



The Secular Trend in Sicily. Proposal for Long Bones Measures and Statures open access databases

Citation: Lauria, G. (2024). The Secular Trend in Sicily. Proposal for Long Bones Measures and Statures open access databases, *Archivio per l'Antropologia e la Etnologia*, 154, 99-111. doi: <https://doi.org/10.36253/aae-3090>

GABRIELE LAURIA^{1*}

¹Università degli Studi di Palermo - Dipartimento di Scienze Biologiche, Chimiche e Farmaceutiche (STEBICEF)

*E-mail: gabriele.lauria03@community.unipa.it

Published: December 1, 2024

©2024 Author(s). This is an open access, peer-reviewed article published by Firenze University Press (<https://www.fupress.com>) and distributed, except where otherwise noted, under the terms of the [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) License for content and [CCo 1.0](https://creativecommons.org/licenses/by/4.0/) Universal for metadata.

Data Availability Statement: All relevant data are within the paper and its Supporting Information files.

Competing Interests: The Author(s) declare(s) no conflict of interest.

Abstract. Human Stature is a widely used index of both individuals and populations. Stature is a sensitive measure of a series of factors including gender, age, social status, and environment. Human biologists and historians can use information on stature to better understand the human condition through the ages. There are three goals of this paper: 1. review previous studies of height; 2. remeasure adult bones and expand sample sizes; 3. provide three free databases (long bone length; average height of populations; average age-related stature. However, the aim of this paper is not to present an exhaustive analysis of the Secular trend in Sicily. The samples range from the Paleolithic to the Contemporary Age. The data consist of measures from 82 adult specimens and includes the average stature of 28 Sicilian populations and the average stature from 11 different periods (plus modern Italians). A few examples of statistical analyses are presented to illustrate the potential, reliability, and reproducibility of the databases.

Keywords: human bones, height, comparative studies, free datasets.

STATURE AND SECULAR TREND

Human Stature (or Height) is the distance from the top of the head to the bottom of the feet, standing erect. Stature is widely used as an index of the biological development of both individuals and populations because it is sensitive to a series of factors including gender, age, social status, and environment.

Changes in height can be studied in regard to the evolution of our species. One highly studied phenomenon in biological anthropology is the Secular

Trend in Height (directional changes in stature in the same population over time). Commonly, increases in height are seen between recent generations, but the growth rate is not always constant over the centuries.

Height is a phenotype that is the result of an interaction between genotype and the environment. Secular trend in height is studied in the same population over time in an attempt to treat the genetic basis as a constant and attribute changes in stature as due to environmental causes. By applying this hypothesis to archaic populations an increase of the stature are viewed as a consequence of environmental variables such as on improved climatic conditions and food supply whereas a decline in stature can be attributed to deteriorating environmental conditions. For instance, periods of urbanization may have led to a decrease in stature.

On the other hand, the European industrial revolutions (and the consequent improvement of life conditions for the lower social levels) provided a widespread increase in stature. Just over the last 100 years, there has been a remarkable increase in average height of more than 10 cm in all age classes.

Research show that the secular trend of increased stature starts between 2 and 5 years old and every 10 years (considering the period 1880-1950) produced an increase of 1 cm (0,5 kg) in childhood, 2.5 cm (2,5 kg) in pre-adolescence and adolescence and 1 cm in the last years of growth, the end of adolescence and the adulthood (Harrison *et al.*, 2004).

This secular trend is still ongoing in many European Countries. It is also present and even more accentuated in many other modern population such as Japan (Harrison *et al.*, 2004). Further, adult stature is obtained earlier along with a correlated secular trend of earlier maturation. The final result is an average increase in stature of 2,5 cm per generation (Harrison *et al.*, 2004).

AIMS OF THE PAPER

The aims of this report are 3 fold:

1. Review previous studies of heights in Sicilian populations' (Tab. 1) (Belvedere *et al.*, 2017; Borgognini *et al.*, 1993; Becker 1999; Castellana and Mallegni, 1986; D'Amore *et al.*, 2010; Di Salvo *et al.*, 1984; 1987; 1991; 1998; 2004; 2006; 2007; 2008a; 2008b; 2012; Fabbri, 1993; Germanà and Di Salvo, 1994; Cangialosi *et al.*, 2022; Lauria and Messina, 2013; Pautasso, 2017; Schimmenti and Di Salvo, 1997; Whitehouse, 2016);

2. Remeasure the adult bones from previous studies and increase sample sizes by integrating new adult bones;

3. Provide free databases, one for long bone Lengths (plus the transversal and sagittal diameters and the circumference at mid-diaphysis of the femurs)

another for average stature in various populations, a third related to age related averages of stature.

