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SOME X-RAYS AND BODY DEVELOPMENT EXAMINATIONS OF MANY TIMES THE WORLD CHAMPION AND THE OLYMPIC GAMES WINNER – A LONG-DISTANCE RUNNER AT HIS 71 YEARS OF AGE

ABSTRACT: Top-performance sporting activities are interesting not only for the athletes and the general public, but also for scientists. What could be in this context more interesting than the possibility of anthropological and medical, especially of X-rays examination of a former world and Olympic champion, long-distance runner, Mr E. Z. at the ages of 23, 29 and of 71 years? During that time there had occurred numerous changes in his movement activity and nutrition regime. These changes caused some significant transformation in his body build, especially as to body composition and body posture (with the exception of foot arch, which has remained, after such a long runner's load, entirely normal) and influenced also some health predisposition. The overall clinical finding agreed with current findings in men of comparable age, with certain alterations in ECG, heart X-ray examination and echocardiogram. Main attention was focused on the X-ray examination of the lumbal spine, pelvis, coxal and knee joints of the sportsman. The findings were interesting, free of the usual pathological findings in the sense of osteoarthrosis, but presented exceptionally advanced osteoporosis. Maybe it was the anticipation of the contemporary situation (1999), when Mr E. Z. is recovering after a colli femoris fracture. As to now, the International Sports Committee has proclaimed Mr E. Z. the fourth best world sportsman of the 20th century.

KEY WORDS: X-ray examinations – Osteoporosis – Osteoarthrosis – Body build – Body composition – Body posture – Somatotype – Sports medicine – Functional anthropology – Olympic Games

INTRODUCTION

In the sporting world of 1949–1958 the name of Mr E. Z. was, and has remained till now, an extraordinary phenomenon. The concurrent wins at the Helsinki Olympic Games in 1952, namely in the 5 and 10 km runs, and also in the marathon race, have not been surpassed by anyone as yet. Altogether 18 world records in the 5–30 km runs and 5 Olympic Games medals, have made Mr E. Z. an unforgettable top figure of the world of athletics. These achievements had their foundation especially in an immensely exacting training mode, unheard of until then, and very risky at that, as the nature and doses of the load were determined solely by the sportsman himself. Because of this, already at the time of his top-achievements, there was an extraordinary concern in the impact of such a sporting activity on his health condition then, and later on (Clarke 1967, Hornof, Novotný 1967, Král *et al.* 1956, Novotný 1981).

A path-breaking work in this respect was Hornof's study (1952) on the somatic function condition of Mr E. Z., i.e. at the time of his top performance. It presented interesting and instructive information, consisting especially in the fact that the findings were in no way extraordinary. Yet it

remained an open question what the case would be after some further years would have elapsed. The answer has not been obtained until lately, by the complex check-up after the lapse of 42 years, when the former phenomenal athlete was 71 years old. The results were partly published (Novotný *et al.* 1994) and supplemented by new methods, issued from Hornof's and Kremer's (1952) findings, providing the reader with a singular chance to get acquainted with the health condition of a unique individual who, in his youth, underwent an enormous long-term load of top-level running. During his career he took part in some 300 contests and covered some 80,000 km.

SHORT CASE HISTORY

It is necessary to present some anamnestic data (Novotný *et al.* 1994, Novotný *et al.* 1995). Mr E. Z. comes from a family where longevity is frequent; however, he has enjoyed a longer life than his brothers. Mr E. Z. had not been seriously ill until his sixties (a mild coronary heart disease, demyelination with a partial paresis of the left lower extremity). He has always been a non-smoker and has never lived on a diet, prefers vegetables, pulse and fish. He eats very few dairy products, excessively uses salt. He drinks tea and fruit juices, as much as 5 l a day. As regards alcohol consumption, he is not a teetotaller. He began to actively participate in athletic contests when he was 19 years old and terminated when he was 35 year old. Then, for another 10 years he had been running for fitness, and afterwards, for the past 25 years, he has altogether discontinued any running activities and his nutritional regime became entirely non-rational.

BRIEF SUMMARY OF CLINICAL EXAMINATIONS

From the cardiopulmonal, hematological and biochemical points of view, clinical examinations did not essentially differ from the findings obtained among the current Czech males of corresponding age. Certain differences in ECG and echocardiogram, haematology show evidence of mild anaemia, biochemical examination reveals some borderline values. These results have already been described in more detail (Novotný *et al.* 1994).

BASIC SOMATOMETRIC CHARACTERISTICS

In comparison (1993) with the 1952 data, the body height decreased (174.3–169.8 cm) and the body weight increased (67.5–74.8 kg). Detailed data on somatometric characteristics are given in a separate paper (Novotný *et al.* 1995). As may be seen, the main features of the present proportionality of the former world champion long-distance runner are flabby muscles and large quantities of body fats.

