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(54) IDEAL BODY WEIGHT NOMOGRAM

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ABSTRACT OF THE DISCLOSURE

A nomograph type calculator which will use skinfold data and information relating to the actual body weight of a person to enable a person's ideal body weight to be determined. The nomograph comprises an elongated outer housing having open ends and a flat, translucent front face with a plurality of elongated, spaced, rectangular transparent windows therein. An indicator plate is slidable longitudinally within the housing adjacent the inner surface of the front face, the plate carrying a plurality of rows of indicia across a central portion thereof, each row of indicia adapted to be located and a portion thereof to be visible through a corresponding window. Two rows of indicia carry respectively calibrations representing a range of skinfold measurement values and a range of percent body fat values. These two rows of indicia and indicia markers associated with corresponding windows are arranged so that at any particular position of the plate in the housing the percentage body fat value is indicated through the one window for the skinfold measurement value indicated through the the other. Another row of indicia has calibrations representing a range of body weight values, these indicia being positioned and coordinated with a scale of percentage body fat indicia along the edge of the corresponding window so that positioning of the plate to align a value of percent body fat with a specific body weight value will give a visual indication of the ideal weight for that particular value of body weight and value of percentage body fat.

BACKGROUND OF THE INVENTION

The present invention relates to a nomograph type calculator for performing simply and readily calculations for determining a person's ideal body weight. More particularly the present invention relates to such a nomograph which will use skinfold data and the actual body weight of a person, and indicate a person's ideal body weight.

Obesity is a common and serious disease, in some regions affecting 25 - 45 percent of persons over 30 years of age. To assist in diagnosis of this disease, and because of a general trend towards "weight consciousness" in persons "ideal" body weight has become an element of significant concern.

Ideal body weight has been traditionally expressed as a function of height and/or frame size, based upon life insurance mortality tables. A more recent approach involves the indirect assessment of body composition.

Though standard weight tables are statistically correct over a large population, the determination of ideal body weight is often in error. This is especially true for both the lean and muscularly developed - generally classified, on the basis of height and frame size, as underweight and overweight, respectively. Furthermore, the majority of such standard weight tables do not account for the progressive replacement of lean tissue with fat throughout adult life. Assessments of body composition on the other hand, although more reliable than weight tables, do not yield measurements which are particularly relevant to the layman. Skinfold thickness measurements and expressions of body density and percent body fat have little significance to the average individual concerned about his or her body weight.

Based upon previously published formulae of Durnin and Ramahan (1967) and Brozek, et al. (1963) for the derivation of body density and percent body fat, respectively, formulae deriving lean body mass and ideal and maximum recommended body weight (kg) have been developed as follows:

$$LBM = [W-(\%BF \times W/100)] \quad (1)$$

$$IW \text{ (male)} = LBM/0.79 \quad (2)$$

$$IW \text{ (female)} = LBM/0.732 \quad (3)$$

Wmax (male) = LBM/0.75 (4)

Wmax (female) = LBM/0.70 (5)

where LBM = lean body mass (kg)

% BF = percent body fat

W = body weight (kg)

IW = ideal weight (kg)

W_{max} = maximum recommended weight (kg)

A number of nomograph or calculator devices are known in the art having a variety of different uses (see for example Canadian Patent No. 942,267 of Herbert Z. Lund, issued February 19, 1974; Canadian Patent No. 778,645 of Carl H. Vorpahl, issued February 20, 1968; Canadian Patent No. 771,026 of Julius N. Cayo, issued November 7, 1967; Canadian Patent No. 992,934 of Heinz Kunert, issued July 13, 1976; Canadian Patent No. 254,879 of August Heinimann, issued October 20, 1925; Canadian Patent No. 105,027 of S. S. Fry, issued April 30, 1907, Canadian Patent No. 160,939 of N. J. Pauly, issued February 23, 1915 and Canadian Patent No. 163,141 of C. G. Davidson, issued June 15, 1915. There is at present, however, no device which can rapidly and readily correlate skinfold measurements or percentage body fat data with a person's actual weight to give an indication of a person's ideal body weight. Instead, at the present time, each specific case must be taken and calculations must be made accordingly.