Place	Previous bibliography
Grotta di San Teodoro	Fabbri, 1993; Whitehouse, 2016
Grotta dell'Uzzo	Borgognini <i>et al.</i> , 1993
Piano Vento	Di Salvo, 1998
Fossato di Stretto Partanna	Schimmenti and Di Salvo, 1997
Roccazzello	Di Salvo, 1998; Schimmenti and Di Salvo, 1997
Grotta del Vecchiuzzo	Lauria and Messina, 2013
Grotta del Fico	Di Salvo, 1998
Marcita	Di Salvo, 1991; 1998
Stretto Partanna	Schimmenti and Di Salvo, 1997
Grotta Chiusilla	Di Salvo, 1998
Polizzello	Schimmenti and Di Salvo, 1997
Baucina	Castellana and Mallegni, 1986
Desucri	Di Salvo and Schimmenti, 2006; Belvedere <i>et al.</i> , 2017
Caserma Tukory	Germanà and Di Salvo, 1994
Contrada Petrarò (Entella)	Pautasso, 2017
Lilibeo	Becker, 1995
San Giovanni Marsala	Di Salvo <i>et al.</i> , 2008
Licata	La Torre and Raffa, 2016
Agrigento	Di Salvo <i>et al.</i> , 2008
Sant'Agata	Di Salvo <i>et al.</i> , 2008
Entella	Di Salvo, 2004
Castel San Pietro	Di Salvo, 2004
Marsala	Di Salvo, 1984
Segesta	Di Salvo, 2004
Monte Iato-Position (A)	Di Salvo, 2004
Monte Iato-Position (B)	Di Salvo, 2004
Monte Maranfusa	Di Stefano and Cadei, 1997
Alia	Cangelosi, 2017
Rotoli	LabHomo-Unpublished
Contemporary Italian	ISTAT-Istituto Italiano di Statistica

Tab. 1. *Previous Study and related Bibliography for each site.*

It is not the intention here, to present a detailed analysis of secular trend in height in Sicily, but we offer few statistical analyses to illustrate the potential, reliability and reproductibility of the databases. The database can be freely used by researchers for further studies and future publications providing that it is properly cited.

MATERIALS AND METHOD

Material

The sample ranges from the Upper-Paleolithic (San Teodoro-C¹⁴ 14.500 B.C.E.) to the Contemporary Age (Rotoli-XXI Century) (Fig. 1 - Tab. 2) and consists in the measurements of 82 adult specimens (Tab. 3), the average stature of 28 Sicilian populations (Tab. 4) and the average stature in 11 different periods (plus the modern Italian) (Tab. 5). For practical reasons, Tab. 3 is not printed in the paper version but, together Tab. 4 and Tab. 5, are downloadable as On-Line File and on ResearchGate, Accademia Edu, or IRIS UniPa online version. Alternatively, an Excel .xls file can be obtained by sending an email to the institutional address of the corresponding author (gabriele.lauria03@community.unipa.it). The links and the extended URL are available in the dedicated section Dataset below.



Fig. 1. Sample Site Map-Key-Dating.

MAIN SICILIAN PERIODS
B.C.E. Before Cristhian Era - C.E. Cristhian Era
Prehistory
Upper-Paleolithic: 14.500 (C ¹⁴ of San Teodoro) - 8.000 B.C.E.
Mesolithic: 8.000-6.000 B.C.E.
Neolithic: 6.000-4.000 B.C.E.
Eneolithic/Copper Age: 4.000-2.500 B.C.E.
Protohistory
Bronze Age: 2.500-1.100 B.C.E.
Early Bronze Age: 2.500-2.000 B.C.E.
Middle Bronze Age: 2.000-1.500 B.C.E.
Late Bronze Age: 1.500-1.100 B.C.E.
Iron Age: 1.100-700 B.C.E.
History
Antiquity: 700 B.C.E. - 100 C.E.
Colonial Period: 700-600 B.C.E.
Classical Period: 600-400 B.C.E.
Hellenistic (Greek Period): 400-200 B.C.E.
Roman Republic Period: 200 B.C.E. - 100 C.E.
Late Antiquity (Roman Empire Period): 100-476 C.E.
Middle Ages: 476-1.492 C.E.
Byzantine Period: 476-1.000 C.E.
Islamic Period: 1.000-1.300 C.E.
Norman/Swabian Period: 1.300-1.492 C.E.
Modern Ages: 1.492-1.789 C.E.
Contemporary: 1.789 C.E. to Nowadays

