Epipaleolithic Human Appendicular Remains from Ein Gev I, Israel
Supporting Information

Les Restes des Membres du Squelette Humain du Epipaléolithique d'Ein Gev I, Israël
Donnés Supplémentaires

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Table S1. Osteometric dimensions of the Ein Gev 1 humeri, in mm.

	M-#[1]	*Right*	*Left*
Maximum length [2]	1	(314.5)	--
Articular length[3]	2	(314.0)	--
Mid-shaft maximum diameter[4]	5	21.0	20.0
Mid-shaft minimum diameter[4]	6	19.0	18.0
Mid-shaft antero-posterior diameter		20.4	19.6
Mid-shaft medio-lateral diameter		19.5	17.7
Distal minimum circumference[4]	7	58.0	--
Pectoralis major breadth[5]		5.2	--
Deltoid tuberosity breadth[5]		6.0	--
Distal epicondylar breadth	4	57.5	--
Distal articular breadth	12a	40.5	--
Olecranon breadth	14	25.2	24.5
Medial pillar thickness		9.0	8.8
Lateral pillar thickness		14.8	(16.0)

[1] M-# refers to the measurement definition in the Martin system (Bräuer, 1988).

[2] Maximum length estimated from the distance between the distal trochlea and the distal lesser tubercle (LTMaxLen; Ein Gev 1: 272.0 mm), using a least squares regression from a recent human sample: MaxLen = (1.147 x LTMaxLen) + 2.51, $r^2 = 0.955$, n = 40; Ein Gev 1 = 314.5 ± 4.6 mm, SE = 1.46%. The recent human sample is a pooled 20th century cadaver and later prehistoric Missouri Native American sample.

[3] Articular length estimated from the distance between the distal capitulum and the distal lesser tubercle (Ein Gev 1: 271.0 mm), using a least squares regression from a recent human sample of humeri: ArtLen = (1.146 x LTArtLen) + 3.61, $r^2 = 0.953$, n = 40; Ein Gev 1 = 314.1 ± 4.6 mm, SE = 1.46%. Reference sample same as in note 2.

[4] Measurement from Arensburg (1977).

[5] Maximum breadths of the muscular insertion rugosities.

Table S2. Cross-sectional diaphyseal parameters of the Ein Gev 1 humeri.

	Right	***Left***
Mid-distal shaft (35%)		
Total area (mm^2): TA	278.2	236.9
Cortical area (mm^2): CA	223.3	206.5
Ant-post second moment of area (mm^4): I_x	6417	4895
Med-lat second moment of area (mm^4): I_y	5535	4043
Maximum second moment of area (mm^4): I_{max}	6538	5044
Minimum second moment of area (mm^4): I_{min}	5415	3894
Polar moment of area (mm^4): J / I_p	11953	8938
Mid-shaft (50%)		
Total area (mm^2): TA	299.9	269.1
Cortical area (mm^2): CA	226.2	202.8
Ant-post second moment of area (mm^4): I_x	7108	5593
Med-lat second moment of area (mm^4): I_y	6513	5351
Maximum second moment of area (mm^4): I_{max}	7691	5913
Minimum second moment of area (mm^4): I_{min}	5930	5031
Polar moment of area (mm^4): J / I_p	13621	10944
Mid-proximal shaft (65%)		
Total area (mm^2): TA	348.5	289.2
Cortical area (mm^2): CA	174.9	173.6
Ant-post second moment of area (mm^4): I_x	7802	6455
Med-lat second moment of area (mm^4): I_y	6576	4960
Maximum second moment of area (mm^4): I_{max}	8142	6513
Minimum second moment of area (mm^4): I_{min}	6236	4901
Polar moment of area (mm^4): J / I_p	14378	11414

Table S3. Osteometric dimensions of the Ein Gev 1 ulnae and right radius, in mm.

	M-#	*Right*	*Left*
Ulnae			
Maximum length	1	--	241.0
Total length	2(1)	--	238.0
Articular length	2	--	(211.0)
Biomechanical length[1]		--	223.0
Mid-shaft antero-posterior depth[2]		23.0	22.0
Mid-shaft medio-lateral breadth[2]		16.0	15.0
Dorsal curvature chord[3]		--	190.5
Dorsal curvature subtense[3]		-	5.0
Radius			
Maximum length[4]	1	(225.5)	--
Articular length[4]	2	(215.0)	--
Mid-shaft antero-posterior depth[2]		11.0	--
Mid-shaft medio-lateral breadth[2]		13.0	--
Distal minimum circumference[2]	3	40.0	--
Lateral curvature chord[5]		147.0	--
Lateral curvature subtense[5]		5.0	--

[1] Distance from the middle of the trochlear notch to the distal head.

