HAS SOCIETY CHANGED ITS ATTITUDE TO INFANTS AND CHILDREN? EVIDENCE FROM ARCHAEOLOGICAL SITES IN THE SOUTHERN LEVANT

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Introduction

Today archaeologists are paying increasing attention to examining social structure within past societies. In this context the analysis of skeletal remains of infants and children can yield important information regarding child raising practices as well as the social and ritual role of children in the past. The two sources of evidence are firstly the timing and severity of episodes of physiological stress shown in developmental lesions of the teeth and bones and secondly the extent to which age at death influences mortuary practices. An additional perspective in such studies is provided by analyses of the extent to which child care and mortuary practices vary according to the sex of the child.

Archaeological studies of gender differences especially in regard to children have been traditionally explored through identification of grave goods considered indicative of female or male roles (Pearson 1999). Physical anthropology expands the study of mortuary practices through direct identification of sex, even when grave goods are absent. The reliability of such analyses varies with the condition of the bones. Using classical morphometric analyses it approximates complete skeleton for a complete adult skeleton However, if the bones are poorly preserved or those of infants or children, the reliability of sex identification from these methods falls as low as 60% (Mays and Cox 2000). Ancient DNA analyses are of course reliable in even such conditions-if sufficient DNA is preserved, but are expensive and time consuming. Thus in Israel where bone preservation is poor and secondary burial with mixing of bones from a number of different individuals is common the number of adult skeletal remains that cannot be accurately sexed is high, while children are usually placed in an unsexed category (Smith 1993). Accordingly archaeological perspectives on the significance of gender differences in Near Eastern societies have relied heavily on written records and ethnographic studies of traditional societies, although ancient DNA analyses may provide more direct evidence in the near future.

Age differences in mortuary customs

Age differences in burial customs may be clearly shown by burial context-or alternately inferred from an unexpected dearth or excess of infant remains in a specific context. The expected pattern of infant mortality from natural causes tends to be the same whether 50% of children die before the age of 15 years as in some developing nations even today (Ewbank and Gribble 1993), or 10% as in some Western countries,

and provides the gold standard against which to evaluate the skeletal record. The first week of life is the most critical, with the frequency of deaths gradually falling thereafter (Lancaster 1990). Preston and Haines (1991:1-2) reported that in the US in 1900, 59% of all deaths of children aged less than 15 years, occurred in the 0-1 year age group, compared with 29% between the ages of 1-4 years (half of these occurred between 1-2 years) and 12% between 5-14 years. The 1922 census for the United States (Steuart 1924:112-117) is one of the earliest National censuses to provide detailed information on death during the first year of life. The overall frequency of deaths in infancy was 76.2 per 1000 births. Of these more than half (60%) died before they were one month old and 2/3 of these died within a week of birth. A similar pattern, with most infant deaths occurring in the first week of the first month was reported by Lawoyin (2001) for a much smaller but more recent study of a rural community in Nigeria, where 55.10 % of all infant deaths occurred in the first month (neonatal deaths) and nearly ¾ (74.1%) of these died in the first week (perinatal deaths).

For our study of age differences in burial patterns we have accordingly examined the ratio of infant to early childhood deaths as well as burial context. The reliability of such comparisons is of course affected by several factors including sample size, number of generations represented and post depositional degradation. All of these factors need to be taken into consideration before evaluating the extent to which the observed ratio of infants to young children deviates from that expected and can be considered evidence of differential burial patterns.

Diachronic trends in infant burial in Israel

The earliest infant skeletons identified from Israel date to the Middle Palaeolithic Period and have been found together with the remains of adults and older children in several cave sites as well as in a rock shelter (at Skhul) used at various times as living sites. They include sites with Neanderthal remains such as Hayonim, Kebara and Amud dated to between 60.000 and 40.000 years ago, as well as those with anatomically modern humans, namely Qafzeh and Skhul, dated to nearly 100.000 B.P. All appear to be primary burials and show no spatial differentiation in the location of skeletal remains by age or by sex in the case of adults.

Very few human remains have been recovered from the succeeding Upper Palaeolithic. Usually they occur as isolated burials in living sites and none are of infants or children. This may indicate some selection by age or sex in the location of burials, or alternately the more ephemeral use of sites identified for this period.

The situation changes in the Epipalaeolithic Natufian period dated 12.000-10.300 B.P., where living sites were larger, used for longer periods and resettled at various times. Many sites have yielded dozens of skeletons, dated to various phases of the Natufian Period. They show marked differences within as well as between different phases of the Natufian in type of burial (primary or secondary) as well as associated artefacts. In all cases the proportion of infants to older children is less than that expected from the number of individuals represented (Table 1), but it is unclear whether this results from differential post-depositional degradation of fragile infant

bones or differences in burial location or type. Grave goods are occasionally present with juveniles and adults of both sexes indicating status differences.

