Computer Program Manual to Calculate Bone Age-Ebrí and Predicted Adult Height of Spanish children and Book Index Bone Maturation (Tarsus and Hand)

DR. DON BERNARDO EBRÍ TORNÉ
DRA. DOÑA MARÍA INMACULADA EBRÍ VERDE
Table of Contents

Presentation........................................................................................................................................ 2
1-USER MANUAL FOR IVOS-EBRÍ PROGRAM .......................................................... 3

2- Management of radiological measurements obtained in the INTRANET viewer RX.
   Standards of measure in the bones of the hand in the viewer of x-rays after being
   installed in the ‘Ebrí-IVOS Program’ on the computer to calculate the bone age and the
   prediction of adult height of the child.
   (Computer figure window with a case of child problem)......................................................... 5

3-Schemes imaging .......................................................................................................................... 7

4-Bibliography.............................................................................................................................. 11

5--BOOCK: BONE MATURATION IN SPANISH CHILD BY LOCALS AND FOREING
   METHODS OF ASSESSMENT OF BONE AGE AND PREDICTION OF ADULT SIZE
   (Prologue and Table of Contents)........................................................................... 12

PRESENTATION:

Dear mates:

On the occasion of the presentation that was on December 11, 2015, in this Illustrious
College of Physicians of Zaragoza, of the Book: "Bone Maturation and Computer Program
for Calculating Bone Age and Prediction of Adult Height" of which they are Authors,
doctors: Bernardo Ebri Torné and Inmaculada Ebri Verde, since then from the web of the
Illustrious College of Physicians of Zaragoza (Spain) www.comz.org the possibility of free
downloading of the installer WinRAR ZIP (.zip): Ebri SetUp iv17.06.22
to the user’s computer, to calculate the Bone Age (Hand and Tarsus Regions) and the
Child’s Prediction of Adult Height. (Region of the Hand).

This will allow, once downloaded and installed on the user’s computer, the program, to be
used from the Intranet of the Sanitary Working Network, to be able to calculate the bone
age and the prediction of adult height of the child under study. In this document, we detail
the rules of use of the software itself, such as measurement standards of digital
radiography in INTRANET, radiological schemes, radiological extent, the last bibliography
of publications of authors "bone age" including book "Index Bone Maturation in Spanish
child”.

As the accompanying diagrams illustrate how to perform the measurements of the bones, and the computer window that comes once introduced the measures in the program, and providing the osificativo diagnosis of child and adult height prediction.

It is advisable and to work on the Intranet, where it is possible to use the digital measurement tool of the carpal bones and metacarpal-phalanges of X-rays to study child patients, the program is downloaded from the Web or used from your computer work, and so saved. Thus, as explained in the rules of use of the program can easily follow the steps to once measured the bones and entered data can be obtained so quickly and automatically bone age of the child and his prediction adult height.

We hope that this service offered to interested physicians, mainly pediatricians, endocrinologists and radiologists, will be useful in their daily practice, because in this way, and to proceed database Aragonese child, "Andrea Prader Study" (Director: Dr. Angel Ferrández Longás) can be overlooked obtaining bone age and height prediction methods for other outsiders, so we estimate the predictions are more accurate FOR SPANISH AND HISPANIC CHILDREN, but it can also be used in Anglo children; and the minimum time learning the technique, we will be amply rewarded by the most accurate results. We believe that the method can also be used for biomedical research.

**Correspondence with authors, in order to clarify doubts or communicate their experience:** ebri@ebri.es
b.ebri@yahoo.es

Best regards of the authors:

Dres. Bernardo Ebri Torné and María Inmaculada Ebri Verde

---

**1-USER MANUAL FOR IVOS-EBRÍ PROGRAM**

Through the Ebrí methodical applied to the indexes: IC (carpal), IMF (metacarpophalangeal and ICMF (carpal-metacarpophalangeal) and after introducing in the General Program for children from 0.5 to 20 years, the data of the child and the measurements of the maximum diameters of the carpal and metacarpophalangeal ossification nuclei studied, the predictive diagnoses, both of bone age and prediction of adult height, can be obtained automatically and directly. Likewise, once the installer downloaded and executed, the user will have a specific program for children from 0 to 4 years old, for the purpose of a more accurate calculation for these short ages of bone age (not for prediction of adult height). And another program, for the region of Tarsus, for children 0 to 4 years, in order to calculate the bone age in this region, which serves as a support to further specify the ossification (it does not serve
to predict adult height). The user will have to download and install on the computer, the file  **WinRAR ZIP (.zip): Ebri SetUp iv17.06.22 attached**, which carries the program: "Ebri-Hand and foot". When executing the file, the program will be installed in the computer, being searched in "All the programs". (To do this, go to the Windows icon located in the upper left corner of the computer, and click on it. When doing so, the user will see "All programs", and clicking on it, will open, letting the program "Ebri Hand and Foot." Clicking on it again, will open up and let you see different options: 1) Uninstall the program; 2) First aid (brief information on the program); 3) Program Ebri Hand 4 years; 4) Ebri Hand Program (General Series of 0.5 to 20 years), 5) Program Ebri Foot 4 years.

