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# A Suitable Estimation of Body Surface Area Based on Six Very Used Formulae and on Weight/Height

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***Abstract*— This study aims to overcome the difficulties caused by the use of different formulae for estimating body surface area (BSA): misappreciations could happen when comparing data differently indexed, particularly in overweight subjects. A table of heights and weights for males and females, based on the Metropolitan Insurance Tables 1983, was composed so to have by each height a wide range of weights and consistent body mass indices, comprised between 21.7 ± 1.33 and 32.8 ± 0.1 kg/m2 for males and between 20.5 ± 1.32 and 32.8 ± 0.09 kg/m2 for females. Based on the weights-heights tables, six BSAs by six widely used formulae were estimated for each set of height and weight. Their average value represented a reference BSA, which was regressed on the ratio of weight/height, and assumed a measure of a correlated BSA. A very high correlation resulted (R2 > 0.998). Using the equations of the regressions, BSA = x + y * weight/height, the corresponding BSAs were estimated, differing from the reference BSA of –0.0783% for males and of 0.023% for females. A further analysis of this method was processed, using for each height 15 random weights, with an average difference 0.19% ± 0.18 for males and 0.038% ± 0.19 for females. Finally, the differences in percentages between indexations operated using the reference BSAs or the BSAs by equation were evaluated, showing an overall average difference of 0.069% for males and of –0.039% for females. The use of these equations may help the clinician avoid the problems due to the differing indexations because they are based on only a single very suitable BSA and because they include a wide range of weights.**

***Index Term*- Body Surface Area, Estimates, Errors, Equations, Weight/Height**

## I. Premise

The use of body surface area (BSA) to normalize the values of many physiologic functions has undergone many criticisms,1–9 but the worlds of research and of clinical practice are clearly interested in continuing the use of this method for indexing physiologic data. Most of the papers describing the procedures followed to measure and to estimate BSA show that the grounds of the possible errors were inborn in the followed methods, fundamentally, the criteria used in selecting the people measured, the methods of measuring, the numerousness of the samples, and the incorrect proportions concerning the distributions for gender and age.8 The more common errors in the current clinical applications are based in selecting the formulae to estimate BSA by poor rational criteria, for instance selecting a formula because it is simple but ignoring the suitability of the procedures on which the formula was based and the consistency between the people on which the formula was based and the people on which the formula should have been applied. These problems could be avoided if the first and most important error in this field was eluded: an error based on not having selected a well-defined restricted group of suitable formulae for BSA estimation. This selection could have been made by an international scientific board of the interested disciplines, which should periodically review the selection. This could have been a fundamental guideline for every researcher or clinician because it would have been based on an international consensus. It would have represented a very relevant tool for the effectiveness of the research and of the clinical applications, taking into account the worldwide use of indexing using BSA. At present, it should be very commendable that in scientific articles the chosen formula for BSA estimation would be always made known: this should let the reader to eventually reformulate the indexation of his/her data to perform a correct comparison of the results. Concerning this topic, it is very important to interject that most of the formulae based on height and weight, that is to say practically all the more used formulae, give back values of estimated BSA that are very close to each other in the case that weights were the normal range according to the heights: differently, the more the weights fall outside the normality, the more the estimates would differ according to the different used formulae.10 Unavoidable erroneous conclusions will result when comparing the values of functions of overweight patients indexed according to different BSA formulae, an event probably of high frequency, taking into account the presence of overweight patients in many pathologic conditions.

Based on the above, the aim of this elaboration was to find a way to avoid the errors due to the different results when indexing on different BSA, paying particular attention to the added problem due to overweight subjects.

## II. Methods

Basal principle: Within the possible numerical relationships between weight and height, particular attention has to be paid to the ratio of weight/height because to get a result that could be associated with a measure of the body surface, weight in kilograms according to the height in centimeters. In 1954, Sendroy and Cecchini11 proposed that this ratio could signify the body frame: these authors used weight/height together with weight+height to estimate the body surface, using a specific diagram. In the present elaboration, based on the principle that weight/height could be assumed as a numerical representation of body surface, the average of six different estimates of BSA (see below) was

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regressed on the ratio of the corresponding weighs and height, weight/height, resulting in very high correlation, $R > 0.999$, $R2 > 0.998$, $p = 0.000$. In the following, the details of the used method are described in three steps.