It is an object of this present invention to provide a device which, when using skinfold measurements relating to an individual, will permit rapid and easy correlation of that information to give percentage body fat and to give that person's ideal body weight in standard weight units, i.e. in a form which is both comprehensible and relevant to the layman. It is a further object of the present invention to provide a pocket-size accurate tool which will aid a physician or physical educator concerned with assessments of body composition or weight counselling.

SUMMARY OF THE INVENTION

According to the present invention, a nomograph is provided which will indicate a person's ideal body weight, the nomograph comprising an elon-

gated outer housing having open ends and a flat, front face. The face has at least one, and preferably a plurality of transparent zones therein. Where a plurality of zones are used, single indicia markers are visibly associated with a first and second of the zones. A third zone has calibrations representing a range of percentage fat value visibly spaced in a line parallel to the longitudinal axis of the housing. An indicator plate is slidable longitudinally within the housing adjacent the inner surface of the front face. The plate carries a plurality of rows of indicia across a central portion thereof, each row of indicia adapted to be located and a portion thereof to be visible through a corresponding zone. A first of the rows of indicia, corresponding to the first zone, has calibrations representing a range of skinfold measurement values. A second of the rows of indicia, corresponding to the second of the zones, has calibrations representing a range of percent body fat values. These two rows of indicia, and the indicia markers of each of the corresponding zones are arranged so that at any particular position of the plate in the housing, a percentage body fat value is indicated by one marker through the second zone which corresponds to the skinfold measurement value indicated by the other marker through the first zone. A third of the rows of indicia has calibrations representing a range of body weight values. These calibrations and the percentage body fat calibrations along the edge of the third zone are arranged and coordinated with appropriate display means so that positioning the plate to align a value of percentage body fat with a specific body weight value will give a visual indication of the ideal weight for that particular value of body weight and value of percentage body fat.

Where the outer housing is a flat open-ended envelope within which the indicator plate can slide from end to end, zones, indicia markers and rows of indicia may be provided for both faces of the device, for example one face being calibrated for body weights for men and the other side for body weights for women. In addition, additional zones may be provided on the device, together with associated rows of indicia, calibrated to give related information such as that of body density, or so that the lean body mass, ideal weight and maximum recommended weight are shown.

Using the nomograph according to the present invention, once appropriate skinfold measurement data is obtained, that data used in the device will provide an appropriate value for percentage body fat in the second zone. The corresponding ideal weight (and optionally lean body mass and maximum weight) is provided in the third zone or in another zone and associated row of indicia values and markers by simply aligning the calibrations representing the person's body weight and the person's percentage body fat at the third zone.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon referring to the drawings in which:

Figure 1 is a front view of a nomograph device according to the present invention;

Figure 2 is a section view of a nomograph along line II-II in Figure 1;

Figure 3 is a front view of a further embodiment of a nomograph according to the present invention;

While the invention will be described in connection with example embodiments, it will be understood that it is not intended to limit the invention to such embodiments. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE INVENTION

In the drawings, similar features have been given similar reference numerals.

Turning first to Figure 1, there is shown a nomograph 2 for indicating information about a person's body weight. The nomograph comprises an elongated outer housing 4 having flat front and back faces, the front face as shown in Figure 1 being translucent and having a plurality of elongated spaced rectangular transparent windows 6 therein. A flat rectangular indicator plate 8 is slidable longitudinally within housing 4, movable beyond open ends 10 of the housing. The indicator plate 8 slides so that its face is adjacent the

inner surface of the front face of housing 4.

On indicator plate 8 are a series of spaced rows of indicia rows 12, 14, 16, 18 and 20 each positioned to correspond with one of the transparent windows 6 and to be visible therethrough. Indicia row 12 is a series of calibrations representing a range of skinfold measurement values, indicia marker 22 being visibly located at associated window 6 to permit alignment of a predetermined value of skinfold measurement with that marker. It has been found satisfactory, according to the present invention, to calibrate the device for a skinfold reading which is the sum of three skinfold measurements: tricep, subscapular and suprailiac.

