LD_{50} – What is it?

The term LD_{50} refers to an estimate of the amount of poison that, under control conditions, will be a lethal dose to 50% of a large number of test animals of a particular species. The value is expressed in milligrams of the substance being tested per kilogram of animal body weight (mg/kg).

Factors affecting LD_{50}

There are a number of factors to consider when using LD_{50} as a guide to an animal's susceptibility to poison.

- Values will differ between populations in relation to their geographic location. For example many native animals in south-western Australia have a higher tolerance to 1080 than similar species in eastern Australia due to their historic exposure to naturally occurring fluoroacetate in many indigenous plants.
- Values may vary with age, sex and nutritional status
- LD_{50} does not measure corrosiveness, caustic burning, irritability, cancer-causing properties or other injurious reactions.
- LD_{50} does not tell you how long an animal takes to die. If an animal takes a long time to die form poisoning (eg. 1080 has a long latent period), it may ingest more poison than is needed. Knowing this may affect the way you lay a poison trail as you do not want to lay more poison than is necessary. If carcasses contain excess poison they may be a source of non-target poisoning as well as increasing the cost.
- Values are expressed as a single dose and do not give information on cumulative effects or repeated sub-lethal doses.

The LD_{50} may be determined for any route of administration including the dermal or oral means of contact or ingestion of chemicals. If a species has a high LD_{50} it means it has a high tolerance to the poison. A low LD_{50} means the species is highly susceptible to the poison.

The LD_{50} for a particular poison can vary greatly between different species of animals. Since LD_{50} is quoted in mg/kg of body weight, the amount of poison to kill an animal is a direct function of the species' body weight.

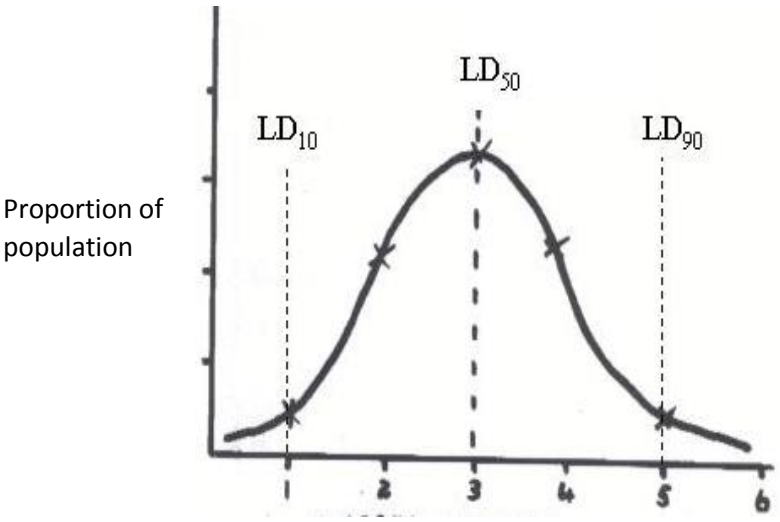
Other LD values

Sometimes you may see other lethal dose figures used in the literature such as LD_{10}, LD_{90} and LD_{95}. These are determined the same way as LD_{50} values and refer to the amount of poison lethal to 10%, 90% or 95% of a large test population. However, because of the way in which LD_{50} is determined, it is the most appropriate figure to use when expressing the susceptibility of a species or the toxicity of a poison. The LD_{100} is sometimes quoted as the dose required in a poison bait. Essentially it would be the dose to kill all individuals of the species and therefore for practical reasons, it is not in fact achievable – usually the LD_{90} or LD_{95} is used.

The Normal distribution

Lethal dose values are based on a normal distribution curve (see graph) which is a commonly used shape to represent frequency distributions for many population attributes such as height and age, but also includes susceptibility or tolerance to drugs or poisons. The LD_{95} is the average value.

Note that the values of a normal curve approach zero to the left and infinity to the right, but never actually reach either extreme and therefore LD_0 or LD_{100} are not statistically possible.