## III. Procedure

First step: Scales of heights and correlated weights have been created, separately for men and women, partially based on the data of Metropolitan Insurance Tables 1980.12 Each scale in the Metropolitan Tables includes 36 heights, from 158 cm to 193 cm for males and from 148 cm to 183 cm for females. Each height corresponds to three body frames (small, medium, great), each of them including a range of weights. In the scales composed for this elaboration, the first weight for the first height of each scale (158-148) was assumed to be the medium weight of the medium frame from the tables, while the first weight for each following height was defined as increasing the previous first weight according to the percentage difference between the previous and the following height. The same procedure was assumed for all the heights to the last height (193 cm and 183 cm, respectively). Along the line of weights for each height, the weight following the first and all the following weights were increased 1 kg in respect to the previous weight. This resulted in a series of increasing weights, to a weight value assumed as the last weight of the line, resulting in the base of the correlated height in a body mass index (BMI) between 32 and 33 kg/m2. This size of BMI was arbitrarily defined as the limit for the increasing of weights for all the heights. The range of weights for each height for males and females are shown in Appendixes A-B and in Appendixes C-D, these last concerning a different scale based on selected random weights according to each height. The BMIs in the scale 158-193 were between 21.7 ± 1.33 and 32.8 ±0.1 kg/m2 and in the scale 148-183 between 20.5 ± 1.32 and 32.8 ± 0.09.

Second step: Based on the above, each height between the second and the last height was characterized as having a greater number of weights respect to the previous height, and the size of the last weight in the line greater than the last of the previous height. Based on the weights for each height, six BSA were calculated for each couple of height-weight, using the following formulae: DuBois and DuBois13 0.007184 * height0.725 * weight0.425 Tikuisis14: (128.1* height0.6 * weight0.44)/104 for males and (147.4 * height0.55 * weight0.47)/104 for females; Nwoye15: 0.02036 * height0.515 * weight0.427 ± 0.01283; Haycock16: weight0.5378 * height0.3964 * 0.24265; Lee17: 73.31 * height0.725 * weight0.425; Yu18: (79.8106 * height0.7271 * weight0.398)/104. The corrections made by dividing the result by 104 were applied because it was necessary to have a BSA in square meters. The mean of the six estimated BSA was calculated and assumed to be the reference BSA, this having particular characteristics: it is based on different populations in a worldwide area, on the overall number of 4.448 measured subjects, according to different methods of measuring: body coating by Dubois and Nwoye, a geometric method by Haycock, body coating and scanning the coatings by Lee, and body scanning by Yu.

The reference BSAs were regressed on the values of the corresponding height/weight, resulting in a steady high correlation concerning all the couples of these data in the scales, in males as well in females, $R > 0.999$, $R2 > 0.998$, $p < 0.000$. Based on the equation of the regression, BSA = x + y * weight/height, it could be possible to estimate directly the BSA according to each height and each of the weights included in the line of that height.

Third step: The suitability of this method was verified by calculating the BSAs using the equation above and evaluating the percentage difference between the reference BSA and the BSAs obtained by the equation. The possibility to have an adequate estimate of BSA for a single casual subject was analyzed using 15 random weights for each height, whose mean and standard deviation was the same as that for the standard weights for that height. Finally, taking into account that BSA is usually applied in the medical field for indexing the values of organic functions according to the equation ndexed function A = A x 1.73/BSA, the percentage differences between the indexations by reference BSA and BSA by equations were calculated, using arbitrary values of glomerular filtration rate.

## IV. Results

The results concerning the BSA estimation by weight/height and the indexations on the two different BSAs are shown in Tables A and B. The results concerning the BSA estimation by weight/height on base of random weights are shown in Tables C and D.