Indicia row 14 is calibrated to represent a range of body density values. Marker 24 associated with the window 6 and indicia row 14 are arranged so that with plate 8 positioned to indicate a particular skinfold measurement at marker 22, the body density corresponding to that measurement is indicated by marker 24.

Indicia row 16 is a scale representing a range of percentage body fat. The indicia marker 26 associated with corresponding window 6 is positioned, and the scale of indicia row 14 is calibrated, so that when plate 8 is positioned to indicate a particular skinfold measurement of row 12, the appropriate corresponding percentage body fat value is indicated by marker 26 on scale 16.

Indicia row 18 is a scale representing a range of body weight values (here shown in kilograms). Along the edge of the window 6 associated with indicia row 16 is a scale 28 calibrated to provide percent body fat values. The body weight values of indicia row 18 and the percent body fat indicia of scale 28 are positioned and coordinated relative to each other and relative to the other markers and indicia rows such that relative movement of plate 8 to align a value of percentage body fat in scale 28 with a specific body weight value in row 16 gives the lean body mass for that body as well as the ideal weight and maximum recommended weight. This may be achieved by a further indicia row 20 representing a range of body weight values, these values and markers 30, 32 and 34 (representing respectively lean body mass,

ideal weight and maximum recommended weight) being appropriately arranged to give proper weight values without further relative movement of plate 8. Alternatively, these markers 30, 32 and 35 may be appropriately positioned with respect to window 6 associated with indicia row 18 (as shown in Figure 3), to show ideal body weight, lean body mass and recommended maximum weight.

In arranging the calibrations of the indicia rows on plate 8, and the markers associated with the various windows, the previously mentioned formulae of Durnin and Ramahan (1967), and Brozek, et al. (1963) and equations 1-5 were programmed on a Hewlett-Packard 9820A desk-top computer. A sliding scale nomogram was developed for both males and females predicting body density (g/cm^3), percent body fat, lean body mass (kg), ideal weight(kg) and maximum recommended body weight (kg) from skinfold thickness measurements. The nomogram illustrated is programmed to reflect only the previously mentioned formulae of Durnin and Ramahan (1967) and Brozek, et al. (1963) and total skinfold thickness standards of 35 and 50 mm for males and 41 and 55 mm for females. However, it may be readily re-programmed to incorporate other skinfold thickness standards and equations predicting body density and percent body fat without changing the basic format of the nomogram.

The nomogram illustrated in Figure 1 may be calibrated for men, based on an ideal weight for a male equal to: lean body mass/0.79. Alternatively it may be set up for women, the ideal weight then being equal to: lean body mass/.732.

It is of course obvious and within the scope of the present invention that one side of the nomogram be set up with calibrations for calculating this relevant information with respect to men, and the opposite side calibrated for this information with respect to women. Alternatively, the housing need not be translucent and have these elongated windows therein so long as an appropriate visual display of the information in question is provided.

In operation, once appropriate skinfold measurements have been taken, plate 8 is moved within housing 4 so that indicia marker 22 is aligned with the appropriate skinfold measurement value on indicia row 12. This immediately provides the proper value of percentage body fat for the person's

body with that given skinfold measurement, by alignment of marker 26 with the required percentage body fat value in indicia row 16 (Figures 1 and 3). As well, as seen in Figure 1, at the same time the density value for that body is provided by alignment of marker 24 with the appropriate density value represented on indicia row 14.

By then moving plate 8 in housing 4 to align the appropriate calibration value representing that person's body weight in indicia row 18 with the appropriate calibration representing the determined value of percentage body fat in the scale 28, markers 30, 32 and 34 become aligned with calibrations on the body weight row of indicia 20 (in Figure 1) or 18 (in Figure 3) to indicate appropriate values of lean body mass, ideal weight and maximum recommended weight for that person. As a person grows older, his or her lean body mass becomes less as lean tissue is replaced with fat. Consequently, a person's diminishing ideal weight is reflected by use of the present invention.