[2] Measurement from Arensburg (1977).

[3] Dorsal chord from opposite the coronoid process to the dorsal concavity just proximal of the head, plus the maximum subtense from the chord to the dorsal diaphysis. The resultant index is M-4.

[4] Radial maximum and articular lengths estimated from the ulnar biomechanical length, using least squares regressions from a recent human sample of paired radii and ulnae: RadMaxLen = (0.999 x UlnBiomLen) + 2.25, r^2 = 0.941, n = 40, Ein Gev 1 = 225.0 ± 4.6 mm, SE = 2.04%; RadArtLen = (0.957 x UlnBiomLen) + 2.24, r^2 = 0.961, n = 40, Ein Gev 1 = 215.5 ± 3.5 mm, SE = 1.64%. Reference sample of paired radii and ulnae from the late prehistoric Pecos Pueblo Native American sample.

[5] Lateral chord from opposite the distal radial tuberosity to the lateral concavity just proximal of the distal epiphysis, plus the maximum subtense from the chord to the lateral diaphysis. The resultant index is M-6.

Table S4. Select Ein Gev 1 carpal and metacarpal osteometric dimensions.

Hamate Right		***Trapezium Left***	
Maximum height	21.8	Dorsal breadth	16.8
Metacarpal facet height	9.8	Maximum thickness	11.7
Metacarpal facet breadth	15.3	Minimum thickness	6.6
Hamulus length (prox-dist)	9.6	Metacarpal 1 facet breadth	14.2
Hamulus thickness (rad-uln)	4.8	Metacarpal 1 facet height	10.8
Hamulus palmar projection	9.8	Tubercle length	11.0
		Tubercle thickness	3.5
		Tubercle projection	1.5
Metacarpals			
Metacarpal 1 articular length	42.3	Metacarpal 4 articular length	52.8
Metacarpal 3 articular length[1]	(59.4)	Metacarpal 3 maximum length[1]	(60.2)

[1] The metacarpal 3 articular length is estimated from the metacarpal 1 and 4 articular lengths using a least squares multiple regressions from a recent human sample: MC3L = (0.247 x MC1L) + (0.895 x MC4L) + 1.66, r^2 = 0.903, n = 184; Ein Gev 1 = 59.4 ± 1.4 mm, SE = 2.29%. The maximum length is then estimated by adding the styloid process projection (0.8 mm) measured on the original bone onto the articular length. The recent human sample is a pooled 20th century cadaver and later prehistoric Missouri Native American sample.

Table S5. Osteometric dimensions of the Ein Gev left femur and right tibia.

	M-#	*Femur Left*	*Tibia Right*
Maximum length[1]	1	(416)	--
Bicondylar length[2]	2	(410)	
Biomechanical length[3]		(391)	
Proximal maximum diameter[4]		31.7	
Proximal minimum diameter[4]		23.6	
Proximal antero-posterior diameter	10	29.8	35.0
Proximal medio-lateral diameter	9	25.2	24.0
Mid-shaft antero-posterior diameter	6	30.0	27.5
Mid-shaft medio-lateral diameter	7	24.0	16.8
Anterior shaft curvature chord	27	298.0	
Anterior shaft curvature subtense		10.0	
Femoral head diameter[5]	19	(45.0)	
Lateral condyle antero-posterior depth	22	(60.0)	--

[1] The maximum length is estimated from the mid-lesser trochanter to the average of the distance to the distal condyles of the Ein Gev femur (EGLen: 344 mm) using a least squares regression based on a recent human sample: MaxLen = (1.17 x EGLen) + 13.8, r^2 = 0.952, n = 47; Ein Gev 1 = 415.8 ± 6.6 mm, SE = 1.58%. The recent human sample is a pooled 20th century cadaver and later prehistoric Missouri Native American sample.

[2] The bicondylar length is estimated from the mid-lesser trochanter to the average distance to the distal condyles of the Ein Gev femur (344 mm) using a least squares regression based on a recent human sample: BicLen = (1.16 x EGLen) + 10.1, r^2 = 0.953, n = 47; Ein Gev 1 = 409.7 ± 6.5 mm, SE = 1.58%. Recent human reference sample as in note 1.