Table A (males), Table B (females)

Table A, 1 and 2: The results concern the whole of data in Tables A1+A2. The percentage differences of the reference body surface areas (BSAs) versus the BSAs by equation were between 0.474% ± 0.15 and –0.0815% ± 0.16. The overall mean of the differences and of their standard deviation are respectively –0.0783% and 0.17. The percentage differences of the indexations based on reference BSAs versus those based on equations were between 00% ± 00 and –0.47% ± 0.24.

Table B, 1 and 2: The results concern the whole data in Tables B1+B2. The percentage differences of the reference BSAs versus the BSAs by equation were between 0.04% ± 0.13 and –0.022% ± 0.23. The overall mean of the differences and of their standard deviation are respectively 0.023% and 0.23. The percentage differences of the indexations based on references BSAs versus those based on equations were between -0.084% ± 0.22 and –0.53% ± 0.18.

Table C (males), Table D (females)

These tables concern the reference BSAs and the BSAs by equations based on 15 random weights for each height. In Table C, the percentage differences of the reference BSAs versus the BSAs by equation were between 0.67% ± 0.2and –0.6% ± 0.28. In Table D, they were between 0.1% ± 0.12 and –045% ± 0.26.

Comparison of results of males versus females: Comparing the percentage differences between references BSAs and BSAs by equation and their standard deviation, males versus females, the statistic two-samples T does not show significant differences: percentage differences T test value –1.04, $p = 0.304$; standard deviations, T test value 0.95, $p = 0.347$.

## V. Discussion

The aim of this elaboration was to offer a tool to go beyond the problem of selecting a specific formula for BSA estimation, a target that the obtained results have reached. The reference BSAs are not based on a single selected formula, but they use six very commonly used formulae. The percentage difference between the reference BSAs and those from the BSA equations demonstrate values included in marginal limits; this allows evaluation of the BSA estimates from the equations to be a very reliable choice that avoids the risk of misinterpretations when comparing data indexed on BSA by different formulae. Because they are based on a wide range of weights for each height, the proposed equations also overcome the effects of the increasing differences between BSA estimated using two different formulae when the weights would be outside the normal limits of the height. The equation BSA = x + y * weight/height can be used to calculate directly the body surface of any single subject having a weight in the range of the weights considered for his/her height, including overweight subjects. From this point of view, it is particularly suitable to take into account 1) that the overweight can be defined by a BMI comprised between 25 and 29.9 kg/m2, 2) that a condition of obesity of level 1 is assumed for BMIs between 30 and 34.5 kg/m2,19 and 3) that this elaboration includes for each height/weight attaining BMIs between 32 and 33 kg/m2. Consequently, it is possible to hold that the equations in Tables A and B could allow estimation of a correct BSA for a wide range of particularly overweight people. For all the considerations above, it seems possible to consider the BSA estimates by equations, probably much more approximated to an adequate estimate than those based on a single casually selected formula.8

## VI. Conclusions

This system for BSA estimation, based on the weight/height ratio, can usefully be adopted to formulate BSA estimates that have the same suitability as estimating a BSA by using six different formulae, with lower time and work investment, avoiding the problems due to different indexations, and overcoming the problems associated with the calculation of BSA in overweight subjects. From an operating point of view, two or more single researchers or groups of the same may agree to adopting this system, greatly simplifying the procedure to index data and improving the effectiveness of the indexations, with an undoubted advantage for a correct comparison. Even in case of comparison of data already indexed according to BSA estimated by different formulae, this system could be used for a new and common indexation by the researchers, using this method as a new language to compare indexed data.

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## APPENDIXES

WARNING – Pay attention to not simplify the equations in the tables when estimating a BSA, for instance modifying 1,02 + 1,628 * w/h in 1 + 1,63 * w/h. The equations have to be applied exactly using their original composition as in the tables to have the correct estimate.