Tab. 2. Main Sicilian Prehistoric, Protohistoric and Historic Periods (delimited according to the archaeological artifacts).

Site	Average M	Average F
San Teodoro	0,00	162,7
Grotta dell'Uzzo	162,2	152,2
Piano Vento	171,8	146,2
Fossato di Stretto Partanna	161	151
Roccazzello	162	155
Grotta del Vecchiuzzo	0,00	157,5
Grotta del Fico	163,6	0,00
Marcita	165	153
Stretto Partanna	161	151
Grotta Chiusilla	167	157
Polizzello	164,6	150,7
Desucri	168,1	153,7
Baucina	158	153,96
Caserma Tukory	165,2	153,6
Contrada Petrarò (Entella)	170,2	154,6
Lilibeo	167,5	155

Site	Average M	Average F
San Giovanni Marsala	168,7	158,3
Sant'Agata	167,5	155,2
Agrigento	167,1	153,04
Licata	166,02	156,19
Entella	171,5	157,5
Castel San Pietro	177,4	157,4
Segesta	171,6	155,3
Monte Iato (Position A)	166	157
Monte Iato (Position B)	172,8	153,6
Maranfusa	167	153,3
Alia	161,08	157,29
Rotoli	163,05	159,09
Modern Italian	175	162

Tab. 4. Dataset reporting the averages of the height for each site.

Period	Average M	Average F
Mesolithic	162,20	152,20
Neolithic	166,40	148,60
Eneolithic	162,00	156,25
Bronze	163,00	152,00
Bronze/Iron	165,80	153,85
Iron	168,10	153,70
Antiquity	165,23	154,29
Late Antiquity	167,33	155,68
Middle Ages-Islamic	171,63	156,80
Middle Ages-Indigenous	169,90	153,45
Contemporary Sic.	162,07	158,19
Contemporary Ita.	175,00	162,00

Tab. 5. Dataset reporting the averages of the height for each period.

Methods

Adult long bones were selected (Buikstra and Ubelaker, 1994; Scheuer and Black, 2000; Ubeleker, 1989) broken or incomplete finds were excluded. Estimation of sex (when possible) was based on skulls and limb morphological characters (Acsádi and Nemeskéri, 1970; Walrath *et al.*, 2004). The stature estimation was always carried out by performing the methods proposed by Trotter and Glaser (Trotter and Glaser, 1952-1958) as reported in Canci and Minozzi (Canci and Minozzi, 2005). References not performing following Trotter and Glaser (Trotter and Glaser, 1952-1958) formulas were excluded. Measures were taken following the standard of Buikstra and Ubelaker (Buikstra and Ubelaker, 1994). Length and Stature were reported in centimetres while transversal and sagittal diameters and the circumference

at mid-diaphysis were in millimetres.

Tab. 3 measures were taken directly by the authors, and Tab. 4 and Tab. 5 join the data collected (remeasurements and new data) and performed by the authors with the data found in the available literature (missing values were reported as 0,00). The averages were calculated excluding the specimens with undetermined sex. Univariate and Multivariate Statistics (Hammer and Harper, 2008) were performed with Excel and the software PAST (Hammer and Harper, 2001). The examples proposed were selected for illustrative purposes only.

UNIVARIATE STATISTICS

The Histogram in Fig. 2a reports the averages of stature divided for populations and sex. A general evaluation of the graphs shows the correlation of height with both sex and time span, with a global increase through the centuries. The Line Graph in Fig. 2b shows the same trend (the populations of San Teodoro, Grotta del Vecchiuzzo and Grotta del Fico were excluded for missing records for one of the two sexes) with the average that quickly increased during the Middle Ages and in the Contemporary populations of Alia (Sicily 19th century), Rotoli (Sicily 21th century) and the data provided by ISTAT on 2013 (with the contemporary Italians taller than the Sicilian of the same period).