Relative Susceptibilities of Non-target Animals to 1080

(Data from McIlroy 1981-1984, Twigg & King 1989, Martin & Twigg 2002 published in Wildlife Research, Johnston& McCarthy 2007 in Emu & King 1993, APB Tech Series No 8)

					Oat Bait*				Fresh Meat Bait***		Prepared Bait****	
Species	**Wt (kg)**	**LD_{50} (mg kg-1)**	**Note**	**Amt of 1080 for LD50 (mg)**	**Wt of bait for LD50 (g)**	**No. of grains for LD50**	**Length of trail** (m)**	**% of Body wt**	**Wt of bait for LD50 (g)2**	**% of Body wt3**	**Wt of bait for LD50 (g)4**	**% of Body wt5**
Australian magpie *Cracticus tibicen*	0.32	9.91		3.17	8.81	264	3	2.75	79.28	24.8	37.01	11.6
Australian magpie-lark *Grallina cyanoleuca*	0.09	6.75	A	0.61	1.69	51	0.6	1.88	15.19	16.9	7.09	7.9
Australian raven *Corvus coronoides*	0.585	5.1	A	2.98	8.29	249	3	1.42	74.59	12.8	34.82	6
Bilby (WA) *Macrotis lagotis*	1.5	15	A	22.5	62.5	1875	23	4.17	562.5	37.5	262.58	17.5
Black duck *Anas superciliosa*	1	18.9		18.9	52.5	1575	20	5.25	472.5	47.3	220.56	22.1
Black kite Milvus migrans	0.56	18.5		10.36					259	46.3	120.9	21.6
Black rat *Rattus rattus*	0.229	0.76		0.17	0.48	15	0.2	0.21	4.35	1.9	2.03	0.9
Blackbird *Turdus merula*	0.08	9.5	A	0.76	2.11	63	0.8	2.64	19	23.8	8.87	11.1
Blotched blue-tongued lizard *Tiliqua nigrolutea*	0.45	336		151.2					3780	840	1764.5	392.1
Bolam's Inland Mouse (WA) *Pseudomys bolami*	0.015	1	A	0.02	0.04	1	0	0.28	0.38	2.5	0.18	1.2
Brown Falcon (WA) *Falco berigora*	0.44	20	B	8.8					220	50	102.7	23.3
Brushtail possum *Trichosurus vulpecula*	2.6	0.67		1.74	4.84	145	2	0.19	43.55	1.7	20.33	0.8
Brush-tailed bettong (WA) *Bettongia penicillata*	1.3	100	A	130	361.11	10833	135	27.8	3250	250	1517.1	116.7
Bush rat *Rattus fuscipes*	0.12	1.13		0.14	0.38	11	0	0.31	3.39	2.8	1.58	1.3

Bush Stone-curlew *Burhinus grallarius*	0.7	10	B	7	19.44	583	7	2.78	175	25	81.69	11.7
Cat *Felis catus*	4.2	0.4		1.68					42	1	19.61	0.5
Common Bronzewing (SA)[##] *Phaps chalcoptera*	0.34	25	A	8.5	23.61	708	9	6.94				
Common planigale (WA) *Planigale maculata*	0.011	4	B	0.04					1.1	10	0.51	4.7
Common ring-tail possum(WA) *Pseudocheirus peregrinus*	0.9	2	A	1.8	5	150	2	0.56	45	5	21.01	2.3
Common starling *Sturnus vulgaris*	0.07	4.75	A	0.33	0.92	28	0.3	1.32	8.31	11.9	3.88	5.5
Common Wombat *Vombatus ursinus*	24	0.2		4.8	13.33	400	5	0.06	120	0.5	56.02	0.2
Crested pigeon (WA) *Ocyphaps lophotes*	0.2	25	A	5	13.89	417	5	6.94				
Crimson rosella *Platycercus elegans*	0.14	0.87	A	0.12	0.34	10	0.1	0.24				
Diamond dove *Geopelia cuneata*	0.03	35.5		1.07	2.96	89	1	9.86				
Dingo *Canis familiaris*	16	0.11		1.76					44	0.3	20.54	0.1
Domestic Fowl *Gallus gallus*	1.5	c 10.0		15	15	450	6.4	1	375	25	175.05	11.7
Domestic pigeon *Columba livia*	0.4	3.98		1.59	4.42	133	2	1.11	39.8	10	18.58	4.6
Eastern grey kangaroo *Macropus giganteus*	30	0.3	A	9	25	750	9	0.08	225	0.8	105.03	0.4
Eastern rosella *Platycercus eximius*	0.1	3.45	A	0.35	0.96	29	0.4	0.96				
Emu *Dromaius novaehollandiae*	40	278	A	11120	30889	926667	11583	77.22	278000	695	129770	324.4
Euro(WA) *Macropus robustus*	25	2	A	50	138.89	4167	52	0.56	1250	5	583.5	2.3
European cattle *Bos taurus*	520	0.39		202.8	563.33	16900	211	0.11	5070	1	2366.68	0.5
Fat-tailed dunnart *Sminthopsis crassicaudata*	0.013	2.06		0.03					0.67	5.2	0.31	2.4

