

Table S1. Demographics and underlying health conditions of heat exhaustion cases during Hajj

Author	Definitions of HE	N*	Gender Male: female	Age (years)	Nationality/world region	Underlying health conditions
Abdelmoety et al.(1)	A case of mild-to-moderate HRI owing to the exposure to high environmental heat; the signs and symptoms included intense thirst, weakness, discomfort, anxiety, dizziness, and syncope; the temp could be normal or slightly elevated (>37°C but <40°C)	187	1.1:1	Mean: 52.5± 17.7	NR	Diabetes: 11 (5.9%) Hypertension: 8 (4.3%) CVD: 4 (2.2%)
Alkassas et al.(2)	A case of mild hyperthermia (core body temp: 37-40°C) along with dizziness, fatigability, headache, nausea, vomiting and/or shortness of breath	40	1.3:1	Mean: 49± 15	Arabs: 20 (50%) Asia: 14 (35%) Africa: 2 (5%) Other: 4 (10%)	Diabetes: 3 (7.5%) Hypertension: 6 (15%) Asthma: 2 (5%) Multiple UHC: 4 (10%)
Almuzaini et al.(3)	NR	48	1.1:1	Mean: 56.3± 14.1 (Range: 22-100) Age groups: <30: 2 (4.5%) 30-44: 8 (18.2%) 45-59: 11 (25%) ≥60: 23 (52.3%)	MENA: 30 (62.5%) South-East Asia: 12 (25%) Sub-Saharan Africa: 3 (6.3%) America: 1 (2.1%) Europe: 1 (2.1%) Western-Pacific: 1 (2.1%)	NR
Baomer et al.(4)	NR	6	NR	NR	Oman: 6 (100%) MENA: 6 (100%)	NR
Elbakry et al.(5)	A case with rise in temp (<40°C), hot and wet skin, confusion, agitation, fainting followed by collapse but not unconsciousness, general headache, anorexia, fatigue, hyperventilation.	155	2.8:1	Mean: 55.7 (Range: 18-83) Age groups: < 40: 28 (18.1%) 40-50: 11 (7.1%)	Saudi Arabia, Syria, Lebanon, Turkey, Yemen, Palestine: 48 (31%) Tunisia, Algeria, Morocco, Egypt, Sudan, Ethiopia, Nigeria, Erythrina, Somalia, Senegal: 56 (36%)	UHC: 33 (21.2%) CVD: 8 (5.2%) Diabetes: 5 (3.2%) URTI: 14 (9.0%) Malaria: 3 (1.9%)

	Tachycardia may or may not be accompanied with hypotension				50-60: 34 (21.9%) > 60: 82 (52.9%)	India, Pakistan, Uzbekistan, Afghanistan, Malaysia, Indonesia, Bangladesh, China, Russia: 51 (33%) Middle East: 48 (31%) Asian: 51 (33%) Africa: 56 (36%)	CNS disorders: 3 (1.9%)
Abudahish & Eibushra.(6)	NR	27	NR	NR		Turkey, North America, Europe, Australia: 1 (3.7%) Gulf countries: 1 (3.7%) Iran: 2 (7.4%) Other Arab countries: 12 (44.4%) MENA: 15 (55.6%) South-East Asia: 1 (3.7%) South Asia: 4 (14.8%) Sub-Saharan Africa: 2 (7.3%) Unknown: 4 (14.8%)	NR
Kashmeery.(7)	NR	14	All males	Mean: 47.5± 3.5 (Range: 25-70)		Algeria: 2 (14.3%) Bangladesh: 2 (14.3%) Egypt: 5 (35.7%) Morocco: 1 (7.1%) Pakistan: 4 (28.6%) MENA: 8 (57.1%) South Asia: 6 (42.9%)	Diabetes: 2 (14.3%) Obesity: 2 (14.3%)
Khan et al.(8)	A case with pale perspiring skin, along with suggestive features	35	2.2:1	Mean (males): 62.2± 7.43 Mean (females): 52.6± 9.3		Indian/South Asian decent: 35 (100%) South-Asia: 35 (100%)	NR
Khogali.(9)	A case with pyrexia accompanied by thirst, fatigue, giddiness and impaired judgment.	654	NR	NR		NR	Majority overweight
Mimish.(10)		28	6:1	Mean: 47± 15		NR	NR

(Range: 25-80)

*Number of heat exhaustion cases

†study reported SEM instead of SD

‡treated with cold intravenous infusion

Heat exhaustion (HE); Heat-related illness (HRI); Cardiovascular disease (CVD); Intravenous (IV); Central nervous system (CNS); Middle East and North Africa (MENA);

Underlying health condition (UHC); Upper respiratory tract infection (URTI); Not reported (NR).