BODY COMPOSITION

In 1951, when Hornof (1952) monitored Mr E. Z., the determination of the body composition was not routine and so from that period there exists only a statement on the minimum thickness of 2 skinfolds. At present the body composition of Mr E. Z. has been determined (IBP method – Seliger, Bartůněk 1976) by Best's skinfold calliper on the 10 body places, in our case by electronic skinfold calliper (Novotný, Babor 1968) and by BIA – bioelectrical impendance analysis (Eckerson *et al.* 1992, Novotný *et al.* 1994). The method of callipers proved to be inaccurate by the existing criteria for older persons already at the time of IBP discovery (Seliger, Bartůněk 1976), as it had insufficiently covered the visceral fat growth. In Mr E. Z., the body fat determined by this method amounted to 18.8%. This is only a moderately elevated value, when compared with the corresponding Czech male population. However, the method of BIA – Bodystat 500 – established a substantially higher value (25.1%). Calculation by the older procedure of Matiegka (1921) arrived to a similar result (24.0%). On the contrary, the procedure of Drinkwatter and Ross (1980), gave a very low and actually only a little probable value (14.6%). The differences among results obtained by the different methods are known and several times described (Novák *et al.* 1968). However, in Mr E. Z. it definitely means an increase in the amount of body fat which, due to the previous precise sporting anamnesis and the present locomotor inactivity, may signal an increased risk in terms of metabolic and cardiovascular lesions. Also the increased values of the abdomino-gluteal (Novotný 1993) indices (AGI-WHR) and the abdominofemoral index (AFI) support the existence of such a risk. Also the centralization index, recently applied (Novotný *et al.* 1995) – not much too reliable an index – is elevated. These statements are already connected with the body fat distribution, which in this case assumes an android character. Out of particular component parts of the body composition, the total body water may draw attention, as its value of 54.8% is higher than one can assume for the age group in question. It is in accord with a former observation when testing the body composition by hydrometry using the deuterium isototope detection (Novotný, Ženíšek 1975), namely that in sporting individuals, the decrease in body water is slower at an older age, than is the case in non-sporting people (Novotný 1981). However, these values were measured in older persons sporting incessantly, while Mr E. Z. has lacked any higher locomotor activity already for a considerable time period. In this sense, the favourable effect may persist even under these circumstances. As to further components of the body composition, it may be assumed that the amount of solids is lower than that observed in marathon runners of advanced age. Further indices, even though these are only theoretical to some extent, confirm the markedly reduced amount of musculature and mildly lower relative mass of the skeleton.

FIGURE 1. Plantograms of Mr E. Z. when aged 71 years.

SOMATOTYPE

To a large extent, body composition is linked to the human somatotype. In the 1951 appraisal, Hornof and Kremer (1952) did not define Mr E. Z.'s somatotype. However, from a photosomatogram made in 1951, the somatotype can be tentatively defined as a medium ectomorphic mesomorphy with slight signs of endomorphy. The numerical Sheldon's expression (1940) would read 1.5–4.0–4.5. If the Heath-Carter's procedure (1967) would be used at present, one would obtain from the respective parameters a designation of 4.5–5.2–1.0, i.e. endomorphic mesomorphy with slight ectomorphy. This indicates a high endomorphic component which, though high at present, was missing in the youth and lacks any primary foundation. On the contrary, the high mesomorphic component has been highlighted which, however, has a considerable primary contribution, but has lately decreased due to the reduced muscle mass. For the clinical application it is necessary to separate the primary components from those developed secondarily, when determining the somatotype. Complex anthropometric check-up will furnish them. Only the mutual relation of both has a greater, health-predictory significance. The considerable difference between the complex somatotype of 1951 (which was also secondarily influenced by sport activity) and the present state (5.5–3.0–2.0), when the primary somatotype is markedly affected by secondary factors arising from considerable

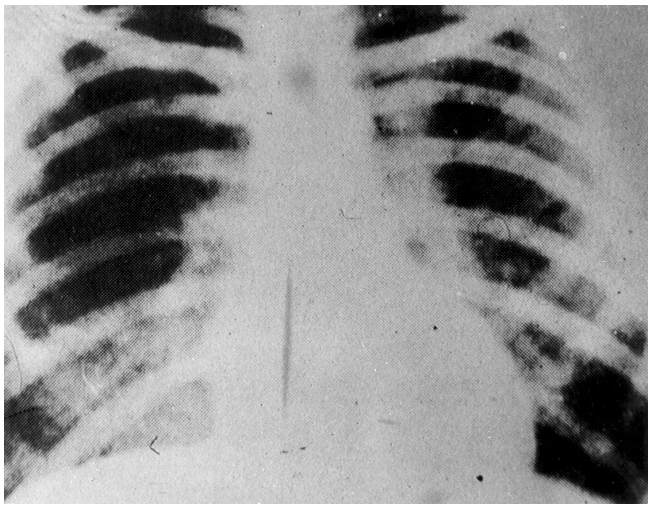

FIGURE 2. X-ray examination of the heart of Mr E. Z. when aged 23 years.