[3] The distance from the proximal neck to the average distance to the distal condyles, parallel to the diaphyseal axis. It is estimated from the mid-lesser trochanter to the average distance to the distal condyles of the Ein Gev femur (344 mm) using a least squares regression based on a recent human sample: BiomLen = (1.07 x EGLen) + 21.82, r^2 = 0.970, n = 47; Ein Gev 1 = 390.9 ± 4.7 mm, SE = 1.22%. Note that the SE_{est} is less than for the maximum and bicondylar lengths, because this measurement does not incorporate variation in the neck-shaft angle. Recent human reference same as in note 1. An estimated tibial biomechanical length was previously employed (Trinkaus, 2018) to scale the Ein Gev 1 tibial midshaft geometric parameters; that length estimate is now considered to be insufficiently reliable and is therefore not included here.

[4] The maximum antero-medial to postero-lateral diameter, and the perpendicular to it, at the maximum development of the gluteal buttress.

[5] The femoral (antero-posterior) diameter is estimated from the acetabular height using a least squares regression based on a recent human sample: FemHdDia = (0.94 x AcetHt) -5.95, r^2 = 0.939, n = 89; Ein Gev 1 = 45.0 ± 1.3 mm, SE = 2.80%. Similar estimation of the femoral head diameter from the lateral condylar depth provides a slightly less precise and lower, but statistically identical, value: FemHdDia = (0.630 x LatCondDep) + 6.37, r^2 = 0.885, n = 39; Ein Gev 1 = 44.1 ± 1.5 mm, SE = 3.40%. The recent human references samples are paired femora and hip bones from the late prehistoric Pecos Pueblo Native Americans for the acetabulum to femoral head dimensions, and a pooled sample of 20th century Chinese and Euroamerican femora for the condyle to femoral head dimensions (see Shang and Trinkaus, 2010 for the latter)..

Table S6. Cross-sectional diaphyseal parameters of the Ein Gev 1 left femur and right tibia.

	Femur Left	***Tibia Right***
Distal shaft (20%)		
Total area (mm^2): TA	729.4	--
Cortical area (mm^2): CA	299.8	--
Ant-post second moment of area (mm^4): I_x	23763	--
Med-lat second moment of area (mm^4): I_y	32159	--
Maximum second moment of area (mm^4): I_{max}	32634	--
Minimum second moment of area (mm^4): I_{min}	23287	--
Polar moment of area (mm^4): J / I_p	55921	--
Mid-distal shaft (35%)		
Total area (mm^2): TA	568.0	--
Cortical area (mm^2): CA	343.1	--
Ant-post second moment of area (mm^4): I_x	24727	--
Med-lat second moment of area (mm^4): I_y	19667	--
Maximum second moment of area (mm^4): I_{max}	24977	--
Minimum second moment of area (mm^4): I_{min}	19417	--
Polar moment of area (mm^4): J / I_p	44394	--
Mid-shaft (50%)		
Total area (mm^2): TA	530.8	341.2
Cortical area (mm^2): CA	393.0	268.7
Ant-post second moment of area (mm^4): I_x	28342	14700
Med-lat second moment of area (mm^4): I_y	15851	6142
Maximum second moment of area (mm^4): I_{max}	28365	15730
Minimum second moment of area (mm^4): I_{min}	15828	5113
Polar moment of area (mm^4): J / I_p	44193	20843
Mid-proximal shaft (65%)		
Total area (mm^2): TA	496.4	--
Cortical area (mm^2): CA	423.5	--
Ant-post second moment of area (mm^4): I_x	22203	--
Med-lat second moment of area (mm^4): I_y	16621	--
Maximum second moment of area (mm^4): I_{max}	23508	--
Minimum second moment of area (mm^4): I_{min}	15315	--
Polar moment of area (mm^4): J / I_p	38823	--
Proximal shaft (80%)		
Total area (mm^2): TA	546.8	--
Cortical area (mm^2): CA	384.5	--
Ant-post second moment of area (mm4): I_x	19920	--
Med-lat second moment of area (mm4): I_y	26259	--
Maximum second moment of area (mm^4): I_{max}	30487	--
Minimum second moment of area (mm^4): I_{min}	15693	--
Polar moment of area (mm4): J / I_p	46180	--

Table S7. Osteometric dimensions of the Ein Gev 1 right talus and calcaneus, in millimeters and degrees.

	M-#	
Talus		
Articular breadth	32bb	43.5
Articular height	3b	23.0
Trochlear breadth	5	27.8
Lateral malleolar height		24.5
Lateral malleolar oblique height	7a	26.0
Head-neck length	8	19.5
Head breadth	10	(21.0)
Posterior calcaneal breadth	13	20.9
Neck angle	16	22°
Trochlear angle		4°
Calcaneus		
Medial breadth	2	39.4
Sustentacular breadth	6	9.2

Table S8. Discrete traits of the Ein Gev 1 right talus, calcaneus, navicular, and cuboid.