By clicking on any of these programs, a column is opened, where the user can enter the data: measurements of the bones (in mm, those of the hand and in cm of the feet), data of the child as sex and dates of birth and RX, size of him and his parents in cm. Once entered, "Vale" is clicked and the enclosed white space will be filled with the child’s ossifying diagnosis and his prediction of adult height. Clicking on the column in "User Manual" opens an information window about the most detailed features of the program itself.

During the installation of the WinRAR ZIP File (.zip) the question will arise if the user wants to install a program icon on the desktop. If so desired, a torch-shaped icon of the 3 programs will be installed, and clicking on each one of them will appear the data entry column, and the user can act directly on this icon.

The data specified in the open column will be filled out by the user, such as the child's initials, gender: Male (H) or Female (M), the measurements of the bones in their maximum distances (See schemes), child size and parents in centimeters, date of birth of the child and the x-ray (day and month to two digits, year in four digits). The x-ray of the hand from which the measurements are taken has to be left-hand and dorsopalmar projection, including the distal ends of cubit and radius. From a lateral x-ray of the foot and in a dorsoplantar projection, as described in the radiological charts, measurements of the tarsus (right foot) are obtained. In this way and after being entered the data of the child are validated by clicking on: "Okay!"

Thus, the following programs automatically give us the three ossific indexes of the hand: (A program calculates bone ages from 0.5 years to 20 years, and another from 0 to 4 years). Another program is for the Tarsal Index, for the calculation of the bone age from this region (children from 0 to 4 years). In all of them, osseous ages quantified by each index, and so-called IVOS (ossific indexes) that allow the reading of bone age directly, will be shown in the form of full normal, advanced or "normal" or significant delay, being recommended then a study or follow-up of the child. The program of 0.5 to 20 years of age allows us to obtain Adult Height Predictions (PTA) through the three indices described, and in two ways: with and without the paternal mean size. The programs for children from 0 to 4 years, only allow the calculation of the Bone Age.
If you enter the data, whether the size or measurements of the bones, the program does not support them, information appears that details the causes for not accepting the data: Usually in the sizes is usually an inadequate measure, and in the nuclei some false measures by excess. Whole numbers followed by decimals, either because of mistakes in the size of the child or in the size of the bone, must be separated from the decimal by a period (.) not by a comma (,) since it is not recognized as a numerical value. If you enter several decimals, the program rounds them.

Obviously, for a correct PTA, the size of the child we introduce into the program must be obtained at a date as close as possible to the date of the hand radiograph. The size of the study child we introduce is assimilated by the program, which refers the data to the prediction equations belonging to each group of the children’s base in Aragon.

The software, is well adjusted to the PTA, in a period of validity from the three years and half to 17 and a half. At bone ages outside these limits, the program does not gives estimates of PTA, although if bone age.

Obtaining PTA could also be obtained manually with a calculator from the age of four, through the prediction equations of a variable (indices), two variables (indices and size of the child) and three variables (indices, child, and paternal mean size; Equations published in the accompanying bibliographical citations. The program, of course, simplifies and automates manual calculation. The measurements obtained from the maximum diameters of the carpal bones, metacarpals and phalanges studied, as well as the radial and cubital distal epiphyses are made in millimeters and their tenths. Measurements of tarsal bones are done in cm. All the measurements have been obtained with a calimeter, nonius or a king’s foot, observing the indications of measurement of these bones, as can be observed in the radiological schemes published in the attached bibliography.

As today, physical X-ray is not usually available, the measurements of the bones have to be made with a digital measuring tool, available in the X-ray viewer of INTRANET.

2- Management of radiological measurements obtained in the INTRANET viewer RX. Standards of measure in the bones of the hand in the viewer of x-rays after being installed in the ‘Ebri-IVOS Program´ on the computer to calculate the bone age and the prediction of adult height of the child.

The Installer WinRAR ZIP File (.zip): Ebri SetUp iv17.06.22, ("Ebri Hand and Foot") will be installed on the user’s computer, before the measurement of the bones of the hand. Opening this one will appear a series of icons, in the shape of a torch and it is here where we have to click on it again. Then a white space and a column with the name of the
bones of the hand appear, as well as spaces to put the name of the patient, sex, date size of the child and the parents on it. It will then minimize the open image in the taskbar of the computer, while we proceed to enter the Healthcare Network INTRANET.