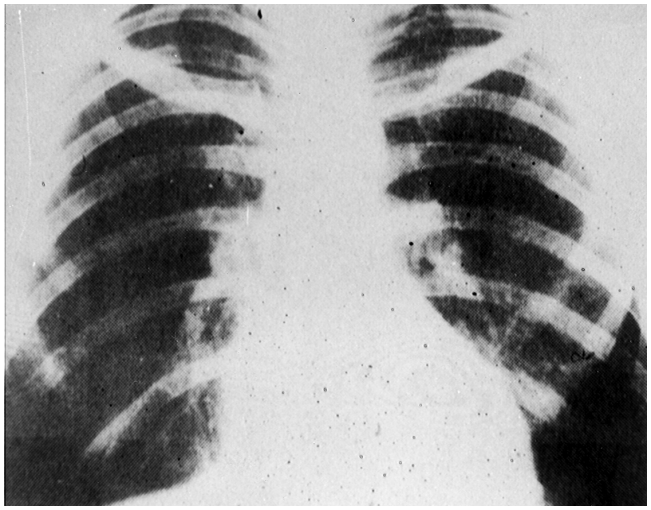

FIGURE 3. X-ray examination of the heart of Mr E. Z. when aged 29 years.

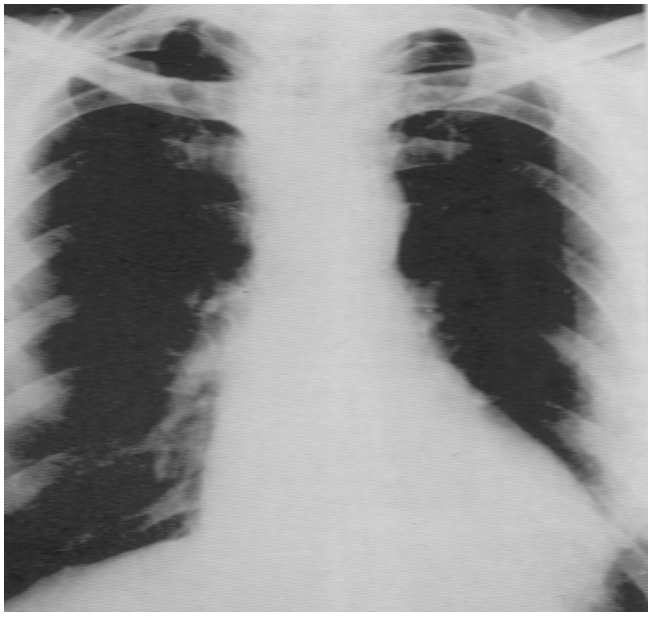

FIGURE 4. X-ray examination of the heart of Mr E. Z. when aged 71 years.