Thus it is apparent that there has been provided in accordance with the invention a pocket-size sliding scale nomogram for indicating a person's ideal body weight that fully satisfies the objects, aims and advantages set forth above. While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly it is intended to embrace all such alternatives, modifications and variations as fall within the spirit and broad scope of the appended claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A nomograph for indicating a person's ideal body weight comprising:

an elongated outer housing having open ends and a flat, front face with at least one transparent zone therein and first and second indicia markers visibly associated therewith;

visible calibrations, associated with the zone and spaced in a line parallel to the longitudinal axis of the housing, representing a range of percent body fat values;

an indicator plate slidable longitudinally within the housing adjacent the inner surface of the front face, the plate carrying a plurality of rows of indicia across a central portion thereof, each row of indicia adapted to be located and a portion thereof to be visible through the transparent zone;

a first of the rows of indicia being calibrations representing a range of skinfold measurement values;

a second of the rows of indicia being calibrations representing a range of percent body fat values.

the first and second rows of indicia, and the respective first and second indicia markers being arranged so that at any particular position of the plate in the housing, a percentage body fat value is indicated by the second marker which value corresponds to the skinfold measurement value indicated by the first marker;

and a third of the rows of indicia being calibrations representing a range of body weight values, these calibrations and the percentage body fat calibrations being arranged and coordinated with appropriate display means so that positioning of the plate to align a value of percentage body fat with a specific body weight value will give a visual indication of the ideal weight for that particular value of body weight and value of percentage body fat.

2. A nomograph according to claim 1, wherein the front face of the housing has a plurality of transparent zones therein, a first and second of the zones having respectively the first and second indicia markers visibly associated therewith; and a third of the zones having the calibrations representing the

range of percent body fat values associated therewith; each row of indicia adapted to be located and a portion thereof to be visible through a corresponding zone, the first and second of the rows of indicia corresponding respectively to the first and second zones.

3. A nomograph according to claim 2, wherein markings appear in the third zone to indicate ideal weight and maximum weight, where ideal weight is determined by the formula: lean body mass / 0.79, and maximum recommended weight is determined by the formula: lean body mass / 0.75.

4. A nomograph according to claim 2, wherein markings appear in the third zone to indicate ideal weight and maximum weight where ideal weight is determined by the formula: lean body mass / 0.732, and maximum recommended weight is determined by the formula: lean body mass / 0.70.

5. A nomograph according to claim 2, 3 or 4, wherein markings are appropriately located and associated with the third zone to indicate lean body mass, ideal weight and maximum recommended weight.

6. A nomograph according to claim 2, wherein a fourth transparent zone is provided in the front face of the housing and a fourth indicia row is positioned on the indicator plate to correspond with the fourth zone, this fourth indicia row being calibrations representing a range of body weight values, and an indicia marker associated with this fourth zone the indicia marker and the calibrations of the fourth row being arranged to indicate ideal weight when the plate is positioned to align at the third zone the value of percentage body fat and the specific body weight values.

7. A nomograph according to claim 2 or claim 6 comprising a further transparent zone in the front face of the housing and a further row of indicia positioned on the plate to correspond to this further zone, this further indicia row being calibrations representing a range of body density values, and an indicia marker associated with this further zone, the calibrations and the associated indicia marker being arranged to indicate the density value of a person's body when the plate is positioned to indicate that person's skinfold measurement value.

8. A nomograph according to claim 2 or 6, wherein the housing is of flat shape and is provided on each side with similar transparent zones therein and wherein a plurality of rows of indicia are provided on each side of the indicator plate each row adapted to be located and a portion thereof to be visible through a corresponding zone the indicia rows being calibrated, and the transparent windows having indicia markers to provide the body mass, ideal weight and maximum recommended weight for men on one side and similar information for women on the other side.