Once in it, x-ray of patient’s left hand is located to study, or lateral and dorsoplantar radiographs of the right foot to study, then opening the display where the radiographic image can be seen. Search on it: tools icon with the name of ‘point to point’ or ‘distance’ measuring instrument (terminology that varies depending on the used display). In any case, click on that instrument, so ‘the mouse’ is enabled to carpal bones and epiphysis nuclei that have to be measured in the hand. Thus maximum distances ‘point to point’ are measured to these bones and nuclei. The carried out measures will appear printed on the measured bone (See the attached diagrams that guide how to measure these maximum distances, as well as publications and the book of ‘Maturing Bone’ included in it). If there was an error in the measure putting ‘the mouse’ over the wrong measure clicking on it with the right side of ‘the mouse’, we can select the option of ‘delete annotation’. The measures are in mm and tenths of millimeters (mm) or in centimeters (cm) in the foot. Depending on the viewer that is used for the measurement, may only allow the measurements in mm, rounding the figures without tenths. In any case and taking into account that the measurements are made about 21 bones in the hand and 9 bones in the foot, and whose result is an average, the possible errors of tenths in rounding are sometimes compensated by more and sometimes by less. It is advisable to measure a bone and then point the figure in the open column of the ‘Ebri Program’ that will be minimized in the taskbar of the computer, but when you click on, it (torch icon) becomes large and appears on the computer screen, then taking advantage to type the numbers obtained on the spaces prepared in it. It will proceed to continue measuring bone by bone, taking the measurements to the column. At the end of these, we fill other data such as size in cm, dates, sex, and initials of the patient.

Once completed everything, we click on ‘Ok’ column of data. Then in the blank space will appear the bone age by the three methods IVO-Ebrí diagnosis and the prediction of the adult height of the child (General Series) (See the outline of a clinical case in the window of the computer where an example of a patient is detailed) Likewise, bone age can be obtained in children aged 0 to 4 years by the three IVO-Ebrí and IVO-Tarsiano methods. 

6
3- SCHEMES IMAGING:
LEFT HAND
DORSO PALMAR VIEW
4-Bibliography


[www.comz.org](https://www.comz.org) banner: Bone Maturation.

[https://www.researchgate.net/profile/Bernardo_Ebri/stats](https://www.researchgate.net/profile/Bernardo_Ebri/stats)


5-Note: The full text of the book "MATURATION BONE IN SPANISH CHILD" IS IN SPANISH LANGUAGE ([www.comz.org](https://www.comz.org)) in Bibliography

MADURACIÓN ÓSEA EN NIÑO ESPAÑOL POR DIFERENTES MÉTODOS PROPIOS Y
Dr. Bernardo Ebrí Torné

Dra. María Inmaculada Ebrí Verde

Hospital Universitario Miguel Servet de Zaragoza

For Correspondence: ebri@ebri.es
b.ebr@yahoo.es

People who want the computer program can be downloaded or used from the website of the Association of Physicians of Zaragoza (Spain) http://www.comz.org

Publisher: Dr. Bernardo Ebrí Torné

INO Editorial.

Depósito Legal: Z-384-2015

ISBN 978-84-937187-9-4

Gobierno de Aragón.

Registro General de la Propiedad Intelectual. Número de Asiento Registral 10/2014

Prologue

The gigantic work of Dr. Bernardo Ebrí on bone maturation is reflected in this book. That such a simple measurement with a vernier of greater diameter than carpal-metacarpal bones and phalanges much information on bone maturation method, can be attributed to the method but not its author. Dr. Ebri constancy over decades, its rigor, not only longitudinal but also transversal studies only deserve their applause filled with admiration.

Those who have devoted much of our activity to the study and monitoring of child growth and development into adulthood, we know
the importance of properly assessing possible as we call bone age. Being as old bone is a tool in the diagnosis and follow various situations affecting the child, we cannot ignore that and unexpected biological evolution itself can change dramatically in a short period of time, 1-2-3 years, thus modifying the initial predictions of adult height, based on bone age should always be made and communicated to parents with great prudence and clarifying that it is a forecast. It is therefore important repeated, particularly around the onset of puberty, control bone age that you can change sharply, to normalize or otherwise mature slowly or do it fast. Studies by Dr. Ebrí especially longitudinal nature like ours Andrea Prader Center, are valid provided that they are not overestimate and especially the evolution of bone maturation periodically check instruments.

Dr. B. Ebrí encourage and daughter Dr. Immaculate Ebrí did his doctorate on the subject, to continue these research studies, make them manageable in numerous consultations that have to make quick decisions. But mostly I encourage anyone interested in this subject not only to read this book if not many other publications of this persistent, admirable researcher is Dr. Bernardo Ebrí.

For my part I convey to you my admiration and gratitude for your enormous work, knowing you are going to continue that. Congratulations and forth.