Fox *Vulpes vulpes*	4.7	0.12	A	0.56					14.1	0.3	6.58	0.1
Galah *Eolophus roseicapillus*	0.31	5.5	A	1.71	4.74	142	2	1.53				
Goat *Capra hircus*	37	0.5	A	18.5	51.39	1542	19	0.14	462.5	1.3	215.9	0.6
Grey shrike-thrush *Colluricincla harmonica*	0.07	12	A	0.84	2.33	70	0.9	3.33	21	30	9.8	14
Hairy-footed dunnart *Sminthopsis hirtipes*	0.016	7	A	0.11					2.8	17.5	1.31	8.2
Hairy-nosed wombat *Lasiorhinus latifrons*	24	0.21		5.04	14	420	5	0.06	126	0.5	58.82	0.2
Heath rat (WA) *Pseudomys shortridgei*	0.07	25	B	1.75	4.86	146	2	6.94	43.75	62.5	20.42	29.2
Horse *Equus caballus*	500	0.41	A	205	569.44	17083	214	0.11	5125	1	2392.35	0.5
Kowari *Dasyuroides byrnei*	0.11	2.9	A	0.32					7.98	7.3	3.72	3.4
Laughing kookaburra *Dacelo novaeguineae*	0.3	6	A	1.8					45	15	21.01	7
Little corella (WA) *Cacatua sanguinea*	0.55	1.43	B	0.79	2.18	66	1	0.4				
Little crow *Corvus bennetti*	0.4	13.4		5.36	14.89	447	6	3.72	134	33.5	62.55	15.6
Little raven *Corvus mellori*	0.56	3.1		1.74	4.82	145	2	0.86	43.4	7.8	20.26	3.6
Long-haired rat *Rattus villosissimus*	0.155	1.4		0.22	0.6	18	0	0.39	5.43	3.5	2.53	1.6
Mallee fowl *Leipoa ocellata*	2	100	A	200	555.56	16667	208	27.78	5000	250	2334	116.7
Maned duck *Chenonetta jubata*	0.7	12.6		8.82	24.5	735	9	3.5	220.5	31.5	102.93	14.7
Mitchell's hopping mouse *Notomys mitchellii*	0.04	19.4		0.78	2.16	65	1	5.39	19.4	48.5	9.06	22.6
Mouse *Mus musculus*	0.014	8.3		0.12	0.32	10	0.1	2.31	2.91	20.8	1.36	9.7
Ooldea dunnart *Sminthopsis ooldea*	0.012	1	B	0.01					0.3	2.5	0.14	1.2