It can be easily noted that the values of the Medieval Islamic populations (Monte Iato A, Castel San Pietro, Entella, Segesta) were higher compared to the other Medieval indigenous groups. In particular the values of Islamic specimens from Monte Iato (Monte Iato A) were taller than the contemporary Sicilians, but shorter than the other Islamic populations living in Sicily during the same period. The indigenous sample (Monte Iato B) were in turn, shorter than the Islamic specimens, but taller than the Sicilian samples. Monte Iato might be on this basis considered an index of a possible genetic exchange between foreign and indigenous peoples.

Other univariate analyses were conducted by grouping the specimens for ages. Populations with missing data (for San Teodoro, Grotta del Vecchiuzzo e Grotta del Fico were available the averages of only the sexes) were excluded. Mesolithic, Eneolithic and Iron Ages were represented by only specimens but the number of specimens increased through the ages.

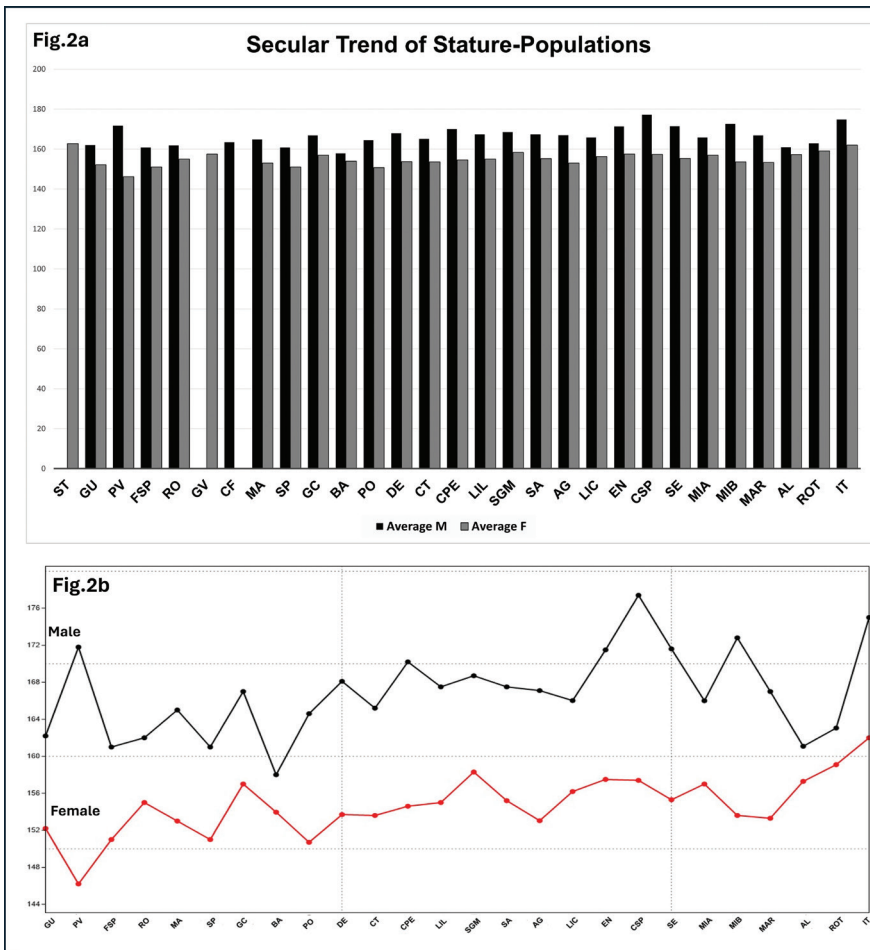


Fig. 2. Histogram of Stature-Periods (a); Line Graph of Stature-Periods.
 Key: ST-San Teodoro; CU-Grotta del' Uzzo; PV-Piano Vento; FST-Fossato di Stretto Partanna; RO-Roccazzello; CV-Grotta del Vecchiuzzo; CV-Grotta del Fico; MA-Marcita; SP-Stretto Partanna; CU-Grotta Chiusilla; PO-Polizzello; DE-Desueri; BA-Baucina; CT-Caserna Tukory; CP-Contrada Petraro (Entella); LIL-Lilibeo; SGM-San Giovanni Marsala; AS-Sant'Agata; AG-Agrigento; LIC-Licata; EN-Entella; CSP-Castello San Pietro; SE-Segesta; MIA-Monte Iato; MIB-Monte Iato; MA-Maranfusa; AL-Alia; RO-Rotoli; IT-Modern Italian.