## Appendix A - Tables 1

| .Males - BSA estimation by weight / height- Resuming Table **1** | | | | | |
|---|---|---|---|---|---|
| n | heights 158 - 175 | range of consistent weights | BSA equation = X + Y * weight/height | difference % of reference average BSA versus BSA by equation Mean ±SD | difference % of indexations on 1,73 m² based on BSA by formulae versus BSA by equations. Mean ±SD |
| 1 | 158 | 60 82 | 0.997 + 1.63 *w/h | 0.125±0.087 | 00.00 |
| 2 | 159 | 61 83 | 1.01+1.63* w/h | 0.0696±00.8 | -0.147±0.30 |
| 3 | 160 | 61 84 | 0.985+1.73* w/h | 0.439±0.21 | 0.437±0.21 |
| 4 | 161 | 61 85 | 0,99 + 1.74 * w/h | 0.228 ±0.11 | -0.198 ±0.28 |
| 5 | 162 | 61 86 | 1+1.748 * w/h | 0,114±0,12 | -0.125±0.23 |
| 6 | 163 | 62 87 | 1.01+1.756 * w/h | 0.0026±0.12 | -0.018±0.32 |
| 7 | 164 | 62 88 | 1.018+1.763 * w/h | -0.0283±0.12 | -0.0564±0.23 |
| 8 | 165 | 63 89 | 1.023+1.774 * w/h | -0.0323±0,.12 | 0.164±0.25 |
| 9 | 166 | 63 90 | 1.05+1.7* w/h | 0.148±0.13 | -0.038±0.19 |
| 10 | 167 | 63 92 | 1.043*1.784 * w/h | 0.208±0.13 | -0.162±0.25 |
| 11 | 168 | 64 93 | 1.05+1.792* w/h | 0.104±0.095 | -0.095±0.21 |
| 12 | 169 | 64 94 | 1.06+1.8* w/h | 0.0019±0.14 | 0.0268±0.24 |
| 13 | 170 | 64 95 | 1.07+1.8* w/h | 0.1±0.15 | 0.067±0.72 |
| 14 | 171 | 65 96 | 1.07+1.816 * w/h | 0.318±0.15 | -0.252±0.26 |
| 15 | 172 | 65 97 | 1.11 + 1.739 * w/h | 0.246±0.14 | -0.216±0.26 |
| 16 | 173 | 66 98 | 1.09+1.833 * w/h | 0.097±0.15 | -0.077±0.28 |
| 17 | 174 | 66 99 | 1.1+1.841 * w/h | 0.0022±0.16 | -0.012±0.24 |
| 18 | 175 | 66 101 | 1.109 + 1.847 * w/h | -0.0003±0.17 | -0.047±0.25 |

## Appendix A - Tables 2

| Males - BSA estimation by weight / height- Resuming Table **2** | | | | | |
|---|---|---|---|---|---|
| n | heights 176 - 193 | range of consistent weights | BSA equation = X + Y * weight/height | difference % of reference average BSA versus BSA by equation Mean ±SD | difference % of indexations on 1,73 m² based on BSA by formulae versus BSA by equations. Mean ±SD |
| 19 | 176 | 67 102 | 1.11+1.85 *w/h | 0.474±0.15 | -0.47±0.24 |
| 20 | 177 | 67 103 | 1.12 + 1.86 *w/h | 0.333±0.17 | -0.255±0.27 |
| 21 | 178 | 67 104 | 1.14+ 1.844 * w/h | -0.0815±0.16 | -0.214±0.27 |
| 22 | 179 | 68 105 | 1.13+ 1.887*w/h | 0.367±0.18 | -0.345±0.24 |
| 23 | 180 | 68 107 | 1.15 + 1.883 * w/h | 0.08±0.18 | -0.016±0.65 |
| 24 | 181 | 69 108 | 1.16 + 1.892 * w/h | -0.032±0.19 | 0.02±0.3 |
| 25 | 182 | 69 109 | 1.167+ 1.9 *w/h | 0.0257±0.19 | -0.039±0.27 |
| 26 | 183 | 69 110 | 1.173 + 1.913 *w/h | -0.008±0.22 | -0.045±0.25 |
| 27 | 184 | 70 111 | 1.18 + 1.924 *w/h | -0,005±0,2 | -0.035±0.26 |
| 28 | 185 | 70 113 | 1.187 + 1.935 *w/h | -0.027± 0.21 | -0.0034±0.28 |
| 29 | 186 | 71 114 | 1.193 + 1.946 * w/h | -0.027±0.21 | -0.012±0.3 |
| 30 | 187 | 71 115 | 1.2 + 1.958 * w/h | -0.036±0.22 | -0.09±0.6 |
| 31 | 188 | 71 116 | 1.207 + 1.968 * w/h | -0.04±0.24 | 0.058±0.29 |
| 32 | 189 | 72 118 | 1.214 + 1.979 * w/h | -0.05±0.23 | -0.034±0.28 |
| 33 | 190 | 72 119 | 1.221 + 1.99 * w/h | -0.066±0.24 | -0.069±0.28 |
| 34 | 191 | 72 120 | 1.228 + 2 *w/h | -0.06±0.25 | -0.066±0.33 |
| 35 | 192 | 73 121 | 1.234 + 2.013 * w/h | -0.07±0.25 | 0.07±0.29 |
| 36 | 193 | 73 122 | 1.241 + 2.023 *w/h | -0.07±0.26 | 0.033±0.29 |