9. A nomograph according to claim 2 or 6, wherein the housing is transparent and the zones are elongated spaced rectangular windows, the longitudinal axes of the windows and housing being parallel.

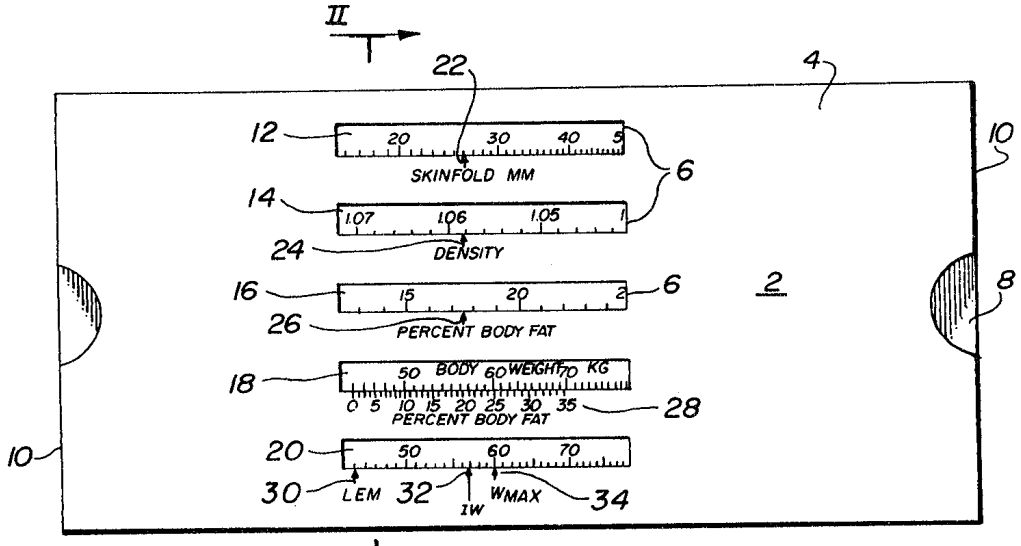

FIG. 1

FIG. 2

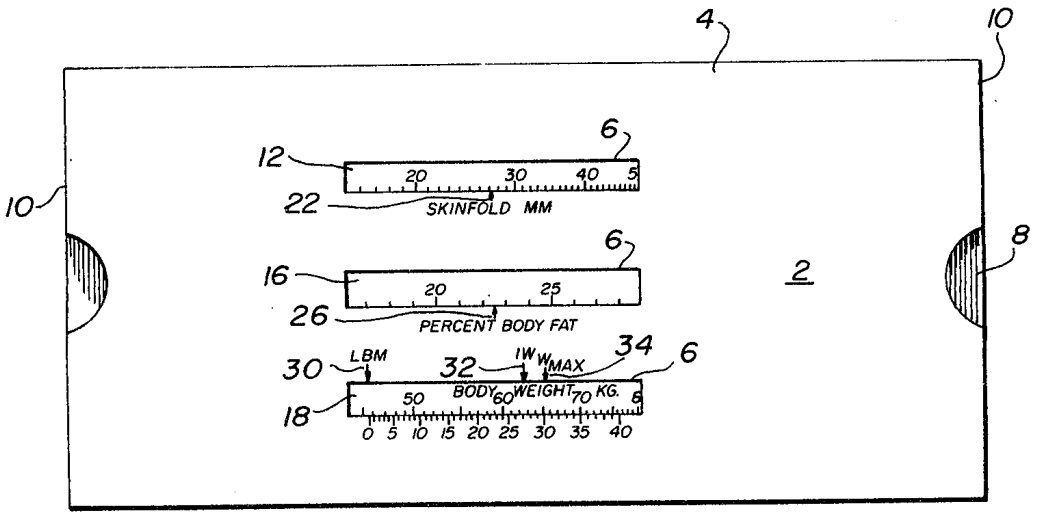

FIG. 3

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