The earliest clear evidence of differential funerary treatment of infants and young children dates to the Pottery Neolithic (Table 1). From this time on some infant remains are buried in pots or covered with shards and buried in and around houses even when other infants, older children and adults were buried extramurally (Kahila Bar-Gal and Smith 2001). In the Bronze Age infant jar burial continued, either within dwellings or in family tombs as for example at Middle Bronze Age Kabri (Kempinski and Niemeier 1992). However, these jar burials appear to have been accorded only some infants. Others were awarded informal burial at best-for example in disused storage pits in the subterranean village of Chalcolithic Shiqmim (Levy *et al.* 1991), or in a disused sewer at Roman-Byzantine Ashkelon (Stager 1991). Where secondary burial was the norm, as in some phases of the Chalcolithic, infants and young children were excluded (Zagerson and Smith 2002; Nagar and Eshed 2001). Even in more recent periods, where single primary interments were the rule, the ratio of infants aged less than one year of age to those aged 2-4 years is significantly different from that expected if all those dying of natural causes were interred in the same fashion (Table 1). While they are generally under-represented, their number and age range in other unusual contexts raises the possibility of infanticide or sacrifice referred to in ancient texts.

For example, the bible describes the practice of infant sacrifice to Moloch among the Canaanites and deplores its spread to the early Israelites. Greek and Roman written sources describe with horror infant sacrifice at Punic Carthage and by inference at Phoenician Tyre, although themselves practicing infanticide. There is however no direct evidence of infant sacrifice from any Canaanite or Israelite archaeological site, while all cremated remains from Phoenician sites in Israel or Lebanon so far analysed have been identified as adults or adolescents (Smith and Avishai 2005).

However, there is good archaeological, epigraphic and historic evidence for infant sacrifice from the tophets found in Phoenician (Punic) settlements most notably in North Africa and Sicily (Brown 1991). During the excavations of the Carthaginian tophet over 400 urns filled with charred human and animal bones set in pits were recovered dating from around 700 to 146 years BC (Stager 1980). A variety of occasions when the Carthaginians practiced the rite of human sacrifice were described by the Greek and Roman writers and could be summarized as follows: regularly on an annual basis, in times of great crisis, and whenever "great favors were requested from the gods".

Knowing the sex of infants found in different archaeological contexts is important for reconstructing parental/society attitudes reflected in differences in nutrition and/or weaning as well as burial practices (Leonard and Thomas 1989; Molleson 1989; Sofaer-Derevenski 1994; Scott and Duncun 1998). It has implications not only for possible sex differences in burial accorded but for the possible role of sex in relation to the question of infant sacrifices and infanticide.

Period	**Site**	**Reference**	**N total**	**<1yr, %**	**1-4 yrs, %**
Natufian **Early** **Late** **Final** **TOTAL**	Mallaha[1,2,3]	Bocquentin 2003	 28 38 21 87	 10.71 0 9.52 5.75	 7.14 31.58 14.29 19.54
Neolithic PPNB	Kfar HaHoresh[1,2,3]	Goring-Moris 2005	40	15.00	12.50
Neolithic PPNC	Atlit Yam[1]	Eshed, 2001	47	2.13	21.28
Chalcolithic	Shiqmim[1,2]	Faerman *et al.* in press	65	18.46	12.31
Chalcolithic	Gilat[1]	Smith *et al.* 2006	92	21.7	14.1
Chalcolithic	Kissufim[3]	Zagerson & Smith 2002	54	2.04	0
Middle Bronze Age IIA-B	Kabri[2]	Faerman *et al.* 2002	98	0	14.29**
Middle Bronze Age IIA,B,C	Yokne'am[2]	Smith *et al.* 2005	32	32.26	12.09
Iron Age II, 8th century BC	Tel es-Safi[2]	Faerman & Smith unpublished	77	11.68	11.68
Hellenistic/ Roman	Ashdod[2]	Haas, 1971	293	3.48	ND
Roman/ Byzantine	Giv'at Shappira[1,2,3]	Arensburg & Belfer-Cohen 2007	51	12.50	7.50
Roman/ Byzantine	Ashkelon[2]	Kahila & Smith 1992	~100	100	0
Ottoman	Dor[1]	Smith & Horwitz in press	172	21.58*	10.07**
Ottoman	Tell el-Hesi[1]	Eakins 1993	143 310	39.72# 30.97#	14.18## 22.01##

Table 1.- Infant mortality between birth and four years.

Note: 1 - Primary burials in individual tombs or occasionally double burials - Infants are often buried in such tombs with an older child or adult.
2 – Primary mass burials, successive burials in the same tomb either constructed or natural caves – here earlier burials are often pushed aside to make room for later burials as shown by lack of articulation.
3 – Secondary burials located in distinct area of large tombs or placed in various containers including pots and ossuaries. We have included accidentally disturbed and reburied skeletal remain in this category.
*- Infants less than 2 years old; ** - children aged 2-5.9 years; # - infants less than 18 months old; ## - children aged 1.5-4.0 years; ND – no data.

Role of molecular archaeology in studies of gender in past societies

Recent developments in molecular biology in analyzing DNA recovered from ancient bones have provided reliable methods for sex determination based on amplification of DNA sequences specific to the X and/or Y chromosomes (Brown 1998, 2000 and references herein). Population structure, male and female status in past societies, and sex differences in burial practices can now be attempted even on fragmentary skeletal remains as well as those of infants and children.