Peaceful dove *Geopelia striata*	0.05	9.5	B	0.48	1.32	40	0	2.64				
Pied currawong *Strepera graculina*	0.3	13.1		3.93	10.92	328	4	3.64	98.25	32.8	45.86	15.3
Pig *Sus scrofa*	55	1.04		57.2	158.89	4767	60	0.29	1430	2.6	667.52	1.2
Plains mouse *Pseudomys australis*	0.065	1.2		0.08	0.22	7	0	0.33	1.95	3	0.91	1.4
Rabbit *Oryctolagus cuniculus*	1.5	0.37		0.56	1.54	46	0.6	0.1				
Red kangaroo *Macropus rufus*	30	3.2		96	266.67	8000	100	0.89	2400	8	1120.32	3.7
Red-necked wallaby *Macropus rufogriseus*	19	0.2	A	3.8	10.56	317	4	0.06	95	0.5	44.35	0.2
Red-rumped parrot *Psephotus haematonotus*	0.06	5.25	A	0.32	0.88	26	0.3	1.46				
Rosenberg's goanna (WA) *Varanus rosenbergi*	0.7	200	A	140					3500	500	1633.8	233.4
Sand goanna *Varanus gouldii*	0.84	43.6		36.62					915.6	109	427.4	50.9
Sandy Inland Mouse *Pseudomys hermannsburgensis*	0.015	39.3		0.59	1.64	49	1	10.92	14.74	98.3	6.88	45.9
Sheep *Ovis aries*	38	0.52		19.76	54.89	1647	21	0.14	494	1.3	230.6	0.6
Shingle-back lizard *Tiliqua rugosa*	0.45	206		92.7					2317.5	515	1081.81	240.4
Southern brown bandicoot[#@] *Isoodon obesulus*	0.8	7	A	5.6	15.56	467	6	1.94	140	17.5	65.35	8.2
Sparrow *Passer domesticus*	0.03	2.82		0.08	0.24	7	0.1	0.78	2.12	7.1	0.99	3.3
Spinifex hopping mouse *Notomys alexis*	0.04	32.5		1.3	3.61	108	1	9.03	32.5	81.3	15.17	37.9
Striped-faced dunnart *Sminthopsis macroura*	0.019	1		0.02					0.48	2.5	0.22	1.2
Sulphur-crested cockatoo *Cacatua galerita*	0.8	3.56		2.85	7.91	237	3	0.99				
Swamp rat *Rattus lutreolus*	0.12	1.7		0.2	0.57	17	0	0.47	5.1	4.3	2.38	2

Tammar wallaby *Macropus eugenii*	6	0.3		1.8	5	150	2	0.08	45	0.8	21.01	0.4
Water rat *Hydromys chrysogaster*	1	3	A	3					75	7.5	35.01	3.5
Wedge-tailed eagle *Aquila audax*	3.1	9.5		29.45					736.25	23.8	343.68	11.1
Western grey kangaroo *Macropus fuliginosus*	30	20	A	600	1666.67	50000	625	5.56	15000	50	7002	23.3
Western pygmy possum *Cercartetus concinnus*	0.013	10	[A]	0.13					3.25	25	1.52	11.7
White-winged chough *Corcorax melanorhamphos*	0.33	1.75		0.58	1.6	48	0.6	0.49	14.44	4.4	6.74	2
Wongai ningaui (WA) *Ningaui ridei*	0.008	3	[B]	0.02					0.6	7.5	0.28	3.5
Yellow-footed antechinus (WA) *Antechinus flavipes*	0.045	12.5	A	0.56					14.06	31.3	6.56	14.6
Yvonne's ningaui *Ningaui yvonneae*	0.008	3	B	0.02					0.6	7.5	0.28	3.5

* 1g of oats has 30 grains @ 0.0375% 1080

** 80 grains per m of trail

*** 3mg 1080 in 75g fresh meat (fox) or 6mg 1080 in 150g fresh meat (wild dog) ie 0.004% 1080

**** Prepared Baits - 3mg 1080 in 35g FoxOff Econobait™ or 6mg 1080 in 70g Doggone™ ie. 0.009% 1080

#@ Southern Brown Bandicoot from WA approx LD50=20mg/kg

[A] approximate LD50

[B] approximate or minimum lethal dose ie dose lethal to 10% of treatment group