Angel Ferrández Longás
Director of Andrea Prader Center

GENERAL INDEX

Pages

Foreword 3

I. INTRODUCTION 54
II. OBJECTIVES AND RATIONALE FOR THIS JOB 58
III. 1. BACKGROUND 62
III.1. Growth and maturation BONE 62
III. 1.1. Both growth and bone maturation are phenomena biological 62
III. 1.2. Bone maturation and growth, it develops enter periods: Prenatal, postnatal and pubertal or adolescent. 62
III. 1.3. Growth rate 69
III. 1.4. Growth channel 71

14
III. 1.5. Changes in body segments 72

III. 1.6. Evaluation of genetic load 73
III. 1.7. Endocrine atmosphere 75
III. 1.7.1. Androgens and estrogens 76
III. 1.7.2. Growth hormone (hGH) 79
III. 1.7.3. Thyroid hormones 83
III. 1.7.4. The glucocorticoid hormones 85
III. 1.7.5. Insulin 85
III. 1.7.6. Somatotropin chorionic or placental lactogenic (HPL)
III. 1.7.7. The importance of parathyroid hormone, vitamin D and Calcitonin 86
III. 1.8. In the normal child is no clear relationship between calcium intake and attained height 89
III. 1.9. Phosphocalcic metabolism in other metabolic disorders are delays growth 91
III. 1.10. In addition to genetic, endocrine and metabolic aspects, there are environmental factors 92
III. 1.11.1. Malnutrition 92

III. 1.11.2. Some researchers claim that the maturation of the dentition 99
III. 1.11.3. For this purpose the surveys feed 100
III. 1.11.4. Gastrointestinal diseases 105
III. 1.11.5. Stunting by emotional deprivation, psychosocial deprivation 106
III. 1.11.6. In addition to the nutritional and psychosocial factors, another group of environmental conditions 107
III. 1.11.7. No systemic endocrine diseases 108
III. 1.11.8. Heart diseases 108
III. 1.11.9. Respiratory diseases 108
III. 1.11.10. Hypoxia 108
III. 1.11.11. Chronic renal disease and renal failure 109
III. 1.11.12. Chronic infections 111
III. 01.11.13. The brief illness 111
III. 1.11.14. Chronic rheumatism, collagen 111
III. 1.11.15. Anemias 111
III. 1.12.1. Constitutional bone diseases 112

III. 1.12.2. Short stature of postnatal onset 113
III. 1.13. Delay 113 family size
III. 1.14. Stature or constitutional delay Vnec / CR (normal variant Short stature / retarded growth) 114
III. 1.15. Genetic Anomalies: gonadal dysgenesis or Turner syndrome 115
III. 1.16. It is understood as overgrowth 115
III. 1.17. Physical growth and bone maturation in athletes 117
III. 2. EVALUATION OF BONE GROWTH AND MATURATION 120
III. 2.1. Growth assessment
III. 2.2. Anthropometry 121
III. 2.3. Growth curves 123
III. 2.4. Family Size 123
III. 2.5. Mathematical models to represent the growth curve 123
III. 2.6. In the opinion of most authors 125
III. 2.7. Before addressing the methods of assessment of bone age 126
III. 2.8. Bone maturation takes the form of cores
endochondral ossification and epiphyseal fusion 126
III. 2.9. Within the morphological chapter of the nuclei of ossification,
many anatomical and pediatric authors talk about their chronology 128
III. 2.10. Supernumerary bones
III. 2.11. Study of this method measures the cortical bone age
and the diameter of the metacarpal bone 129
III: 2.12. Also interesting is the correlation of bone age and dental 130
III. 2.13. The method of the cervical vertebrae, CVMS method (Vertebral cervical ripening stages)
131
III. 2.14. Forensic experts are investigating the physiological age 132
III. 2.15. Under normal conditions, the determination of bone age, serves the growth forecast, which
is important in pediatrics 132
III. 3. BRIEF HISTORICAL MEMORY: valuation methods BONE AGE AND PREDICTION OF SIZE 134
III. 3.1. Interest in bone maturation dates back to the era prerroentgeniana 134
III.3.2. Ebrí Torné in (1977) 135
III. 3.3. Greulich and Pyle atlas the point in his (1959) 137
III. 3. 4. The Greulich and Pyle Atlas, qualitative analysis method
bone age
III. 3.5. To overcome the difficulties described in the method of GP especially you asynchronies
numerical methods were created 141
III. 3.6. Other planimetric determinations, or in which a computer program developed for the
calculation to the intervention bone age 145
III. 3.7. Tanner numerical methodology: TWI, TWII and TWIII 147
III. 3.8. Prediction Methods adult height 159
III. 3.8.1. Being able to predict the final size will reach 159 child
III. 8.2. Methods of predicting adult height are more used the Bayley and Pinneau based on the
Greulich and Pyle atlas 160
III. 8.3. Subsequently, new methods have been described that fuel parameters other than the bone
age 161
III. 8.4. In the same year 1975, Roche-Wainer and Thissen 162
III. 8.5. Hapo (Height Adjusted for Pubertal Onset) 162
III. 8.6. The projected size 163
III. 8.7. Roche and Wettenhall (1969) 163
III. 8.9. In 1994, 166 Torne Ebrí
IV. MATERIAL AND METHODS 170