Successful sex identification has also been achieved on infant remains found in Israel. Out of the 17 burials found at Tel Teo, the Huleh valley 10 were infants, with 6 of them dated to the pottery Neolithic and the remainder dated to the Chalcolithic and Early Bronze Age (Eisenberg 1987). They were found in jars or under potsherds beneath house floors and their ages ranged from birth to three months. Nine of these were subjected to DNA-based sex identification (Smith *et al.* 1999). The results were consistent with all five specimens (of nine), which yielded amplifiable DNA, being male. This finding suggests that special treatment might have been given to male infants (Figure 1).

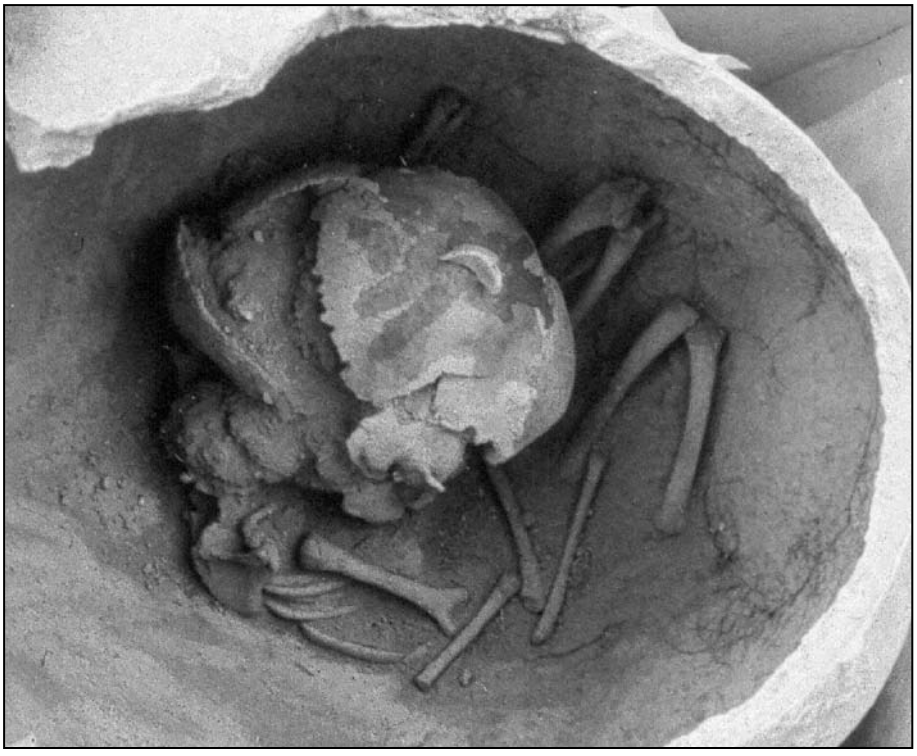


Figure 1.- An infant jar burial from the Neolithic Tel-Teo. Archive of the Laboratory of Bio-Anthropology and Ancient DNA, the Hebrew University of Jerusalem.

Later we applied this approach to clarify a possible cause of infanticide in infants from Roman Ashkelon. Human settlement of Ashkelon dates back over 5000 years, and most of this period Ashkelon was a major seaport (Stager 1991). Skeletal remains of over 100 neonates were unearthed during archaeological excavations by the Leon Levy Expedition to Ashkelon. The infant bones were found in the sewer beneath a bathhouse built in the 4th century and used until the 6th century AD. No signs of careful burial or associated grave goods were found: the infant remains had been discarded in the gutter of the sewer along with animal bones, potsherds and isolated coins. This casual mode of disposure contrasted sharply with the careful infant jar burial from the same archaeological period discovered in the close proximity. If the Ashkelon sewer served as a public place for disposal of infants who had died from natural causes but had been considered too unimportant or too young for full burial rites one would expect to find infants of different ages (Smith and Kahila 1992). None of the infants showed evidence of disease or skeletal malformation, indicating that they may have been the victims of infanticide.

Infanticide since time immemorial has been an accepted practice for disposing of unwanted infants. Currently illegal in most societies, the practice of infanticide was widespread in the past for a variety of cultural and economic reasons (Langer 1974; Williamson 1978). The sex of a child was often an important factor. Both in ancient and modern societies more daughters than sons were selected for infanticide (Pomeroy 1983). We therefore thought that the Ashkelon bones would have been of females. Since the reliability of morphometric analyses for sex identification is low, we approached this by means of DNA analyses of the X and Y alleles of the amelogenin gene following the procedure established in our laboratory (Faerman *et al.* 1995). We reported on successful DNA amplification in 19 out of 43 left femurs tested: 14 were found to be male and 5 females (Faerman *et al.* 1997). This extremely high ratio of males to females differs from that expected in the event of neonatal death from natural causes, although the small size of our sample means that this factor cannot be entirely excluded. However if taken at face value the findings raise the intriguing possibility that the infants in the sewer were the unwanted offspring of courtesans working in the bathhouse with some female infants kept and raised as future replacements in the profession. The linkage of baths with prostitution has been emphasized by the classic authors (cited in Dauphin 1996). There were both private and public bathhouses in Roman Ashkelon. The small bathhouse, where infant remains were found, was probably one of many private baths run for profit in this seaport. The bathhouse built over earlier Roman villas included one room full of oil lamps decorated with the erotic images. The bathhouse was located in what was probably a part of the "red-light" district of Roman Ashkelon, and the proprietor welcomed guests with the signpost: *"Enter, enjoy, and …"*.