Table S2. Signs and symptoms, and clinical and key laboratory findings among heat exhaustion patients during Hajj

Author	N*	Rectal Temp	Vital signs	Signs and symptoms	Clinical and laboratory findings
Abdelmoety et al.(1)	187	<40°C	SBP (mmHg): 123± 2.0 DBP (mmHg): 72± 13 RR (breaths/min): 30± 24 PR (beats/min): 98± 18	Hyperthermia: most patients Convulsion: 1 (0.5%) Diarrhea: 1 (0.5%) Dizziness: 40 (21.4%) Vomiting: 20 (10.7%) Headache: 14 (7.5%) Nausea: 6 (3.2%) Postural hypotension: 4 (2.1%) Altered mental status: 7 (4%) Tachycardia: 7 (4%) Tachypnea: 4 (2.1%) Hypotension: 3 (1.6%) Irritability: 12 (6.4%)	<i>All blood gas values were normal, except for decreased PaO₂ indicating hypoxemia. Hyponatremia, hypokalemia, high glucose, and high BUN concentration were the top abnormal results:</i> High glucose: 15 (8.5%) High creatinine: 9 (4.8%) Decreased PaO ₂ : 24 (19%) Hyponatremia: 18 (9.6%) High BUN: 15 (8.0%) Hypokalemia: 18 (9.6%) Low PLT: 8 (4.3%) Low Hb: 13 (7.0%) High WBC: 12 (6.4%) High CK: 8 (4.3%) High AST: 10 (5.3%) High LDH: 4 (2.1%) High ALT: 5 (2.7%)
Alkassas et al.(2)	40	Mean: 38± 0°C	PR: (beat/min): 99± 18	Mainly moist, hot red skin Dry skin: 10 (25%) Moist skin: 20 (50%) Red skin: 20 (50%) Pale skin: 2 (5%) Hot skin: 18 (45%) Cold skin: 3 (7.5%) Dizziness: 27 (67.5.7%) Fatigability: 33 (82.5%) Headaches: 20 (50%)	GCS: 15± 0 Blood glucose (mg/dl): 114± 47

				Shortness of breath: 15 (37.5%) Vomiting and nausea: 8 (20%) Heat muscle cramps: 2 (5%) Chest pain: 9 (22.5%)	
Elbakry et al.(5)	155	Mean: 39°C Range: 38-40°C	RR (breath/min): Mean 28 (Range: 18-50) PR (beats/min): Mean 96 (Range: 62-167)	Hyperventilation: 155 (100%) Unconscious or semi-comatose, confused, or agitate: 18 (11.6%) No CNS clinical manifestations: 137 (88.4%)	Tachycardia: most patients Hypoxia: 134 (86.5%) Mild hypoxia (O ₂ saturation 91-94%): 81 (52.3%), Moderate to severe hypoxia (O ₂ saturation < 90%): 53 (34.2%)
Kashmeery.(7) †	27	NR	NR	NR	<i>Sodium, potassium, chloride, and blood osmolality, and GH within normal range. Significantly reduced aldosterone. Highly elevated vasopressin and, renin and elevated cortisol:</i> Sodium (mmol/L): 140± 4.3 Potassium (mmol/L): 3.7± 0.1 Chloride (mmol/L): 94.6± 0.8 Plasma osmolality (mmol/kg): 269.6± 2.7 Haematocrit: 43.2± 1.3 Renin (ng/mL/h): 396.7± 88.6 Cortisol (µg/dL): 42.9± 4.3 Vasopressin (pg/mL): 42.5± 18.8 PTH (pmol/L): 143.3± 47.6 ACTH: NDL GH (ng/mL): 4.42± 0.8 Aldosterone (pg/mL): 187.9± 21.4
	14	SPs: Mean: 40.5± 1.7°C NSPs: Mean: 39.8± 0.2°C	SBP(mmHg): 120.1± 5.8 DBP (mmHg): 68.1± 4.4 RR (breaths/min): 25.8± 3.7 PR (beats/min): 79± 5	Hyperventilation: 14 (100%) Semi-conscious: 2 (14.3%) Skin temp: SPs: 38.2± 0.2 NSPs: 38.0± 0.3 Oral temp:	<i>Hyperventilation, low DBP, elevated pulse, above normal range of venous blood O₂ partial pressure and saturation percent:</i> O ₂ saturation (%): 82.4± 3.6 PaO ₂ (mmHg): 67± 8.5