Looking at the Histogram in Fig. 3a it appears that height remained quite constant during Prehistory until the Iron Age for which we can note an initial increase. Statures remained stable during Antiquity and Late Antiquity and underwent a significant increase during the Middle Ages.

The Line Graph in Fig. 3b again highlights that Islamic Medieval specimens were taller than others of the same period. Islamic stature values were only

reached in the Contemporary Age. The increase is moreover highlighted by the difference among the last three groups (Contemporary Sicilian - 19th century, Contemporary Sicilian - 21st century and Contemporary Italian - 21st century). We can note that modern Italian mainland with the averages are higher than those in Sicily.

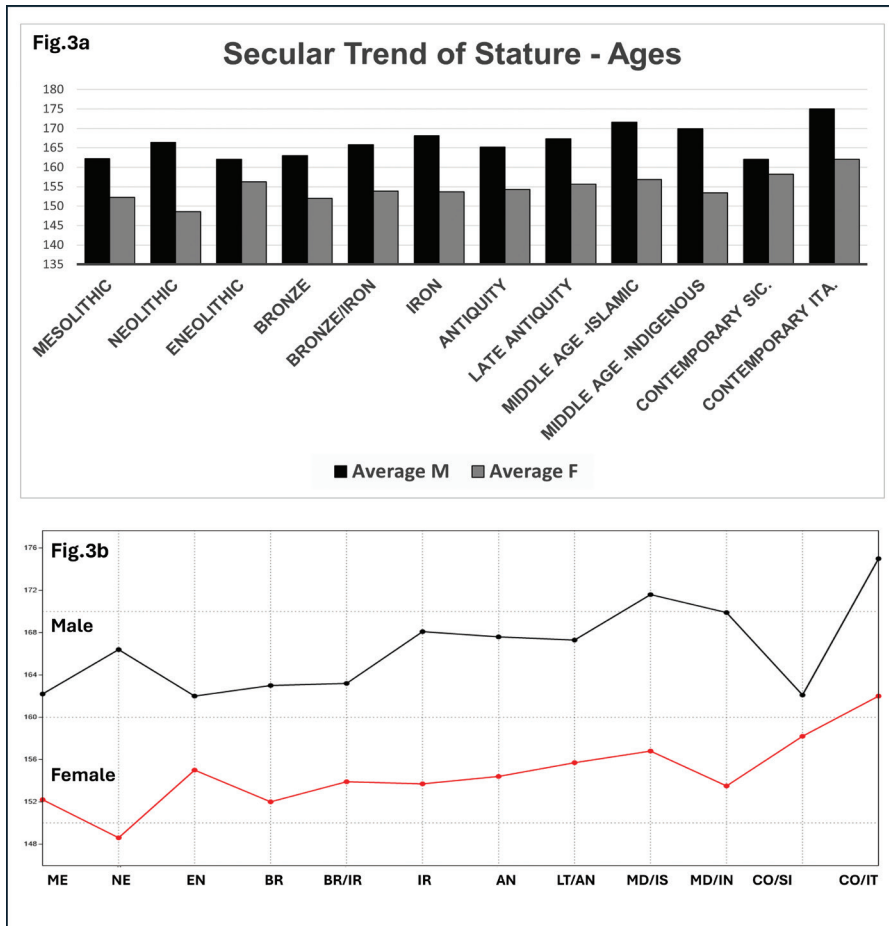


Fig. 3. Histogram of Stature-Ages (a); Line Graph of Stature-Ages.
 Key: ME-Mesolithic; EN-Eneolithic; BR-Bronze; BR/IR-Bronze/Iron; IR-Iron; AN-Antiquity; LT/AN-Late antiquity; MD/IS-Middle Ages Islamic; MD/IN-Middle Ages Indigenous; CO/SI-Contemporary Sicilian; CO/IT-Contemporary Italian.