Ancient DNA analysis has also been applied to identify sex of infants from Roman Britain (Mays and Faerman 2001). Previous study of infant burials suggested that infanticide had been routinely practised during the Roman period in Britain. This, together with the observation that there is an adult sex imbalance in favor of males at many Romano-British cemetery sites has raised the question of female infanticide. Of 31 individuals sampled, sex identification was successful in 13, of which nine were

males and four females. Given the difficulties in obtaining amplifiable nuclear DNA from these burials, this study could not provide firm conclusions regarding the preferential infanticide of one sex or other in Roman Britain. However it does add to the corpus of data of sexed infant burials from this period.

In the only other attempt to identify sex in Romano-British infants using a DNA, of which we are aware, Waldron *et al.* (1999) amplified the amelogenin sequences in the DNA extracts from seven perinatal Roman infant burials from Sussex. Sex was successfully identified in four cases, of which three were male. As with the previous work, the sample was too small to come to firm conclusions concerning whether there was an excess of deaths of one sex. However, the findings indicated that if the infants were accepted as infanticide victims then the practice was clearly not confined to one sex. Combining the data from these two sites gives an excess of males (12 males versus 5 females). Although this imbalance only reaches significance at the 0.1 level (chi-square = 2.9, $0.05 < p < 0.10$) it is suggestive of an excess of male deaths among Romano-British infants and does not explain the reverse sex imbalance of adults shown in the cemeteries.

Ancient DNA analysis as briefly reviewed here provides the necessary technology for expanding research into intriguing aspects of human history as they pertain to the attitude of society towards infants and children in life and death and the extent to which they were influenced by the sex of the child.

Perceptions of children vary considerably even in contemporary societies. In some children are incorporated into the work society as soon as they are able, frequently from the age of to 4 to 5 years. In others, they may be treated as a distinct group in terms of treatment accorded to them and demands made upon them throughout adolescence (Sophaer-Derevenski 1994). Irrespective of the attitude towards them as a group boys and girls are usually treated differently. These differences may begin at birth with the practice of infanticide or sacrifice focusing on one or the other sex as previously described. It is frequently seen in maternal care expressed in earlier weaning of female children while boys enjoy preferential access to foods and other resources (Johansson 1984). Even when children are not actively incorporated into the work force girls are expected to help with household tasks (Beaumont 1994).

Growth and disease in infants and children

In past populations infectious diseases as well as malnutrition resulted in high mortality of infants and children. Under marginal conditions preferential treatment of male infants would have undoubtedly affected the most disadvantaged. For example Scott and Duncan (1998) showed that infant mortality in England correlated with food shortages evidenced by fluctuations in wheat prices. Under such circumstances gender differences in childcare and division of food may affect survival or in less severe cases result in stunted growth. If severe this may be evaluated by comparing dental and skeletal age, since tooth development is more buffered against environmental insults than skeletal development expressed by long bone length or shape (Gowland and Chamberlain 2002; Liversidge *et al.* 1998). Moreover, the tooth enamel first formed after birth, differs from that formed in utero and can be identified on cross sections of

the tooth by their relation to the neonatal line. This enables us to accurately measure postnatal survival independently of birth weight or size (Smith and Avishai, 2005). Standards of tooth development in samples of known age can then be calibrated for use in archaeological material from measurements of ground sections of teeth where the neonatal line is present (Skinner and Dupras 1993).

Investigation of human remains based on morphological, morphometric and roentgenologic findings allows reconstruction of nutritional status and general health from birth to death (e.g. Katzenberg and Saunders 2000). More specific studies on the differential diagnosis of disease affecting the skeleton include histological techniques (Schultz 2001) and ancient DNA analyses (Filon *et al.* 1995; Faerman *et al.* 2000). Two examples have been chosen to illustrate the application of this comprehensive approach for reconstructing the life history of infants and children from settlements based on subsistence farming. The first describes skeletal remains recovered from the Chalcolithic village of Shiqmim, dating to an early phase of this adaptation some 6000 years ago. The second example is derived from the cemetery associated with the Ottoman cemetery at Dor that dates back some 300 years (Figure 2).

Early subsistence farmers at Chalcolithic Shiqmim

The Chalcolithic period in the southern Levant is characterized by complex rituals associated with treatment of the dead that included defleshing and collection of bones of older children and adults into ossuaries of various types at some sites, primary and secondary burial in stone cairns or tumuli in large cemeteries at others and primary le intramural burials as well as infant burials under pot shards or in jars at yet other sites. At Shiqmim, the proximity of the Chalcolithic village to the adjacent cemetery complex of Metzud Aluf presupposes a connection between the two and provides a unique opportunity to explore some of the biological constraints affecting burial type and location.