## Appendix B - Tables 1

| Females - BSA estimation by weight / height- Resuming Table 1 | | | | | |
|---|---|---|---|---|---|
| n | heights 148- 165 | range of consistent weights | BSA equation = X + Y * weight/height | difference % of reference average BSA versus BSA by equation Mean ±SD | difference % of indexations on 1,73 m² based on BSA by formulae versus BSA by equations. Mean ±SD |
| 1 | 148 | 50 72 | 0.859+ 1.722 *w/h | 0.04±0.13 | -0.084±0.22 |
| 2 | 149 | 50 73 | 0.868+1.728 *w/h | -0,007±0,14 | -0.053±0.18 |
| 3 | 150 | 51 74 | 0.876 + 1.735 *w/h | 0.015±0.15 | -0.006±0.31 |
| 4 | 151 | 51 75 | 0.884 + 1.742 * w/h | 0.024±0.15 | -0.049±0.24 |
| 5 | 152 | 51 76 | 0.892 + 1.749 * w/h | 0.033±0.16 | -0.093±0.27 |
| 6 | 153 | 52 77 | 0.9 + 1.757 *w/h | 0.018±0.16 | -0.064±0.3 |
| 7 | 154 | 52 78 | 0.908 + 1.765 *w/h | 0.0052±0.17 | -0.042±0.28 |
| 8 | 155 | 52 79 | 0.916 + 1.773 *w/h | -0.0072±0.17 | 0.039±0.31 |
| 9 | 156 | 53 80 | 0.923 + 1.781 * w/h | 0.04±0.18 | -0.096±0.31 |
| 10 | 157 | 53 81 | 0.931 + 1.789 * w/h | 0.03±0.18 | -0.037±0.29 |
| 11 | 158 | 53 82 | 0.939 + 1.797 x w/h | 0.021±0.18 | -0.015±0.28 |
| 12 | 159 | 54 83 | 0.946 + 1.806 x w/h | 0.044±0.19 | -0.037±0.29 |
| 13 | 160 | 54 84 | 0.954+1.814 *w/h | 0.035±0.19 | -0.087±0.21 |
| 14 | 161 | 54 85 | 0.962+ 1.823 * w/h | 0.003±0.19 | 0.016±0.32 |
| 15 | 162 | 55 86 | 0.97 + 1.83 *w/h | 0.021±0.2 | 0.0012±0.27 |
| 16 | 163 | 55 87 | 0.977 + 1.84 * w/h | 0.022±0.2 | -0.032±0.34 |
| 17 | 164 | 55 88 | 0.985+1.848 * w/h | 0.016±0.2 | 0.016±0.28 |
| 18 | 165 | 56 89 | 0.993 + 1.857 *w/h | -0.014±0.32 | 0.014±0.32 |