RESULTS AND DISCUSSION 190
V. Chronology of hand bones 190
V.2. Maximum diameter of the carpal bones and metacarpophalangeal (epiphysis) 203
V.3. Morphological variations of metacarpophalangeal and carpal bones (epiphysis) 220
V.4. Correlation coefficients between the diameters of the carpal and metacarpal bones epiphysis (values in mm) and the age of the children 227
V.5 Correlation coefficients between the diameters of the different carpal and metacarpal bones epiphysis each. Global series by age ranges. Men and Women 239
V.6. Correlation coefficients between the diameters of the various carpal bones metacarpophalangeal regarding the Indices: IC, IMF, ICMF and Bone Age: GP and TW2. Global Series and Women 251

V.7. Tables and Charts exposure of arithmetic mean, standard deviation, maximum and minimum values, and percentiles indices: IC, IMF and ICMF, by age group 260
V.9. Tables and Charts exposure of arithmetic mean, standard deviation, maximum and minimum values and percentiles of Bone Ages: EOIC, EOIMF, EOICMF, EOGP and EOTW2, by age group 287
V.10. Correlation coefficients each other, from: IC, IMF, ICMF, EOIC, EOIMF, EOICMF, EOGP and EOTW2. Regression coefficients for the different correlations. Student T rates and bone ages together 310

V.11. Differences between chronological age and bone of the Bone ages studied: IC, IMF, ICMF, GP and TW2, by age groups and both sexes. Conjoin 321
V.12. Descriptive study of the size of children casuistry. Comparison with other Spanish Series 339
V.13. Several correlations: The adult height and their chronological age, height of children and their adult height, height of children and their indices and bone ages, the adult height of children and paternal average size. T Student between adult height of both sexes 348
V.14. Correlation coefficients and regression between indices (CI, IMF, ICMF) and bone age (EOGP, EOTW2) to the height of children by age groups and in both sexes. Predictions of the indices and bone ages: GP and TW2 by age group from the carvings. Prediction sizes from rates and bone age by age group 360
V.15. Ebrí prediction equations of Adult Height (PTA) children, through one, two and three variables. Men and Women 380
V.16. Analysis of absolute prediction errors with Methodical Predictive Adult Size Ebrí in casuistry General. Comparative study with Swiss population 408

V.17. Study Subgroup casuistry whose bone age is no different in plus / minus one year of chronological age. Errors absolute predictions of adult height by the predictive method Ebrí. Comparative study of the differences predictive (average figures) between the predicted size and adult size reached 418
V.18. Determination of IVO (Osificativo Rating Index) Men and Women in manually. Program statistic for determining bone ages: IVOS and Prediction of adult height (PTA) for two three variables for use in the Clinic 428

CONCLUSIONS 439
RESUMEN 445
SUMMARY 447
BIBLIOGRAPHY 449
INDEX OF TABLES AND GRAPHICS:

Graphic IV.1. Histograma both sexes distribution casuistry 171
Table. IV.1. Distribution of Cases in years. Men and Women 172
Table IV.2. Middle Ages in years when children were measured and X-rayed in your birthday each and distributed by study groups. Both sexes 174
Figure IV. 2. Maximum core diameters ossification Carpal 177
Figure IV. 3. Maximum core diameters ossification Carpal 178
Figure IV.4. Maximum diameters of the cores of ossification Metacarpals 179
Figure IV.5. IVO equivalents on bone age 180
Tables IV.3. Casuistry subgroup where the EO does not differ by plus / minus one year from the EC.

Men 184
Tables IV. 4. Sub-casuistry where the EO does not differ by plus / minus one year from the EC. Women 185