The human remains found in the Chalcolithic village at Shiqmim were recovered from fill, trash pits, tunnels and single and multiple graves dug into the floor of semi-subterranean rooms that served for older children and adults (Levy *et al.* 1993; Dawson, Levy and Smith, 2003) and were primarily those of infants and children. Those recovered from the cemetery were in contrast primarily adult secondary burials buried in well-constructed stone built circular tumuli (Levy and Alon, 1982).

Age of death. Of the 65 individuals recovered from the Shiqmim village nearly a fifth were infants aged from birth to 12 months (Table 2) (Faerman *et al.* in press). In contrast to infant burials from other Chalcolithic villages such as Abu Matar, Gilat, Grar, Tel Teo and Ghassul, the infants found at Shiqmim were not buried in pots or covered by shards (Kahila Bar-Gal and Smith 2001; Smith *et al.* 2006).

For the skeletal remains recovered from the village, post-cranial remains were more frequent than cranial or dental remains and most of the crania that were recovered were those of infants or young children. This is the opposite of that expected from non-anthropogenic post-depositional processes, where the thicker denser bones of

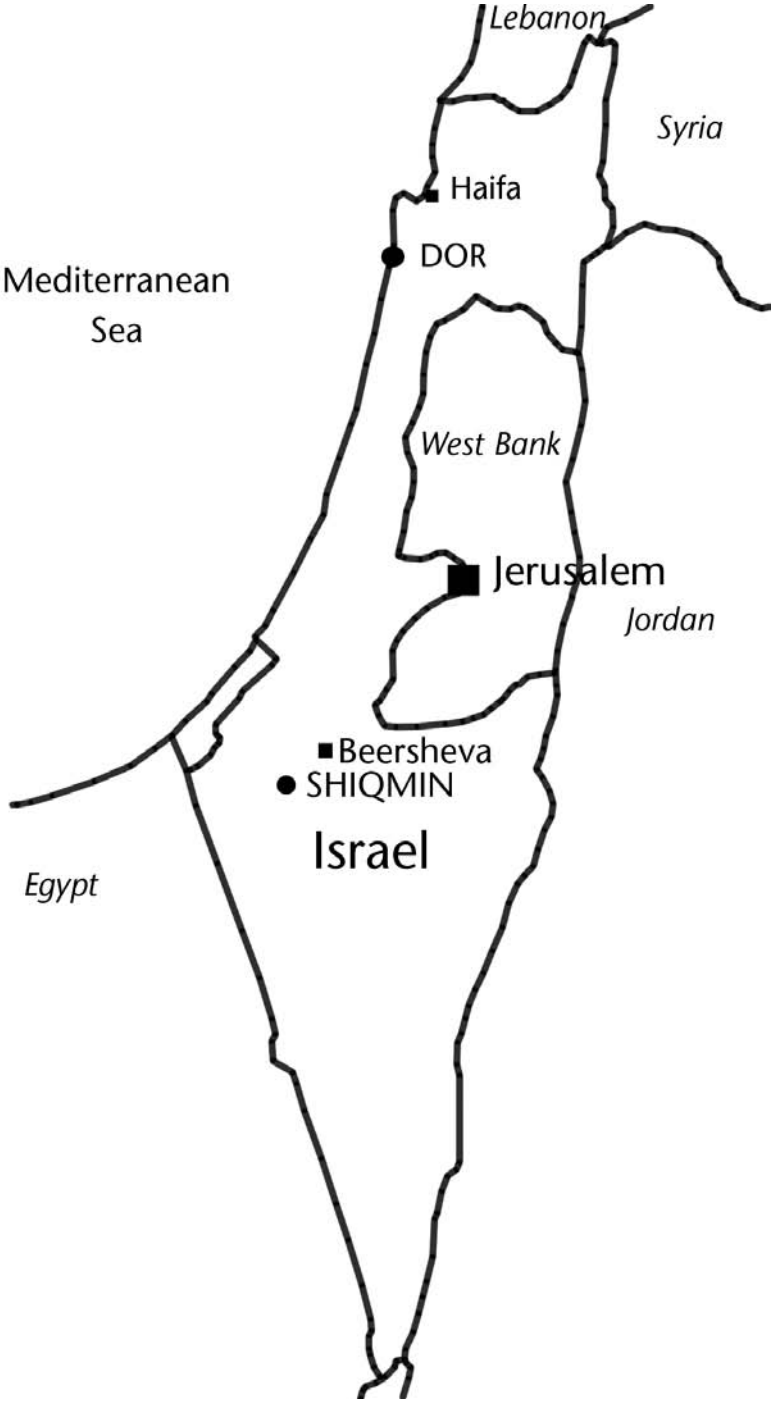


Figure 2.- A map showing the geographic location of the archaeological sites at Shiqmim and Dor.