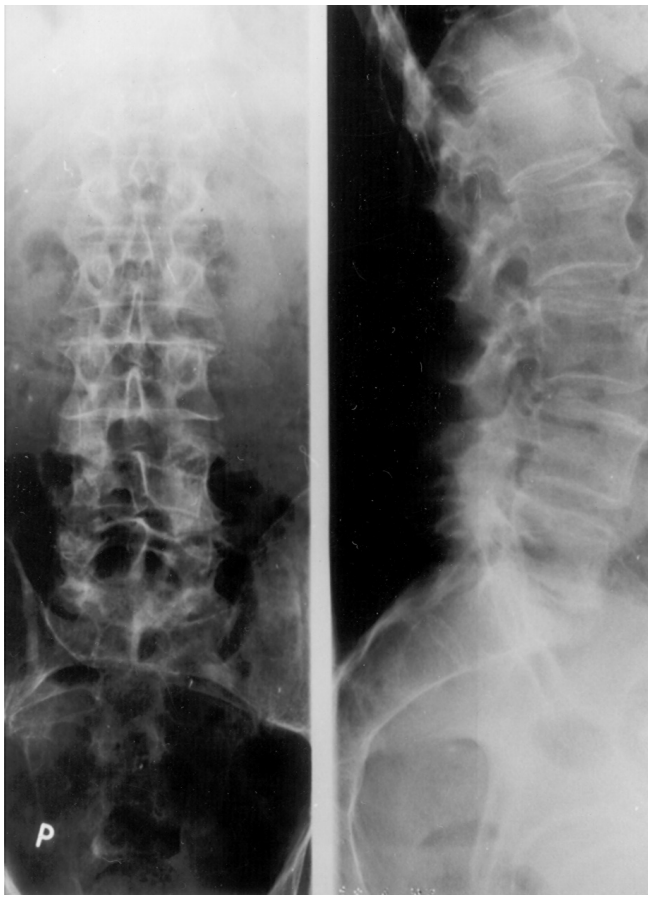

FIGURE 5. X-ray examination of the lumbal spine of Mr E. Z. when aged 71 years. Frontal and sagittal projections.

changes in life-style, supplies the complex clinical evaluation with a warning about some serious health risks, and also enables one to take preventive measures. In this case it is the cardio-vascular system which represents an increased risk.

POSTURE EXAMINATION

According to the study of Hornof (1952), Mr E. Z.'s posture at the time of his top-performance sporting activity showed only a slight variation from the standard. At present Mr E. Z.'s posture is characterized by adequate holding of the head, a well arched chest (the cyrtogram shows a small asymmetry with a sagittal dominance), markedly enlarged thoracic kyphosis, moderately enlarged lumbal lordosis, moderate prominence of the abdominal wall, lower left shoulder girdle without scoliotic finding. In the upright position there is a marked semiflexure in the left knee joint as a consequence of paresis after a neurological incidence. The spine mobility at the maximal anteflexure is moderately limited, while at the maximal retroflexure it is reduced almost to the upright position. All these findings are photosomatographically documented. Somatoscopicaly, the shape of the foot is without any perceptible sinking.

FIGURE 6. X-ray examination of the pelvis and coxal joints of Mr E. Z. when aged 71 years.

The fluorescence pedobaroscopy and plantography (*Figure 1*) indicate a moderate sinking of the transverse arch. The state of the foot arch was not described in the 1952 study, as it was then probably found standard. Also the present state can be considered as normal. This finding is generally instructive, since the greater body mass and the long-term running overload use to be put, at times, in connection with the sinking foot arch. Some studies have already corrected such views (Nachbauer, Nigg 1992, Novotný 1986).

X-RAYS EXAMINATIONS

a) X-rays of the lungs and heart

Chest symmetrical, apices of the lungs clear. The subclavicular region clear, the hila not enlarged. The diaphragm free, the costophrenic angles clear. The left ventricle hypertrophic, reaching beyond the medioclavicular line. Left atrium not enlarged. Right ventricle slightly exceeding the right edge of the spinal column. Longitudinal dimension 18.1 cm, right transverse 5.2 cm, left transverse 12.7 cm. The overall transverse dimension 17.9 cm. In accordance with the 1951 data assessed only in AP projection. Plain X-rays of the heart in oblique and lateral projections are not available. *Figures 2–4* provide a comparison of plain X-rays from 1945, 1951 and 1993. The size of the heart, assessed by plain X-ray pictures as in 1951 (to allow comparisons), shows that the longitudinal dimension increased by 3.1 cm, the right transverse dimension only by 0.8 cm, the left transverse dimension, however, by 3.0 cm, i.e. the total transverse dimension by 3.8 cm. The X-ray tend to indicate a hypertrophy of the left ventricle.

b) X-rays of joints and bones

Owing to the predominant loading of the lower body half during the athletic activity of Mr E. Z., when investigating him at his 71 years of age (in 1951 this check had not been carried out), we focused our attention on the X-ray

FIGURE 7. X-ray examination of the knee joints of. Mr E. Z. when aged 71 years. Frontal projection.

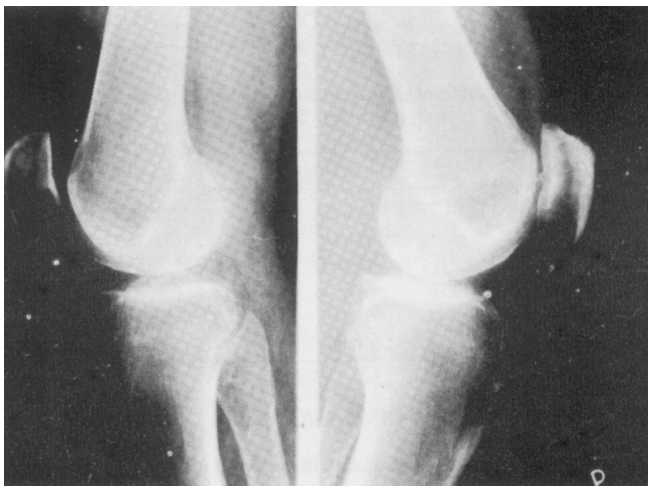

FIGURE 8. X-ray examination of the knee joints of. Mr E. Z. when aged 71 years. Sagittal projection.

