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RED CELL, PLASMA AND BLOOD VOLUME IN HEALTHY MEN MEASURED
BY RADIOCHROMIUM (Cr^{51}) CELL TAGGING AND HEMATOCRIT:
INFLUENCE OF AGE, SOMATOTYPE AND HABITS OF
PHYSICAL ACTIVITY ON THE VARIANCE AFTER
REGRESSION OF VOLUMES TO HEIGHT AND
WEIGHT COMBINED *

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Methods employing radioactively tagged red cells have been widely adopted for measurement of blood volume. However, in comparison with the work which has been done with the dye (1-5) and carbon monoxide (6) methods, little attention has been given to the establishment of mean values for men and women or to study of the variance encountered among healthy subjects. Most clinical investigators have collected their own control data, based often on study of relatively few or not entirely healthy subjects (7-13).

A rather large scatter of data around mean prediction values has been found by all workers, regardless of methods employed, when values for whole blood volume (Vwb), red cell volume (Vrbc) and plasma volume (Vpl) are related to body weight, height, or combinations of these measures (1-5, 13, 14). Some of this variation presumably results from differences in body composition, since blood volume correlates both with body density (5, 15) and with lean body mass (16, 17). However, it has not been shown that predictions based on total body mass are less accurate than those based on lean body mass, which requires a separate measurement (15, 16). Consideration of fat thickness and girth measurement, in addition to height and weight, was found by

Hicks, Hope, Turnbull and Verel to improve prediction (14). Gregersen and Nickerson (3) classified subjects according to somatotype and found that variance of blood volume per unit of body surface area was reduced to an important degree when dealing with extreme body types but not in the middle ranges. Divergent results have been reported concerning the influence of age and of physical training on blood volume (2, 18-23).

We have used the Cr^{51} method of Sterling and Gray (24, 25) to measure Vrbc and, indirectly from the hematocrit, Vwb and Vpl in 201 healthy prison inmates. Trivariate regression equations have been derived for the plane surfaces which relate the volumes to height and weight and a graphic system for their rapid application to practical problems has been developed. By analysis of individual differences, "residuals," from the mean regression planes, we have studied the effects of the following factors on the variability of the data: age, body build, habits of physical activity and, to a limited extent, seasonal changes.

SUBJECTS

The subjects were selected by careful screening from normally active volunteers. Most of them were white (see Table I for racial and national origins). Information from the prison health records was supplemented by interviews conducted by a physician from our group, by minifilm X-rays of the chest and by laboratory tests which included complete blood count, sedimentation rate, urinalysis, electrocardiogram and a serologic test for syphilis. Volunteers were rejected if the results of these tests were abnormal, if their blood pressures were above 140 mm. Hg systolic or 90 diastolic, or if they had recognizable disease or past history of illness, such as rheumatic fever or tuberculosis, which might be present

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