Table IV.5. Various abbreviations bone studied. Values in mm 188

Table V.1.1. Chronology of the carpal and metacarpal bones (epiphysis) in both sexes 192
Table V.1.2. Chronology of the carpal bones, both sexes, found by Ebri Torné in 1980 in a cross-Aragonese population of 5225 individuals 193
Table V.1.3. Chronology of the carpal bones, jointly sexes, found by Ebri Torné in 1980 in a cross-Aragonese population of 5225 individuals 194
Table V.1.4. Chronology of the carpal bones, both sexes, found by Diez Aparicio (1961) Schinz and other anatomical authors 194
Table V.1.5. Equity percentages of the carpus and metacarpophalangeal (epiphysis) in different age groups bones. Men and women 198
Table V.1.6. Percentages of carpal bones and metacarpophalangeal (Epiphysis) which were found at its inception in radiography, when its size was less than 2mm 199
Table V.1.7. Percentage of ownership of the nuclei of ossification in both sexes, in different age groups, from the beginning to completion 100%, I found by Ebri Torné (1980) in a cross-Aragonese population of 5225 individuals 200
Table V.1.7 bis. Percentage of ownership of the nuclei of ossification in both sexes, in different age groups, from inception to completion 100%, found by Ebri Torne (1980) in a cross Aragonese population of 5225 individuals 202
Table V.2.8. Average of maximum diameters of the carpal bones in mm. Men 204
Graphic V.2.1. Average of maximum diameters of the carpal bones in mm. Men 205
Table V.2.9. Average of maximum diameters of the carpal bones in mm. Women 205
Graphic V.2.2. Average of maximum diameters of the carpal bones in mm. Women 206
Graphic V.2.3. Average of maximum diameters of the carpal bones in mm. Males. Torne Ebri (1980) 210
Graphic V.2.4. Average of maximum diameters of the metacarpophalangeal bones (epiphysis) in mm. Women. Torne Ebrí (1980) 210
Table V.2.10. Average of maximum diameters of the metacarpophalangeal bones (epiphysis) in mm.
Men 213
Graphic V.2.5. Average of maximum diameters of the metacarpophalangeal bones (epiphysis) in mm. Men 214
Table V.2.11. Average of maximum diameters of the metacarpophalangeal bones (epiphysis) in mm. Women 214
Graphic V.2.6. Average of maximum diameters of the metacarpophalangeal bones (epiphysis) in mm. Women 215
Table. V.3.12. Morphological variations of metacarpophalangeal and carpal bones (epiphysis) 220
Graphic V.3.7. Accessories carpal bones. Dorsal face 221
Graphic V.3.8. Accessories carpal bones. Palmar face 222
Table V.3.13. Distribución by frequency and sex of Bones Accessories carpal described by Ebrí Torné in (1982) 223
Table V.3.14. Intervals Accessories onset of carpal bones in both sexes, described by Ebrí Torné in (1982) 225
Table V.4.15. Getting the diameters of the carpal and metacarpal bones epiphysis in relation to chronological age. Global series. Men 233
Table V.4.16. Getting the diameters of the carpal and metacarpal bones epiphysis in relation to chronological age. Global series. Women 234
Table V.4.17. Getting bone age of each carpal and metacarpal bone epiphysis in relation to their diameters. Global series. Men 235
Table V.4.18. Getting bone age of each carpal and metacarpal bone epiphysis in relation to their diameters. Global series. Graphic Women V.4.9. Correlation between the large bone and chronological age. Men 236
Graphic V.4.9. Correlation between the large bone and chronological age. Men 237
Graphic v.4.10. Correlation between 1st metacarpal epiphysis and chronological age. Women 238
Graphic V.4.12. Correlation between the hamate bone and chronological age. Women 238
Graphic V.5.13. Correlation between the large bone and epiphysis of the first metacarpal. Global series. Men 242
Table V.5.19. Correlation coefficients between the bones carpal and metacarpophalangeal each other. Global series. Men 244
Table V.5.20. Correlation coefficients between the bones carpal and metacarpophalangeal each other. Global series. Women 245
Graphic V.5.15. Correlation between the radial epiphysis and the hamate. Global series. Men 246
Graphic V.5.16. Correlation between the radial epiphysis and the hamate. Global series. Women 246
Table V.5.21. Correlation coefficients of different metacarpophalangeal and carpal bones together. Age group of 10 years. Men 249
V.5.22 tables. Correlation coefficients of different metacarpophalangeal and carpal bones together. Age group of 10 years. Women 250
Table V.6.23. Correlation coefficients between the diameters of the various carpal bones-about metacarpophalangeal Indexes: IC, IMF, ICMF and Bone Age: GP and TW2. Global series. Men 255
Table V.6.24. Correlation coefficients between the diameters of the various carpal bones-about metacarpophalangeal Indexes: IC, IMF, ICMF and Bone Age: GP and TW2. Global series. Women 256
Graphic V.6.17. Overall correlation between the index Carpal with Capitate Bone. Men 257
Graphic V.6.18. Overall correlation between the index Metacarpofalángico with Capitate bone. Men 257
Graphic v.6.19. Overall correlation between the index Carpometacarpofalángico with Capitate bone 258
Graphic V.6.20. Overall correlation between the index Carpal Epiphysis of the first metacarpal. Women 258
Graphic V.6.21. Overall correlation between the index Metacarpofalángico the epiphysis of the first metacarpal. Women 259
Graphic V.6.22. Overall correlation between the index Carpometacarpofalángico the epiphysis of the first metacarpal. Women 259
Table V.7.25. Stocking rates: IC, IMF, ICMF. Men 265

Tabla.V.7.26. Stocking rates: IC, IMF, ICMF. Women 266
Graphic V.7.23. Stocking rates: IC, IMF, ICMF. Men 266