## Appendix B - Tables 2

| Females - BSA estimation by weight / height- Resuming Table **2** | | | | | |
|---|---|---|---|---|---|
| n | heights 166 - 183 | range of consistent weights | BSA equation = X + Y * weight/height | difference % of reference average BSA versus BSA by equation Mean ±SD | difference % of indexations on 1,73 m² based on BSA by formulae versus BSA by equations. Mean ±SD |
| 19 | 166 | 56 91 | 1 + 1.862 * w/h | 0.10±0.22 | -0.14±0.3 |
| 20 | 167 | 56 92 | 1.013+1.864 *w/h | -0.022±0.23 | -0.0012±0.31 |
| 21 | 168 | 57 93 | 1.017 + 1.879 * w/h | 0.017±0.23 | -0.037±0.32 |
| 22 | 169 | 57 94 | 1.025+1.887 *w/h | 0.015±0.23 | -0.027±0.32 |
| 23 | 170 | 57 95 | 1.033 + 1.895 + w/h | 0.013±0.24 | -0.047±0.29 |
| 24 | 171 | 58 96 | 1.041 + 1.904 * w/h | -0.012±0.24 | 0.0097±0.3 |
| 25 | 172 | 58 97 | 1.048+ 1.912 * w/h | 0.045±0.24 | -0.075±0.34 |
| 26 | 173 | 58 98 | 1.057 + 1.918 * w/h | 0.044±0.25 | -0.031±0.33 |
| 27 | 174 | 59 99 | 1.064 + 1.929 * w/h | 0.014±0.25 | -0.011±0.33 |
| 28 | 175 | 59 100 | 1.0715+1.939 *w/h | -0.0075±0.26 | -0.006±0.32 |
| 29 | 176 | 59 102 | 1.0812 + 1.943 * w/h | 0.011±0.26 | 0.0014±0.38 |
| 30 | 177 | 60 103 | 1.089 + 1,951 * w/h | 0.029±0.26 | -0.022±0.37 |
| 31 | 178 | 60 104 | 1,097 + 1.959 * w/h | 0.038±0.27 | 0.008±0.38 |
| 32 | 179 | 60 105 | 1.105 + 1.968 * w/h | 0,023±0.27 | 0.0025±0.35 |
| 33 | 180 | 61 106 | 1.113+ 1.976 * w/h | 0.032±0,27 | 0.024±0.38 |
| 34 | 181 | 61 107 | 1.121 + 1.984 * w/h | 0.041±0.28 | 0.0004±0.31 |
| 35 | 182 | 61 109 | 1.13 + 1.989 * w/h | 0.07±0,.29 | 0.016±0.33 |
| 36 | 183 | 62 110 | 1.138 + 1.998 *w/h | 0.056±0.29 | 0.013±0.38 |

Appendix C - Tables 1

Males - Random weights according to heights - BSA by regressions versus reference BSA - Table 1

| n | height | random weights | BSA by regression | average refererence BSA | Diff % |
|---|---|---|---|---|---|
| 1 | 158 | 68.9±4.4 | 1.71±0.045 | 1.72±0.049 | 0.67±0.2 |
| 2 | 159 | 76.3±3.65 | 1.79±0.037 | 1.81±0.38 | 0.77±0.04 |
| 3 | 160 | 71.8±6.2 | 1.76±0.067 | 1.76±0.068 | 0.15±0.01 |
| 4 | 161 | 73.7±0.12 | 1.79±0.01 | 1.79±0.066 | 0.27±0.066 |
| 5 | 162 | 74.6±6.4 | 1.80±0.07 | 1.81±0.07 | 0.16±0.11 |
| 6 | 163 | 74.8±7.9 | 1.80±0.082 | 1.8±0.08 | 0.11±0.19 |
| 7 | 164 | 75.5±7.8 | 1.83±0.084 | 1.83±0.085 | 0.046±0.09 |
| 8 | 165 | 75.1±6.8 | 1.83±0.073 | 1.83±0.074 | 0.17±0.09 |
| 9 | 166 | 79.1±6.7 | 1.86±0.07 | 1.88±0.07 | 1.23±0.09 |
| 10 | 167 | 78.8±9.07 | 1.88±0.1 | 1.89±0.1 | 0.052±0.16 |
| 11 | 168 | 80.6±9.2 | 1.91±0.01 | 1.91±0.01 | 0.052±0.16 |
| 12 | 169 | 81.5±7.05 | 1.93±0.07 | 1.93±0.07 | 0.08±0.12 |
| 13 | 170 | 83±9.4 | 1.95±0.01 | 1.95±0.1 | 0.1±0.18 |
| 14 | 171 | 85.4±9.4 | 1.98±0.1 | 1.98±0.01 | 0.31±0.19 |
| 15 | 172 | 82.2±8.14 | 1.94±0.08 | 1.96±0.09 | 0.27±0.18 |
| 16 | 173 | 81.4±7,.6 | 1.95±0.08 | 1.96±0.08 | 0.19±0.18 |
| 17 | 174 | 86±8.8 | 2.01±0.09 | 2±0.08 | 0.49±0.29 |
| 18 | 175 | 91±9.15 | 2.07±0.097 | 2.06±0.09 | -0.6±0.28 |