Age group	Burial	Pit	Wall	Niche	Floor	Fill	Sub-room & sub-tunnel	Tunnel	Total
Infants:									
0-6 months	5*	1	2	1*	2	1	1	-	13
7-12	1	-	-	-	-	-	-	-	1
13-18	2	-	-	-	-	1	-	-	3
19-24	2	-	-	-	-	-	-	-	2
Unknown	-	-	-	-	-	1	-	1	2
Subtotal infants	10	1	2	1	2	3	1	1	21*
Children	5	1	-	-	-	4	1	-	11
Juveniles	3	1	-	-	-	1	1	-	6
Adoles-cents	5	1	-	-	-	-	3	-	9
Subtotal subadults	23	4	2	1	2	8	6	1	47*
Adults	20								20
TOTAL	*67**								*67**

Table 2.- Age distribution of infants and children in the Shiqmim village in relation to burial type (for Faerman *et. al.,* in press)
Note: * Including 2 infants that were reported from the field.

adults are preferentially preserved. Moreover, it cannot be entirely attributed to any special care in the burial of infants. In the cemetery of Mezud Aluf, where bone preservation was poorer than in the village, the ratio of cranial to post-cranial remains was similar to that found by Agelarakis *et al.* (1998) in ossuaries from Ma'avarot cave as is usual where secondary burial is practiced.

The absence of a standard burial practice for those interred in the village contrasts to the significant effort expressed in burial in the cemetery complex. If the two sites were in use at the same time it may be assumed that those buried in the village were considered less important than those buried in the cemetery. Since children and adults

of both sexes (but not infants) were found in both locations this would indicate a hierarchal society, with inherited status.

This pattern of the age distribution resembles that found at other Chalcolithic village sites with primary burials such as Gilat that are characterized by a high frequency of infants (Smith *et al.* 2006). At Mezad Aluf cemetery where secondary burial was the norm the age distribution was very different with no infants, fewer young adults and more of older individuals. The number of individuals examined is too small to assess the statistical significance of these differences, but the same dichotomy in age distribution seen between the village and cemetery is apparent in the age distribution observed in intramural versus cemetery burials at other Chalcolithic sites. This suggests that infants were not considered important enough for full burial rites (Zagerson and Smith 2002; Nagar and Eshed 2001).

Health status. Porotic pitting of the orbital roof (*cribra orbitalia*) was observed in two infants (aged 1.5 and 2 years, respectively) out of 6 subadults for whom frontal bone was present and in one adolescent and four adult individuals. In addition the same younger infant showed significant thickening of the frontal bone (~6 mm). This condition traditionally attributed to anaemia (Angel, 1966) could have resulted from a variety of causes including genetic beta-thalassemia (Filon *et al.* 1995) environmental iron-deficiency anaemia (Stuart-Macadam and Kent 1992) malnutrition (e.g., starvation, rickets, scurvy) (Ortner and Ericksen 1997; Ortner and Mays 1998) or infectious diseases. No signs of periostitis were observed in the long bones.

Dental findings from the village showed that most juvenile, adolescent and adult individuals had at least one hypoplastic tooth (Lev-Tov Chattah and Smith, in press). Hypoplasia is a sensitive and non-specific indicator of stress involving poor nutrition and/or disease during infancy and childhood. The findings therefore suggest that most individuals had suffered from and survived at least one episode of physiological stress during infancy and childhood.

Infants and children in the Ottoman period

Dor was an important port between the Middle Bronze Age and Roman periods. It is located on the Eastern Mediterranean coast of northern Israel (Figure 2). Its location was a strategic point along various trade routes, and so merchants from the East and West travelled to Dor for business. After the Arab conquest in the 7th century AD, the site was abandoned. Subsequently, a small subsistent farming settlement that also practiced herding and fishing developed in Dor and continued throughout the Ottoman Period. The skeletal remains studied in this project date between the 16th and 19th centuries of the Ottoman Empire.

During the Ottoman period, small settlements of poor socio-economic status were scattered throughout the coastal Mediterranean plain of Israel due to large swampy areas in the region. Many epidemics plagued the area, including the countrywide 1865 cholera outbreak during which the city of Jaffa had 1500-2000 deaths (Smith and Horwitz, in press). By the end of the 19th century, the area experienced an improved economy, as well as population growth, from approximately 500 inhabitants in 1823 to 1500 by the end of the nineteenth century. This population increase was

only one component of a countrywide change resulting from economic and political reforms as well as improved trade with Europe.

Skeletal remains of a total population of 172 individuals were excavated at the site of Dor (Smith and Horwitz, in press). The skeletal remains were recovered from individual cist tombs, double burials usually containing an adult and a child, and dump burials that contained skeletal fragments of several individuals and represent reburial of remains from accidentally disturbed graves that were re-buried in a collective pit.

Age of death. The age distribution at Dor is characterized by high infant mortality with relatively few individuals surviving to old age (Smith and Horwitz in press) and resembles that found in present-day developing countries. Subadult deaths (0-17 years) accounted for more than a half of the total deaths at the site. The mortality during the first 2 years was more than twice higher than that in the four subsequent years of life, followed by almost the same level of about 10-11% in juveniles and adolescents (Table 3). Comparison with the findings from the Ottoman period Bedouin Tell el-Hesi population which is characterized by a very similar high subadult mortality (nearly 64%; Eakins 1993) reveals some differences in the age distribution of deaths. Infant mortality in Dor is one and a half times lower than that in Tell el-Heist and almost three times lower for the category of children. The reverse picture is observed both in the juvenile and adolescent groups. While the Dor population maintains the same level of mortality from early childhood through adolescence, a marked decrease in mortality is observed in the juvenile and adolescent groups in Tell el-Hesi.