Graphic V.7.24. Stocking rates: IC, IMF, ICMF. Women 267
Table V.7.27. IC standard deviations (-2 SD, -1 SD, 1DS, 2DS) males 268
Table V.7.28. IC standard deviations (-2 SD, -1 SD, 1DS, 2DS) females 269
Table V.7.29. IMF standard deviations (-2 SD, -1 SD, 1DS, 2DS) males 270
Table V.7.30. IMF standard deviations (-2 SD, -1 SD, 1DS, 2DS) females 271
Table V.7.31. ICMF standard deviations (-2 SD, -1 SD, 1DS, 2DS) males 272
Table V.7.32. ICMF standard deviations (-2 SD, -1 SD, 1DS, 2DS) females 273
Graphic V.7.25. IC standard deviations (-2 SD, -1 SD, 1DS, 2DS) males 274
Graphic V.7.26. IC standard deviations (-2 SD, -1 SD, 1DS, 2DS) females 274
Graphic V.7.27. IMF standard deviations (-2 SD, -1 SD, 1DS, 2DS) males 275
Graphic V.7.28. IMF standard deviations (-2 SD, -1 SD, 1DS, 2DS) females 275
Graphic V.7.29. ICMF standard deviations (-2 SD, -1 SD, 1DS, 2DS) males 276
Graphic V.7.30. ICMF standard deviations (-2 SD, -1 SD, 1DS, 2DS) females 276
Table. V.8.34. Prediction equations bone age based on the indexes: IC, IMF, ICMF. Correlation coefficients and significance. Equations of the regression line. Global series. Women 280
Table V.8.35. Prediction equations indexes: IC, IMF, ICMF and Bone Age and TW2 GP depending on chronological age. Correlation coefficients and significance. Equation regression line. Global series. Men 280
Graph. V.8.31. Correlation between IC and Chronological Age. Men 282
Graph. V.8.32. Correlation between IC and Chronological Age. Women 282
Graph. V.8.33. Correlation between IMF and Chronological Age. Men 283
Graph. V.8.34. Correlation between IMF and Chronological Age. Women 283
Graph. V.8.35. Correlation between ICMF and Chronological Age. Men 284
Graph. V.8.36. Correlation between ICMF and Chronological Age. Women 284
Graph. V.8.37. Correlation between EOGP and Chronological Age. Men 285
Graph. V.8.38. Correlation between EOGP and Chronological Age. Women 285
Graph. V.8.39. Correlation between EOTW2 and Chronological Age. Men 286  
Graph. V.8.40. Correlation between EOTW2 and Chronological Age. Women 286  
Table V.9.38. Bone Tights Ages: EOIC, EOIMF, EOICMF, EOGP and EOTW2. Women 293  
Graphic V.9.42. Bone Tights Ages: EOIC, EOIMF, EOICMF, EOGP and EOTW2. Women 294  
Table V.9.40. Means and standard deviations. of Bone Age: EOIC. Women 296  
Table V.9.41. Means and standard deviations. of Bone Age: EOIMF. Men 297  
Table V.9.42. Means and standard deviations of Bone Age: EOIMF. Women 298  
Table V.9.43. Means and standard deviations of bone age: EOICMF. Men 299  

Table V.9.44. Means and standard deviations of bone age: EOICMF Women 300  
Table V.9.45. Means and standard deviations of Bone Age: EOGP. Men 301  
Table V.9.46. Means and standard deviations of Bone Age: EOGP. Women 302  