Appendix D - Tables 1

Females - Random weights according to heights - BSA by regressions versus reference BSA - Table 1

| n | height | random weights | BSA by regression | average refererence BSA | Diff % |
|---|---|---|---|---|---|
| 1 | 148 | 61.7±5.13 | 1.58±0.06 | 1.58±0.06 | 0.1±0.12 |
| 2 | 149 | 61.3±7.3 | 1.58±0.08 | 1.58±0.08 | 0.005±0.14 |
| 3 | 150 | 64.8±6.9 | 1.63±0.08 | 1.62±0.08 | -0.45±0.26 |
| 4 | 151 | 64.5±5.4 | 1.63±0,.62 | 1.63±0.061 | -0.44±0.26 |
| 5 | 152 | 64,3±6,8 | .1.63±0.08 | 1.63±0.08 | 0.08±0.16 |
| 6 | 153 | 66.5±7.9 | 1.66±0.09 | 1.66±0.09 | 0.029±0.14 |
| 7 | 154 | 66.5±5.6 | 1.67±0.06 | 1.67±0.06 | 0.12±0.11 |
| 8 | 155 | 67.3±6.76 | 1.69±0.08 | 1.69±0.08 | -0.04±0.13 |
| 9 | 156 | 67.9±6.4 | 1.70±0.074 | 1.70±0.07 | 0,14±0,13 |
| 10 | 157 | 70.9±6.9 | 1.74±,0.79 | 1.74±0.078 | 0.095±0.16 |
| 11 | 158 | 68.9±8.4 | 1.72±0.096 | 1.72±0.096 | 0.06±0.15 |
| 12 | 159 | 69.8±6.4 | 1.74±0.07 | 1.74±0.07 | 0.16±0.21 |
| 13 | 160 | 72.5±5.7 | 1.78±0.064 | 1.78±0.063 | 0.17±0.12 |
| 14 | 161 | 71.5±10.1 | 1.77±0.11 | 1.77±0.11 | 0,013±0,17 |
| 15 | 162 | 72.9±9.6 | 1.79±0.11 | 1.79±0.11 | 0.038±0.24 |
| 16 | 163 | 74.2±9.4 | 1.81±0.11 | 1.81±0,.1 | 0.058±0.18 |
| 17 | 164 | 72,.7±8.8 | 1.80±0.01 | 1.79±0.09 | 0.085±0.17 |
| 18 | 165 | 76±8.3 | 1.85±0,.9 | 1.85±0.09 | 0.08±0.17 |

Appendix C - Tables 2

Males - Random weights according to heights - BSA by regressions versus reference BSA Table 2