examination of the lumbal spine, pelvis, coxal and knee joints. The position of the lumbo-sacral spine in the sagittal and lateral projections is presently physiologic (*Figure 5*). There is porosis of vertebrae with marked sclerotic demarcation – framing – of the vertebrae. Vertebral bodies are of adequate height. In the sagittal projection the tapering vertebrae bodies are the L3 – proximally right, L4 – proximally and distally left, and L5 – also left, into smaller osteophytes. In the lateral projection there is a small osteophyte at the distal border of L1, and larger osteophytes at the proximal borders of L3 and L4. The intervertebral disks L3 and L4 are by a third lower. The spines of the vertebrae L3–L5 are in close touch, with only a mild sclerotic demarcation in the place of apposition. In the pelvis there is a developed osteoporosis of the *os sacrum*, in the vicinity of the symphysis and *foramen obturatum*. At the distal border of the symphysis on the left, there is an osteophyte of 10 mm in lenght. The area of the symphysis is filled with calcified striae. The margins of the symphysis are sclerotic, more markedly on the right. There is a distinct periostosis on the outer border of the *foramen obturatum* on the right, extending over 3×10 mm. It corresponds rather to ossification, which does not coalesce with the bone. At the lower border of the ischial bone on the left, there is also a mild periostosis. This may rather be a state after the healed fracture, at the junction of the ischial and pubic bones (*Figure 6*). Both hip joints are in a normal position. The left articular cavity is proximally and laterally mildly narrowed. In the place of the narrowing a contour flattening is indicated (necrotic focus) on the *capitulum* over the small oval clearing of 5 mm in diameter. Here a fine calcified stria, 20 mm long, parallel with the *capitulum* contour, projects into the articular cavity and ends 5 mm outside. On both *capitulae* there is a marked osteoporosis with partial resorption of the main bone trabeculae. Both knee joints have the standard width of the joint cavity, condyles are smooth, bone structure is thinned (osteoporosis), more pronounced on the ventral margin of the tibial epiphysis and tibial metaphysis and on the left patella. Osseous apposition (an osteophyte) on the proximal and on the ventral margins right (*Figures 7, 8*).

Altogether, in the case of Mr E. Z. the signs of arthrosis can be considered as surprisingly slight (Balke 1984). However, porosis is extraordinarily high. A series of factors may be its cause. One of them may be the anamnestically discovered, and in the last years existing, minimal intake of food rich in calcium. Also the biochemical check-up confirms a lower plasmatic level of calcium (2.16 mmol/L). Also the possible reaction to long-term extraordinary physical overload in youth, and the subsequent 25 years of minimum locomotor activity, which make this case quite specific, should be taken into consideration. Among other things, a thorough check-up of his calcium-phosphate metabolism could help explain the reasons of the high osteoporosis. The implications of problems regarding the emergence of arthritic alterations and osteoporosis in athletes can be gathered from a series of papers (Montoye 1984, Středa, Trnavský 1989). At present (1999), Mr E. Z. has been recovering from a *colli femoris* fracture. This is not rare in his age, and taking into account the earlier described findings of extraordinary osteoporosis, the possibility of this complication should have been anticipated.

CONCLUSION

The body structure of the 71 years old man who, in his youth as a former world and Olympic champion, has covered over 80,000 km by intensive running, does not expose any distinct negative consequences of the previous enormous physical burden. Special attention should be

paid, in this sportive anamnesis, to the steadily normal arch shape and no arthritic changes. Generally speaking, it does not differ much from the findings observed in males of the general population of the same age. One can observe the preservation of a series of attributes relating to his top athletic achievements. Some less favourable findings, of which some entail a health risk (e.g. extraordinary degree of osteoporosis) can be attributed in the first place to the existing long-term absence of any suitable movement activity and especially to his nutrition regime which is not optimal. Considering the extreme sporting activity of Mr E. Z. in his youth, his family anamnesis and later not optimal life regime, in the complex of anthropological and health results, favourable findings prevail.

Note: Realization of X-ray examination of Mr E. Z. in his 71 years of age has been performed with the kind permission Prof. MUDr. L. Vyhnánek, DrSc., the head of Charles University First Medical Faculty radiological clinic.

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