Talus	
Medial malleolar distal extension	present
Medial trochlear distal extension	absent
Lateral malleolar distal extension	present
Medial squatting facet	absent
Lateral squatting facet	present
Sulcus tali rounding	present
Sulcus tali facet	absent
Antero-medial calcaneal facet fusion	fully fused
Calcaneus	
Antero-medial talar facet fusion	fused – no notch
Navicular	
Navicular-cuboid facet	present
Cuboid	
Navicular-cuboid facet	present
Peroneal facet	present – prox edge

Table S9. Osteometric dimensions of the Ein Gev 1 cuboid and cunieform bones, in millimeters.

	Cuboid Right	***Med. Cun Right***	***Med. Cun. Left***	***Int. Cun. Left***	***Lat. Cun. Left***
Height	22.7				
Medial length (M-1)	25.5				
Lateral length (M-2)	14.1				
Dorsal length (M-1)		22.3	--	14.4	18.6
Middle length (M-2)		20.8	20.5	13.7	17.0
Metatarsal height (M-5)	15.7	25.4	--	--	--
Metatarsal breadth (M-3)	24.2	--	--	11.2	(12.6)

Table S10. Osteometric dimensions of the Ein Gev 1 left metatarsals, in millimeters.

	MT-1	***MT-2***	***MT-3***	***MT-4***	***MT-5***
Maximum length	57.2	70.9	--	--	--
Articular length	55.2	69.0	--	--	--
Mid-shaft height	11.9	9.3	9.3	9.0	9.3
Mid-shaft breadth	12.5	6.8	6.4	6.8	6.9
Prox max height	--	18.6	18.8	17.3	16.4p
Prox max breadth	--	14.5	13.3	12.4	21.4p
Prox artic height	--	(18.0)	18.7	15.7	--
Prox artic breadth	--	12.9	12.3	10.1	--
Distal height	20.4	15.3	--	--	--
Distal max breadth	21.8	10.8	--	--	--
Distal artic breadth	17.7	10.8	--	--	--
Horiz head angle[1]	9°				
Horiz base angle[2]		7°	--	21°	--

[1] The angle between the intersesamoid crest in plantar view and the diaphyseal axis, as a reflection of hallux valgus.

[2] The angle between the medio-lateral tangent to the tarsal facet and the diaphyseal axis, as a reflection of pedal arch formation.

Table S11. Osteometric dimensions of the Ein Gev 1 pedal phalanges, in millimeters.[1]

	Prox Phal 1	***Prox Phal 2***	***Mid Phal ?***
Maximum length	34.4	--	11.1
Articular length	(26.0)	--	9.2
Mid-shaft height	9.5	5.9	--
Mid-shaft breadth	12.7	6.0	--
Proximal maximum height	--	10.3	7.7
Proximal maximum breadth	--	11.4	9.5
Proximal articular height	--	9.0	6.5
Proximal articular breadth	--	9.9	9.2
Distal height	10.8	--	4.7
Distal breadth	(16.5)	--	8.4

[1] The proximal phalanx 1 is crushed onto the medial side of the left metatarsal 1 head, and therefore it is assumed to be left. The sides of the proximal phalanx 2 and the middle phalanx are unknown, but the lateral deviation of the middle phalanx head implies that it is left, and the proximal phalanx 2 may well be left by association.

Table S12. Comparative sample probability values[1] and Z-scores[2] for Ein Gev 1 relative to each of the comparatie samples.[3]

	Kruskal-Wallis p-value		***Z-score for Ein Gev 1 versus***			
	4 samples	***5 samples***	***EUP***	***LUP***	***NEA***	***NWA***
Humerus 50%						
Dominant J vs. BML	<0.001	<0.001	0.700	-0.995	-0.899	0.322
Non-dominant J vs. BML	<0.001	0.001	0.793	-0.419	-0.734	0.149
Dominant I_{max} vs. I_{min}	0.153	0.241	-1.655	-1.778	-1.102	-1.753
Non-dominant I_{max} vs. I_{min}	0.051	0.085	-0.384	-1.356	-0.342	-1.080
35% asymmetry	0.025	0.048	-0.416	-0.419	0.495	-0.278
50% asymmetry	0.019	0.009	-0.260	-0.758	0.233	-0.412
Femur						
Bicondylar length	<0.001	<0.001	-1.626	-1.011	-2.323	-2.710
Head diameter	<0.001	<0.001	-0.818	-0.607	0.563	-0.334
Head diameter vs. length	<0.001	<0.001	1.429	0.261	2.661	0.761
50% J vs. BML	<0.001	<0.001	0.516	-0.191	-0.851	0.686
50% I_x vs. I_y	0.078	0.121	1.314	2.280	1.664	1.772
80% I_{max} vs. I_{min}	<0.001	<0.001	-0.197	0.231	1.016	-0.265
Tibia						
50% I_{max} vs. I_{min}	<0.001	<0.001	1.293	1.026	2.162	0.730

Tabe S12 (cont.):

[1] Given the small sizes and frequently non-normal distributions of the comparative samples, the p-values are from Kruskal-Wallis non-parametric tests. The bivariate comparisons are based on the distributions of the individual deviations from the reduced major axis lines through the pooled sample (not including the few southwest Asian specimens). The 5-sample comparisons include the small southwest Asian sample; the 4-sample comparisons do not.