					<i>SPs: 39.0±0.2</i>	
					<i>NSPs: 38.6±0.2</i>	
Mimish.(10)	28	Mean: 1.0°C	38.7±	BP (mmHg): 102± 18 HR (beats/min): 97± 16 (Range: 64-170)	Fatigue, lethargy and drowsiness	<i>Volume depletion evidenced by low JVP, postural drop in BP and increase in PR. Shorter QT intervals and frequent ECG abnormalities but no Ischemic changes: ECG abnormalities: 21 (75%) PR interval (ms): 152± 22 QT interval (ms): 326± 30, Pathological Q-waves: 2 (7.1%) Conduction abnormalities: 6 (21.4%) Nonspecific ST-T changes: 5 (17.8%) Ischemic changes: 0 (0%)</i>

¥ treated with cold intravenous infusion

†Study reported SEM instead of SD

Shivering patient (SP); Non-shivering patient (NSP); No detectable levels (NDL); Blood pressure (BP); Systolic blood pressure (SBP); Diastolic blood pressure (DBP); Arterial pressure (AP); Respiratory rate (RR); Pulse rate (PR); Parathyroid hormone (PTH); Adrenocorticotrophic hormone (ACTH); Growth hormone (GH); Electrocardiogram (ECG); Partial pressure of oxygen (PaO₂); Jugular venous pressure (JVP); Blood urea nitrogen (BUN); Platelets (PLT); Aspartate aminotransferase (AST); Lactate dehydrogenase (LDH); White blood cell count (WBC); Alanine aminotransferase (ALT); Creatine kinase (CK); Hemoglobin (Hb); Central nervous system (CNS); Not reported (NR).

Table S3. Management and outcome of heat exhaustion patients during Hajj

Author	N*	Management	Cooling threshold	Cooling time	Outcome
Abdelmoety et al.(1)	187	Most patients managed with the use of a fan, water spray, and ice packs to reduce the body temp. Measures to ensure airway patency and intubation were provided to 9 (4.8%) patients. Rehydration by IV line, cardiac monitor, and Foley catheter were provided to 20 (10.7%) patients.	NR	NR	Died: 0 (0%) Discharged: 162 (94.7%) Admitted to ICU: 2 (1.2%) Discharged against medical advice: 7 (4.1%)
Almuzaini et al.(3)	48	Patients were moved to a cooler place and placed in a supine position with elevated legs and hips, clothes were lightened up and oral hydration started. For nauseated patients, IV fluid was given.	NR	NR	NR
Elbakry et al.(5)	155	After admission to the cooling unit, thorough examination, investigation, monitoring and charting were carried out. O ₂ saturation was determined in all patients before the start of management. Continuous O ₂ saturation measurement in patient suffering from moderate or severe hypoxia. The tissue O ₂ saturation readings were recorded along with other vital signs (PR, BP, RR and oral temp). If the tissue O ₂ saturation was < 95%, O ₂ was administered at a rate of 4-6 L/min using a facemask with or without a reservoir bag. O ₂ therapy was discontinued once the O ₂ saturation (as tested on room air) returned to the normal value for the age. If cooling was applied, once oral temp reached 38°C, it was stopped.	Oral temp: 38°C	NR	11 (7.1%) patients admitted to the medical ward for further investigation, treatment, and follow-up due to CNS symptoms, cardiovascular or endocrine disorders.
Kashmeery.(7) †	NR	Patients were cooled on a canvas bed through vigorous fanning in air-conditioned wards while covered with cool water soaked muslin sheets. IV infusion line was set up using normal saline or 5% dextrose in normal saline. Criteria for recovery were restoration of normal vital signs, clearance of giddiness and fatigue and reduction of rectal temp to 38°C.	Rectal temp: 38°C	NR	NR
	14 [‡]	Patients treated with the same above protocol but: 1. IV fluid given was 12°C cold normal saline at a rate of ≈ 8 mL/kg BW/h (180 drops/70 kg BW/min) and 2. rectal temp was not taken as a criterion for recovery, rather, clearance of giddiness, cramps,	NR	Reduce temp by 1°C (min): Rectal: 41.4± 7	Died: 0 (0%) Recovered: 14 (100%)

		fatigue and nausea in addition to ameliorated oral temp were focused on when evaluating recovery.		Oral: 39.8± 7.4 Skin: 78.2± 18.8	
Khogali.(9)	654	After diagnosis, patients were transferred to a special treatment ward for management where they were cooled by covering with large sheets of gauze wetted with room temp water. Fans were used to aid cooling and 5% glucose in normal saline was administered to all patients. A fluid balance chart was kept to monitor urine output.	NR	NR	Died: 1 (0.1%) Recovered: 653 (99.9%)
Mimish.(10)	28	Oral or IV volume repletion	NR	NR	NR

[‡]treated with cold IV infusion

[†]Study reported SEM instead of SD

Blood pressure (BP); Respiratory rate (RR); Pulse rate (PR); Central nervous system (CNS); Intensive care unit (ICU); Intravenous (IV); Not reported (NR).

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