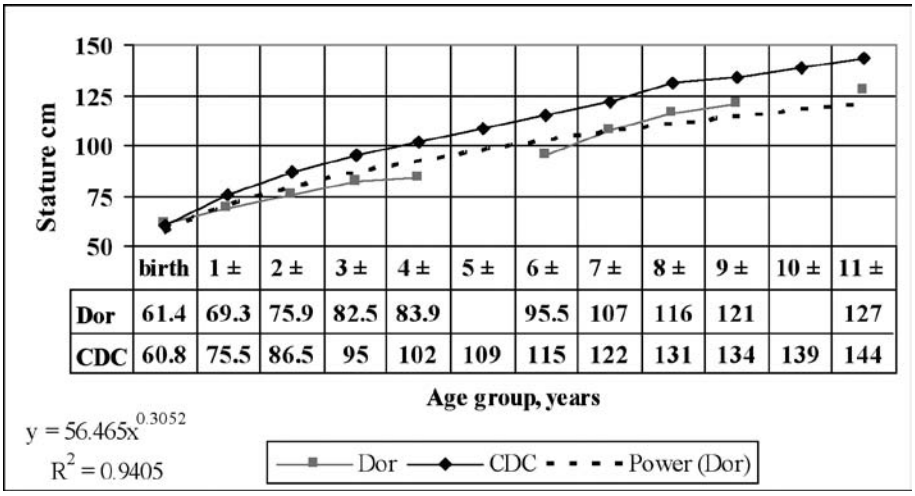
Age category	**Dor (Smith and Horwitz in press)**		**Tell el-Hesi, field VI/IX (Eakins 1993)**	
	Number of individuals	**Percentage of individuals**	**Number of individuals**	**Percentage of individuals**
Infants	30*	21.58	83**	30.63
Children	14	10.07	77	28.41
Juveniles	16	11.51	10	3.69
Adolescents	14	10.07	3	1.11
Subtotal subadults	71	53.23	173	63.84
Adults	65	46.76	97	35.79
TOTAL	139***	100	271***	100

Table 3.- Age distribution at Dor compared to that of Tell el-Hesi.
Note:
* - Number of infants aged 0-24 months;
** - Number of infants aged 0-18 months;
*** - Only those individuals for whom age estimation was possible are included.

Health status. Stature in children from Dor calculated from diaphyseal length of tibias and femurs in relation to dental age was compared to that of a modern American sample of known age (Figure 3). Children from Dor were found to be consistently shorter than the American group but were well within the expected values derived from adult stature at Dor. The stature differences may be partly genetic but growth stunting through poor nutrition and health must also have played a role, given the frequent episodes of stress shown by growth arrest lines on the bones and hypoplastic defects of the teeth. The dental age for height scattergram indicates a falloff in growth at 18 months of age that probably corresponded with the average age of weaning. When malnutrition occurs, it inevitably increases the incidence of all kinds of diseases. Food supplies were either not enough to meet growth requirements or alternately absorption was impaired because of infections.

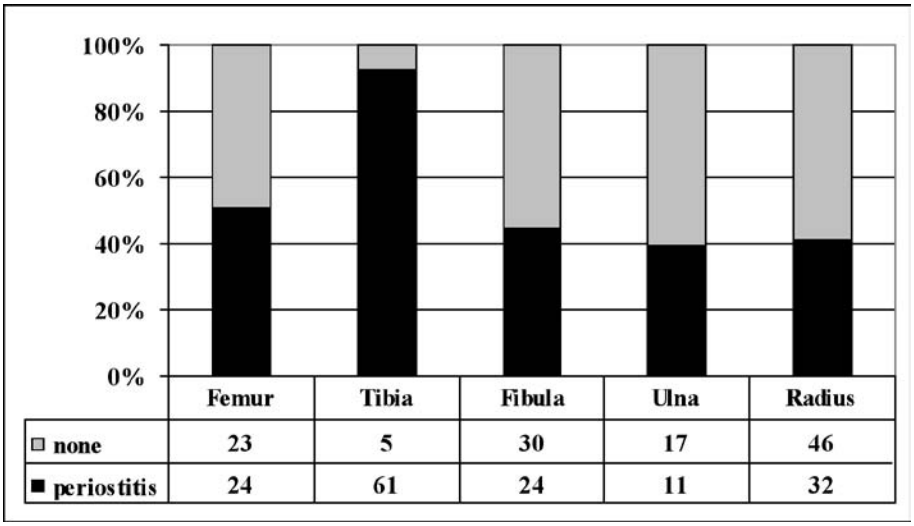
The subadult human remains exhibited high frequencies of skeletal pathologies. The pathological lesions identified at Dor fall into two categories. The first are developmental defects that result from acute infection or malnutrition during infancy and childhood and present in the teeth as hypoplastic defects of enamel. The second category includes signs of infectious diseases, trauma, tumours, degenerative diseases and nutritional disorders identified in the bones that may have occurred at any time throughout life. They provide an indication of the type and severity of environmental stress experienced by the inhabitants of Dor during their lifetime.