CONCLUSIONS

This paper presents three databases: Tab. 3 - Long Bones Measures, Tab. 4 - Average of the Stature of 26 Sicilian Populations and Tab. 5 - Average of the Stature of 10 Sicilian Periods, which are freely available and require only appropriate citation if used. The analyses presented, two univariate and two multivariate examples, serve show that the databases are useful and reliable, of the databases.

The analyses reported in Fig. 2, Fig. 3 and Fig. 4 display the increase of the height through the time, clearly demonstrating the phenomenon of the Secular Trend. Moreover, focusing on a short time span (among the periods listed in Tab. 1) makes it possible to distinguish settlers and indigenous populations and possible admixture. The reliability showed in these examples show that these databases can form a solid basis for reported allows future detailed studies.

DATASETS

Tab. 3, Tab. 4 and Tab. 5 are full free downloadable as On-Line file and copyable on the paper version available on the author's profiles' of:

ResearchGate:

(<https://www.researchgate.net/profile/Gabriele-Lauria/publications>);

Accademia Edu:

(<https://independent.academia.edu/GabrieleLauria/Papers>);

IRIS UniPA:

(<https://iris.unipa.it/cris/rp/rp18034>).

Alternatively, is possible have the .xls file sending an email to the institutional address of the author (gabriele.lauria03@community.unipa.it).

The datasets are an intellectual property of the author and are at full free disposal with the proper citation of this paper. The author declare that he has no conflict of interest and no competing interest in the sharing of the data. The data reported in the present study is based on the measures of skeletal findings available by excavations and institutional permits.

BIBLIOGRAPHICAL REFERENCES

- Acsádi, G.Y., Nemeskéri, J. 1970. *History of human life span*. Budapest.
- Belvedere, O., Burgio, A., Bordonaro, G., Forgia, V. 2017. Baucina (Pa)–Monte Falcone 2014. Indagini nella necropoli. *FOLD&R FastiOnLine documents & research*: 380.
- Borgognini Tarli, S., Canci, A., Piperno, M., Repetto, E. 1993. Dati archeologici e antropologici sulle sepolture mesolitiche della Grotta dell'Uzzo (Trapani), *Bullettino di Paleontologia Italiana*, 84: 85-179.

