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# Human Skeletal Remains from a Burial Cave near Ḥorbat Zelef: A Paleodemographic Study

Yossi Nagar

Skeletal remains in a very poor state of preservation were unearthed in a cave opposite Ḥorbat Zelef (see Covello-Paran, this volume). The bone fragments, dated to Early Bronze Ages I and III, the Intermediate Bronze Age and Late Bronze Ages I and II, were of limited informative value; sex estimation and description of pathologies could not be carried out. Exact dating of the majority of the skeletal remains from Ḥ. Zelef was not possible. In the present study, only teeth from loci dated to LB I and II (Loci 101, 102 and selected baskets) are described. Fortunately, the tooth sample was large enough to reconstruct basic demographic parameters of the Ḥ. Zelef population in the Late Bronze Age. The estimation of age was based upon tooth attrition stages, following Nagar and Winocur (in prep.).

Table 1 presents the count of the six tooth types most abundant in the sample. The data shows that the teeth from the Late Bronze burial phases at Ḥ. Zelef represent at least 27 individuals of all age groups.

*Skeletal Age Distribution*

All the teeth in Table 1 were sorted into 10-year age groups, according to their attrition stages. The conclusive age distribution of the population was obtained by averaging the results from the various teeth.

Two methodological problems might affect the reliability of the demographic analysis: first, the results are from samples of uneven size; second, the small number of children's teeth and infant tooth buds at Ḥ. Zelef is demographically impossible (Smith 1993). The first problem was solved by adjusting the results from each tooth sub-sample to a theoretical population of 100 individuals, before combining it with the other sub-samples. The second problem probably

**Table 1. Assessing the Minimum Number of Individuals in the Ḥ. Zelef Late Bronze Age Population**

| Tooth Type | Age Group (years) | Criteria[i] | Right | Left |
|---|---|---|---|---|
| Central upper incisors (teeth 11, 21) | < 10 | Deciduous incisors (for ages <7y), permanent teeth (for ages 7–10y) | 4 | 5 |
| | > 10 | Permanent teeth, root closed | 17 | 26 |
| | *Total* | | *21* | *31* |
| Upper first molars (teeth 16, 26) | < 10 | Deciduous second upper molars | 3 | 8 |
| | > 10 | Permanent teeth; minimum age determined by root development and crown attrition stages | 20 | 12 |
| | *Total* | | *23* | *20* |
| Lower first molars (teeth 36, 46) | < 10 | Deciduous second lower molars | 6 | 4 |
| | > 10 | Permanent teeth; minimum age determined by root development and crown attrition stages | 21 | 22 |
| | *Total* | | *27* | *26* |

[i] Age estimation by tooth eruption and development stages, following Hillson 1993:176–201.

resulted from the poor state of preservation of the anthropological findings at the site (Walker and Johnson 1988). Moreover, elderly individuals might also be underrepresented due to extensive tooth loss in the older age groups and the general trend of under-aging inherent in this aging method (Nagar and Hershkovitz 2004; Walker and Johnson 1988). This is especially the case when age distribution is based mainly on first molars. This problem was addressed by artificially increasing the number of individuals in the >60-year age category by 10%, and by standardizing the <10-year age category as 40% (following Coale and Demeny 1966: model West 5). This standardization allows comparison of samples calculated in the same way, while life expectancy at the age of 10 years is the more reliable unit of comparison. The revised data were used to reconstruct a life-table (Table 2), using formulae published by Ubelaker (1974).

According to Table 2, life expectancy at Ḥ. Zelef was generally low, about 25 years at birth, 27 years at the age of 10. This value is similar to that reported for the ‘En Esur (Early Bronze Age; Nagar and Winocur, in prep.) and Rishon Le-Ẓiyyon (Middle Bronze Age; Nagar, internal IAA Report 1998) populations. The death curve derived from the Ḥ. Zelef data (Fig. 1) strikingly resembles that of the ‘En Esur population (Nagar and Winocur, in prep.).

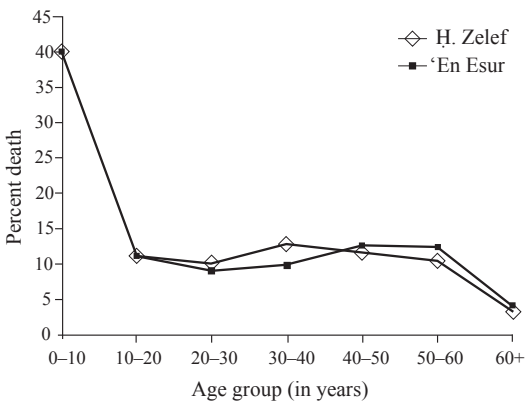


Fig. 1. Death curve of the Ḥ. Zelef Late Bronze Age population.

## CONCLUSIONS

Despite the very poor state of preservation of the skeletal remains from Ḥ. Zelef, palaeodemographic analysis was made possible by sorting the teeth collected from this site according to their attrition stages. The results show a minimum of 27 individuals buried in the tomb during the Late Bronze Age. The population’s life expectancy at birth was 25 years. The striking resemblance of the life expectancy and the shape of the death curve of three different Bronze Age populations: Ḥ. Zelef, ‘En Esur and Rishon Le-Ẓiyyon, might indicate a population ‘death pattern’ characteristic of this period.

**Table 2. Life Expectancy Table of the Ḥ. Zelef Late Bronze Age Population**

| Age Interval | No. of Deaths | Percent Deaths | Survivors Entering | Probability of Death | Total Years Lived between X and X+5 | Total Years Lived after Lifetime | Life Expectancy |
|---|---|---|---|---|---|---|---|
| (X) | (Dx) | (dx) | (lx) | (qx) | (Lx) | (Tx) | (e0x) |
| 0–10 | 41 | 39.5 | 100.0 | 0.4 | 802.3 | 2433.6 | 24.3 |
| 10–20 | 11 | 11.1 | 60.5 | 0.2 | 549.2 | 1631.4 | 27.0 |
| 20–30 | 11 | 10.2 | 49.4 | 0.2 | 443.0 | 1082.2 | 21.9 |
| 30–40 | 13 | 12.9 | 39.2 | 0.3 | 327.7 | 639.2 | 16.3 |
| 40–50 | 12 | 12.0 | 26.3 | 0.5 | 203.1 | 311.5 | 11.8 |
| 50–60 | 11 | 10.6 | 14.3 | 0.7 | 90.0 | 108.4 | 7.6 |
| > 60 | 4 | 3.7 | 3.7 | 1.0 | 18.5 | 18.5 | 5.0 |
| *Total* | 103 | | | | 2434.0 | | |

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