In a subset of 61 individuals aged from birth to 11 years nearly 70% showed signs of periostitis in at least one of the long bones with the tibia, the most commonly affected bone (over 90%), followed by the femur (51%) and then by the rest of the bones (~45% each) (Figure 4, Smith, Giv'ol, Sasson, Faerman, unpublished data). The lesions were most severe in the tibia and femur. The highest frequency of periostitis was observed in infants aged up to 18 months of life (Figure 5). This fact coincides in time with the falloff in growth of infants.



	birth	1 ±	2 ±	3 ±	4 ±	5 ±	6 ±	7 ±	8 ±	9 ±	10 ±	11 ±
Dor	61.4	69.3	75.9	82.5	83.9		95.5	107	116	121		127
CDC	60.8	75.5	86.5	95	102	109	115	122	131	134	139	144

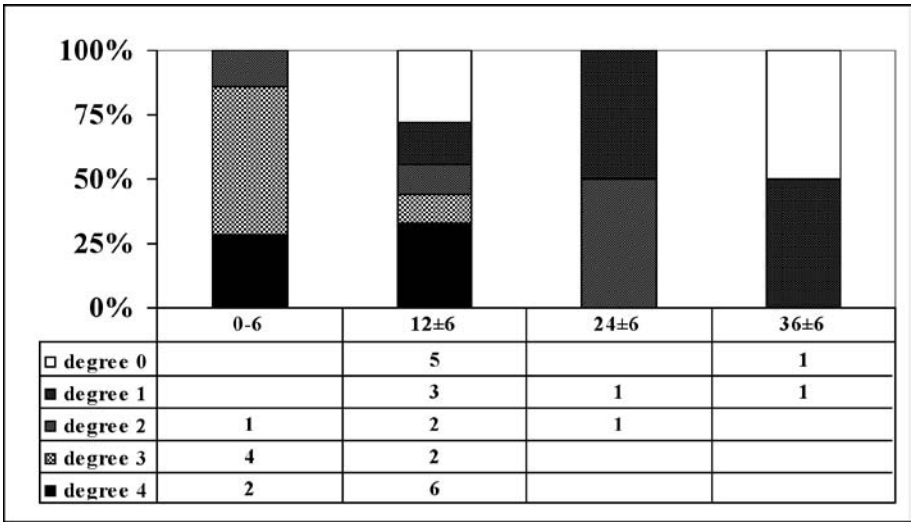
Figure 3.- Stature in Dor juveniles calculated from tibial (0-5 years) and femoral (6-11 years) in comparison to CDC data (http://www.cdc.gov/growthcharts).



	Femur	Tibia	Fibula	Ulna	Radius
none	23	5	30	17	46
periostitis	24	61	24	11	32

Figure 4.- Prevalence of periostitis in relation to bone type in a subset of juveniles aged 0-11 years (N=61). Humerus has been excluded due to a small sample size.

Nearly 25% of children aged less than 6 years exhibited at least one lesion in the skull with *cribra orbitalia* and irregular new bone formation on the external cranial surface being most frequent. A high prevalence of enamel hypoplasia both in the primary and secondary dentition together with a high frequency of growth arrest lines in the long bones of both subadults and adults provides additional evidence of chronic ill health throughout infancy and childhood at Dor.



	0-6	12±6	24±6	36±6
degree 0		5		1
degree 1		3	1	1
degree 2	1	2	1	
degree 3	4	2		
degree 4	2	6		

Figure 5.- Degree of severity of periostitis in tibiae of infants and young children aged 0-36 months from Dor (N=29). 0 – none, 1 – slight pitting, 2 – slight pitting and striations, 3 – pitting, striations and thin patches of new bone formation, 4 – areas of elevated new bone formation (modified from Ribot and Roberts 1996).

Altogether, the findings indicate that the population of Dor suffered from several stress events in early infancy and childhood that resulted in delayed growth and ill-health. These dying as infants or young children also showed a high prevalence of different pathologies implying that they were ill for some time before their death.

Similarities that have been observed between the two populations separated by almost six thousand years (Shiqmim and Dor) might indicate similar stress events that have been experienced by both populations. Growth stunting and a high prevalence of pathology observed here suggest malnutrition and infections as major factors in both periods.

Concluding remarks

Life history of past populations is recorded in the skeleton and this information can be retrieved using traditional anthropological methodology (bone and teeth morphology and morphometric) accompanied with that of histology, roentgenology, ancient DNA and etc. A biocultural approach which brings the anthropological findings together with the archaeological context allows reconstruction of the impact of social structure and culture on nutritional status and general health from birth to death and thus provides insights into the life history of past communities.

Analysis of age at death in relation to burial customs and archaeological period has revealed differences in age distribution of subadults and especially infants found in archaeological context. Small sample size, uncertainty as to the number of generations represented together with poor bone preservation and completeness of skeletons limit the value of such studies for palaeodemography. However as shown by Table 1, these differences are associated with burial practices expressed in primary versus secondary burial and intramural burial of infants. They thus provide an important source of information on the attitude of past societies to infants and children.

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