[2] The Ein Gev 1 Z-scores are their deviations from each comparative sample's mean, divided by the sample's standard deviation. Note that they are approximate, given the variable normalities and sizes of the comparative samples' distributions.

[3] The comparative samples are European earlier Upper Paleolithic (EUP), European late Upper Paleolithic (LUP), northeast African Later Stone Age (NEA), and northwest African Later Stone Age (NWA), plus the southwest Asian Epipaleolithic.

Table S13. Southwest Asian Upper Paleolithic comparative cross-sectional geometric parameters. Right/left values are provided for the Ohalo 2 right and left femora and tibiae.

	Kharaneh 1[1]	***Mataha F-81***[2]	***Nahal Ein Gev 1***	***Neve David 1***	***Ohalo 2 (Rt/Lt)***[3]
Humerus Rt					
35% J/I_p	--	8881	3921	--	13216
50% I_{max}	5153	7510	3210	10449	9666
50% I_{min}	3565	4423	2207	6149	6214
50% J/I_p	8718	11933	5417	16598	15881
Humerus Lt					
35% J/I_p	--	6690	3310	--	8941
50% I_{max}	9116	5234	--	--	5925
50% I_{min}	5817	3114	--	--	3939
50% J/I_p	14933	8348	--	--	9864
Femur					
50% I_x	--	20148	18328	23848	47715/43365
50% I_y	--	16746	14981	20129	25000/24777
50% J/I_p	--	36894	33308	43977	72715/68142
80% I_{max}	--	25569	22960	43404	39119/39419
80% I_{min}	--	13089	12779	22965	23276/22572
Tibia					
50% I_{max}	--	26409	--	23393	34698/31768
50% I_{min}	--	8791	--	6237	11381/10717

Table S13 Cont.

[1] The Kharaneh 1 humeral midshaft second moments of area were estimated from the published (Rolston, 1982) maximum and minimim midshaft diameters (right: 19.0 and 16.0; left: 22.5 and 18.0) using least squares regressions based on a pooled Eurasian Late Pleistocene humeral sample providing both cross-sectional geometric parameters and diameters ($\ln(I_{max}) = 3.090 \times \ln(MaxDia) + 0.386 \times \ln(MinDia) - 1.62$, n = 80, $r^2 = 0.879$, and $\ln(J/I_p) = 2.590 \times \ln(MaxDia) + 0.836 \times \ln(MinDia) - 0870$, n = 83, $r^2 = 0.862$ respectively); $I_{min} = J - I_{max}$ (see Sparacello et al., 2016). The Late Pleistocene sample has consistent percent cortical areas, which often differ from Holocene ones, making these regression equations more appropriate for the Kharaneh 1 humeri..

[2] Mataha F-81 data from Stock et al. (2006) and Stock (pers. comm.).

[3] Trinkaus (2018).

Table S14. Upper Paleolithic / Later Stone Age sites from Europe and northern Africa providing comparative data; see Materials for southwest Asian comparative specimens.

Europe EUP	***Europe LUP***	***NE Africa***	***NW Africa***
Barma Grande	Arene Candide	Nazlet Khater	Afalou
Bausu da Ture	Arancio	Sahaba	Taforalt
Caviglione	Bichon	Wadi Halfa	
Cro-Magnon	Cap Blanc		
Dolní Věstonice	Chancelade		
Grotte des Enfants	Climente		
Mittlere Klause (Neuessing)	Continenza		
Mladeč	Grotte-des-Enfants		
Ostuni	Farincourt		
Paglicci	Les Forges (Bruniquel)		
Pataud	Lafaye (Bruniquel)		
Paviland	Laugerie Basse		
Pavlov	La Madeleine		
Předmostí	Oberkassel		
La Rochette	Peyrat		
Sunghir	Le Placard		
Veneri (Parabita)	Rochereil		
Willendorf	Romanelli		
	Romito		
	St. Germain-la-Rivière		
	San Teodoro		
	Tagliente		
	Villabruna		

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