÓB NA STRUKTURĘ BIOLOGICZNĄ DAWNYCH POPULACJI

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Problem udziału chorób, w szczególności takich, których ślady znaleźć można na materiałach kostnych, w kształtowaniu struktury biologicznej populacji ludzkich w dawnych czasach zbadany został na czterech seriach szkieletowych. Dwie z nich to małe serie charakteryzujące się dobrym stanem zachowania materiału kostnego (Doktorce, Suraż), dwie dalsze — duże serie, lecz zachowane w znacznie gorszym stanie (Złota, Czersk).

Zbadano następujące charakterystyki demograficzne: 1) liczebność serii, 2) przeciętny wiek w chwili śmierci osób dorosłych, 3) frakcja zmarłych w wieku dziecięcym (d_{0-14}), 4) współczynnik reprodukcji potencjalnej (R_{pot}), 5) wskaźnik stanu biologicznego (I_{bs}), 6) współczynnik reprodukcji netto (R_0).

Wydzielono sześć grup schorzeń: 1) wrodzone wady rozwojowe, 2) zmiany systemowe, 3) procesy zapalne, 4) zmiany degeneracyjne i deformacyjne, 5) zmiany nowotworowe, 6) zmiany pourazowe.

Ogół osób ze zmianami patologicznymi nie odzwierciedla rzeczywistej struktury demograficznej populacji. Dokładniejsza analiza wykazała pewne zależności między strukturą biologiczną grupy a stanem zdrowia.