Table V.9.47. Means and standard deviations of Bone Age: EOTW2. Men 303  
Table V.9.48. Means and standard deviations of Bone Age: EOTW2. Women 304  
Graphic V.9.43. Means and standard deviations of Bone Age: EOIC. Male 305  
Graphic V.9.44. Means and standard deviations of bone age: EOIC. Women 305  
Graphic V.9.45. Means and standard deviations of bone age: EOIMF. Men 306  
Graphic V.9.46. Means and standard deviations of bone age: EOIMF. Women 306  
Graphic V.9.47. Means and standard deviations of bone age: EOIMF. Men 307  
Graphic V.9.49. Means and standard deviations of bone age: EOGP. Men 308  
Graphic V.9.50. Means and standard deviations of bone age: EOGP. Women 308  
V.10.49 table. Correlation coefficients of the various indices and bone together ages. Men 315  
V.10.50 table. Correlation coefficients of the various indices and bone together ages. Women 316  
Tabla.V.10.51. Regression coefficient (b) of the different correlations between rates and bone ages. Men 317  
Table. V.10.52. Regression coefficient (b) of the different correlations between rates and bone ages. Women 318  
Table. V.10.53. "T" Student between the means of the different rates in both sexes 319  
Table. V.10.54. "T" Student between the mean bone ages in both sexes 320  
V.11.55 table. Differences between chronological age and bone age distributed by age groups, of different bone ages together. Men 337  
V.11.56 table. Differences between chronological age and bone age distributed by age groups, of different bone ages together. Women 338  
Graphic V.12.53. Boys percentiles Size 342  
Graphic V.12.54. Percentiles Size Women 342  
Graphic V.12.55. Mean and standard deviation of length of males 343  
V.12.57 table. Stockings, typical deviations, minimum and maximum values, percentiles carvings. Men 344  
Tabla.V.12.58. Stockings, typical deviations, minimum and maximum values, percentiles of sizes
Women 345
Graphic V.12.56. Mean and standard deviation of length of Women 346
V.12.59 table. Sizes of children described by Wall et al in 1954, and Garcia Palacios Almansa in 1968,
Ebru Torné in (1974) 346
V.12.60 table. Sizes of children described by Ebru Torné in (1980) 347
V.13.61 table. Coefficient of correlation between the height of children of both sexes and their
chronological age. Global Series 350
V.13.62 table. Coefficient of correlation between the size of children and their adult size by age
group 351
V.13.63 table. Coefficient of correlation between the size of children and their ages and bone indices
globally Series 352
V.13.64 table. Coefficient of correlation between adult height of children and parental average size 353
V.13.65 table. "T" Student between adult height of both sexes 354
Graphic V.13.57. Correlation between the size and chronological age. Men 355
Graphic V.13.58. Correlation between the size and chronological age. Women 355
Graphic V.13.59. Correlation between the average size and size fathers. Adult. Men 356
Graphic V.13.60. Correlation between the average size and size fathers. Adult. Women 356
Graphic V.13.61. Correlation between size and IC. Men 357
Graphic V.13.62. Correlation between size and IC. Women 357
Graphic V.13.63. Correlation between size and MFI. Men 358
Graphic V.13.64. Correlation between size and MFI. Women 358
Graphic V.13.65. Correlation between size and ICMF. Men 359
Graphic V.13.66. Correlation between size and ICMF. Women 359
V.14.66 table. Correlation coefficients between the various indices to study and bone ages: GP and
TW2 for height in global series. Regression coefficients. Predicting rates and bone ages from size 363
Coefficients regression. Predicting rates and bone ages from scratch. Men 364
Coefficients regression. Predicting rates and bone ages from scratch. Women 367
V.14.69 table. Correlation coefficients of indexes: IC, IMF, ICMF, EGOP and EOTW2 about the sizes of
the children, age groups. Regression coefficients. Height prediction from rates and bone ages. Men 371
V.14.70 table. Correlation coefficients of indexes: IC, IMF, ICMF, EGOP and EOTW2 about the sizes of
the children, age groups. Regression coefficients. Height prediction from rates and bone ages. Women 376
V.15.71 table. Prediction equations Adult size from a variable: IC, IMF, ICMF or EGOP, EOTW2, by
age group. Men 386
V.15.72 table. Prediction equations Adult size from a variable: IC, IMF, ICMF or EGOP, EOTW2, by
age group. Women 390
V.15.73 table. Prediction equations Adult size from two variables: IC, IMF, ICMF or EGOP, EOTW2,
and height of children by age groups. Men 393
V.15.74 table. Prediction equations Adult size from two variables: IC, IMF, ICMF or EGOP, EOTW2,
and height of children by age groups. Women 397
V.15.75 table. Prediction equations to Adult Size from three variables: IC, IMF, ICMF or EGOP,
EOTW2; size of children and parental average size, by age group. Men 400
V.15.76 table. Prediction equations Adult size from three variables: IC, IMF, ICMF or EGOP, EOTW2;
Carving children and paternal average size, by age group. Women 404
V.16.77 table. Absolute errors in cm, of General casuistry, of the different indices and bone ages: GP
and TW2. Men and Women 409
V.16.78 table. Absolute errors in cm, of casuistry of 10-18 years, of different indices and bone ages:
GP and TW2. Men and Women 411
Table. V.16.79. Absolute errors in cm, Casuistry Switzerland longitudinal 10 to 18, of different ages
and rates bone analyzed. Men and Women 414
Table V.17.80 mean differences between prediction cm and the predicted adult height in children in
our series whose bone age does not differ by more / less than a year for
to chronological age from 4 to 16 years 419
Table prediction V.17.81 Average differences between height in cm predicted in adult and children
in our series from six months to 20 years, 1.2 and 3V 421
Table V. 17.82. Mean differences between prediction cm predicted adult height and adult reached
by the CAP (Andrea Prader Center) 424
Table V. 17.83. EA in cm of Sub-aged Casuistry bone not differ by more / less than chronological age
426
Figure V.18. 67. Equation of the regression line. (B = tag, D = (Yi - a) xi. If xi = 1, b, is the amount and increased (Going from "a" to yi) with increasing x unit (passes 0-1) 430
Graphics: V.18.68. Confidence limit 432
Table: V.18.85. Parámetros a, b of the regression line 433
Tabla.V.18.86. Final equations for calculating IVOS from each index and chronological age 434
Graphics: V.18.69. IVO equivalents in bone ages 435
Graphics. V.18.70. Computer window, input data 437
Figure V.18.71. CD annex at the end of the work, with statistical program for PC 438

---- ANNEX 439 pages to page 625

Note: The text of the book "MATURATION BONE IN SPANISH CHILD" IS IN SPANISH LANGUAGE. This book and the computer program informatic in English, full bibliography, etc, is also on this website