- Buikstra, J., Ubelaker, D.H. 1994. *Standards for human collection from human skeletal remains*. Arkansas Archeological Survey Research Series NO. 44.
- Canci, A., Minozzi, S. 2005. *Archeologia dei resti umani: dallo scavo al laboratorio*. Carocci ed.
- Cangialosi, E.O., Lauria, G., Raffa, A.T., Meli, F. 2022. Analisi antropologica dei reperti osteologici tardo-antichi provenienti dal contesto ipogeico di Licata. Lipogeo Zirafi-settore G–Licata (Sicilia), *Archivio per l'Antropologia e la Etnologia*, 152: 61-74.
- Castellana, G., Mallegni, F. 1986. The Prehistoric Settlement of Piano Vento in the Territory of Palma di Montechiaro (Agrigento, Italy), *Archivio per l'Antropologia e la Etnologia*, 116: 61-80.
- D'Amore, G., Di Marco, S., Di Salvo, R., Messina, A., Sineo, L. 2010. Early human peopling of Sicily: Evidence from the Mesolithic skeletal remains from Grotta d'Oriente, *Annals of human biology*, 37(3): 403-426.
- Di Salvo, R. 1984. Studio antropologico e paleopatologico di resti scheletrici umani rinvenuti nella necropoli ellenistico-romana di Marsala (Trapani), *Archivio per la Antropologia e la Etnologia*, 114: 283-310.
- Di Salvo, R. 1987. Gli inumati di Manuzza-Selinunte (Trapani) (IV-III sec. a.C.), *Archivio per la Antropologia e la Etnologia*, 117: 259-284.
- Di Salvo, R. 1991. Tre resti cranici da Marcita, *Archivio per l'antropologia e l'etnologia*, 117:
- Di Salvo, R. 2004. I Musulmani della Sicilia occidentale: aspetti antropologici e paleopatologici, *Mélanges de l'école française de Rome*, 116-1: 389-408.
- Di Salvo, R., Germanà, F., Tusa, S. 1998. *Uomini e Culture della Sicilia Preistorica*. Gaia editrice.
- Di Salvo, R., Mannino, G., Mannino, M.A., Schimmenti, V., Sineo, L. 2012. Le sepolture della Grotta d'Oriente (Favignana). In: *Proceedings of Riunione Scientifica, Istituto Italiano di Preistoria e Protostoria - San Cipirrello (PA) 16-19 novembre*: 341-351.
- Di Salvo, R., Schimmenti, V. 2006. Le sepolture della Grotta d'Oriente. In: *Proceedings of Riunione Scientifica, Istituto Italiano di Preistoria e Protostoria - San Cipirrello (PA) 16-19 novembre*: 341-351.
- Di Salvo, R., Schimmenti, V. 2008a. Gli inumati della necropoli di San Agata – Piana degli Albanesi (Palermo) di età tardo romana (IV-V sec. d.C.). studio antropologico e paleopatologico, *Archivio per la Antropologia e la Etnologia*, 138: 35-46.
- Di Salvo, R., Schimmenti, V., Mannino, M., Caramelli, D., Lalueza-Fow, C., Messina, A., Sineo, L. 2007. Ecologia, morfometria e genetica dei reperti paleo mesolitici di Grotta D'Oriente (Favignana, TP). In: *Proceedings of XVII Congresso degli Antropologi Italiani. Mediterraneo, crocevia di popoli e culture. Processi microevolutivi delle popolazioni umane*: 52-53.
- Di Salvo, R., Schimmenti, V., Messina A. 2008b. Nota paleobiologia degli inumati del cimitero sub divo si S. Giovanni – Marsala (Trapani-Sicilia) di età paleocristiana (III-IV sec. d.C.), *Archivio per la Antropologia e la Etnologia*, 138: 113-122.
- Fabrizi, P.F. 1993. Nuove determinazioni del sesso e della statura degli individui 1 e 4 del Paleolitico superiore della Grotta di San Teodoro, *Rivista di scienze preistoriche*, (45): 219-232.
- Germanà, F., Di Salvo, R. 1994. Dettagli di paleopatologia in un resto cranico punico dalla Caserma Tukory di Palermo, *Archivio per l'Antropologia e la Etnologia*, 125: 107-120.
- Hammer Ø., Harper, D.A. 2008. *Paleontological data analysis*. John Wiley & Sons.
- Hammer, Ø.; Harper, D.A., Ryan, P.D. 2001. PAST: Paleontological Statistics Software Package for Education and Data Analysis. In: *Palaeontologia Electronica*. Volume 4.

- Minneapolis: Coquina Press: 9.
- Harrison, G.A., Tanner, J.M., Pilbeam, D.R., Baker, P.T. 2004. *Population genetics-gene frequency changes. An Introduction to Human Evolution, Variation, Growth, and Adaptability*. Oxford Science Publications.
- Lauria, G., Messina, A. 2013. The Cave of Vecchiuzzo: anthropology, paleopathology and hierarchy of the human group with a statistical overview (Petralia Sottana – Palermo, Italy), *Archivio per l'Antropologia e la Etnologia*, 143: 145-156.
- Pautasso, A. 2017. *Il Thesmophorion di Entella. Scavi in Contrada Petrarò*. Edizioni della Normale di Pisa.
- Scheuer, L., Black, S. 2000. *Developmental juvenile osteology*. Elsevier
- Schimmenti, V., Di Salvo, R. 1997. *Progetto del Laboratorio Osteologico per l'archivio informatizzato*.
- Trotter, M., Gleser, G.C. 1952. Estimation of stature from long bones of American Whites and Negroes, *American journal of physical anthropology*, 10(4): 463-514.
- Trotter, M., Gleser, G.C. 1958. A re-evaluation of estimation of stature based on measurements of stature taken during life and of long bones after death, *American journal of physical anthropology*, 16(1): 79-123.
- Ubelaker, D.H. 1989. Human skeletal remains. Excavation, analysis, interpretation, *Am. J. Biol. Antropol.*, 32: 3-24.
- Walrath, D.E., Turner, P., Bruzek, J. 2004. Reliability test of the visual assessment of cranial traits for sex determination, *American Journal of Physical Anthropology*, 125(2): 132-137.
- Whitehouse, R.D. 2016 (ed.). *Gender & Italian Archaeology: Challenging the Stereotypes*. Routledge.