| n | height | random weights | BSA by regression | average refererence BSA | Diff % |
|---|---|---|---|---|---|
| 19 | 176 | 87.2±11.2 | 2.03±0.12 | 2.04±0.12 | 0.46±0.21 |
| 20 | 177 | 85.3±10.9 | 2±0.11 | 2.01±0.11 | 0.54±0.24 |
| 21 | 178 | 88.9±12.1 | 2.06±0.12 | 2.07±0.13 | 0.31±0.2 |
| 22 | 179 | 87.5±8.8 | 2.05±0.09 | 2.06±0.09 | 0.48±0.14 |
| 23 | 180 | 87.3±12.9 | 2.06±0.13 | 2.06±0.14 | 0.014±0.28 |
| 24 | 181 | 90.5±11.6 | 2.11±0.12 | 2.12±0.13 | 0.01±0.28 |
| 25 | 102 | 00.7±7.5 | 2.09±0.00 | 2.09±0.00 | -0.06-0.12 |
| 26 | 183 | 93.1±10.4 | 2.15±0.11 | 2.14±0.095 | -0.15±0.16 |
| 27 | 184 | 92.6±13 | 2.15±0.14 | 2.14±0.13 | -0.15±0.16 |
| 28 | 185 | 100.2±11.5 | 2.23±0.12 | 2.23±0.12 | -007±0.21 |
| 29 | 186 | 87±8.5 | 2.1±0.09 | 2.11±0.09 | 0.15±0.16 |
| 30 | 187 | 99.2±9 | 2.24±0.095 | 2.24±0.09 | 0.051±0.17 |
| 31 | 188 | 99.5±11 | 2.25±0.12 | 2.25±0.11 | 0.03±0.21 |
| 32 | 189 | 100±9.4 | 2.24±0.01 | 2.24±0.096 | 0.095±0.15 |
| 33 | 190 | 102.8±1.,9 | 2.3±013 | 2.28±0.13 | 0.59±0.46 |
| 34 | 191 | 99.9±13.2 | 2.27±0.14 | 2,27±0,14 | -0.0032±0.26 |
| 35 | 192 | 99.9±11.2 | 2.28±0.12 | 2.28±0.11 | 0.054±0.23 |
| 36 | 193 | 102.4±11.7 | 2.31±0.12 | 2.31±0.12 | 0.018±0.19 |

Appendix D - Tables 2

Females - Random weights according to heights - BSA by regressions versus reference BSA - Table 2

| n | height | random weights | BSA by regression | average refererence BSA | Diff % |
|---|---|---|---|---|---|
| 19 | 166 | 79.1±7.5 | 1.89±0.084 | 1.89±0.082 | 0.19±0.17 |
| 20 | 167 | 74.9±9 | 1.85±0.1 | 1.85±0.1 | 0.07±0.18 |
| 21 | 168 | 76.7±8.7 | 1.87±0.1 | 1.88±0.1 | 0.13±0.18 |
| 22 | 169 | 83.2±9.17 | 1.95±0.1 | 1.95±0.1 | 0.03±0.17 |
| 23 | 170 | 78.7±11 | 1.91±0.12 | 1.91±0.12 | 0.05±0.21 |
| 24 | 171 | 78.6±11.2 | 1.92±0.12 | 1.92±0.12 | 0.04±0.19 |
| 25 | 172 | 76.4±10.4 | 1.90±0.11 | 1,90±0.11 | 0.13±0.21 |
| 26 | 173 | 77.7±10.9 | 1.92±0.12 | 1.92±0.12 | 0.1±0.23 |
| 27 | 174 | 82±12 | 1.97±0.13 | 1.97±0.13 | 0.04±0.27 |
| 28 | 175 | 79.9±0.15 | 1,96±0.15 | 1.96±0.15 | 0.04±0.29 |
| 29 | 176 | 81.8±11.6 | 1.98±0.13 | 1.98±0.13 | 0,06±0,29 |
| 30 | 177 | 86.8±12.3 | 2,05±0,14 | 2.05±0.13 | -0.4±0.25 |
| 31 | 178 | 86.5±12 | 2.05±0.13 | 2,05±0,13 | 0.07±0.23 |
| 32 | 179 | 92.4±8.3 | 2.12±0.09 | 2.12±0.09 | 0.06±0.22 |
| 33 | 180 | 90.1±10.17 | 2.10±0.11 | 2,10±0,.11 | 0.10±0.18 |
| 34 | 181 | 87.2±12 | 2.08±0.13 | 2.08±0.13 | 0.11±0.23 |
| 35 | 182 | 88.5±11 | 2.10±0.12 | 2.10±0.12 | 0.17±0.22 |
| 36 | 183 | 90.2±12.5 | 2.12±0.14 | 2.12±0.13 | 0.094±0.24 |