

Table V. The effects of single doses of *d*-amphetamine, *d*-methamphetamine, ephedrine, methylphenidate, and phenmetrazine on urinary epinephrine, norepinephrine, dopamine, creatinine, and urine volume during the first 3 hours after the drugs were administered

Treatment	No. Subjects	Epinephrine (μg per 3 hr.)	Norepi- nephrine (μg per 3 hr.)	Dopa- mine (μg per 3 hr.)	Creati- nine (mg. per 3 hr.)	Urine volume (ml. per 3 hr.)
Placebo	13	1.90 $\pm$ 0.26	9.1 $\pm$ 1.4	96 $\pm$ 25	262 $\pm$ 53	539 $\pm$ 48
<i>d</i> -Amphetamine, 7.5 mg. per 70 Kg.	13	3.01 $\pm$ 0.39*	12.9 $\pm$ 2.9	346 $\pm$ 262	263 $\pm$ 22	553 $\pm$ 86
<i>d</i> -Amphetamine, 15.0 mg. per 70 Kg.	13	3.66 $\pm$ 0.44*	12.2 $\pm$ 1.7	180 $\pm$ 113	251 $\pm$ 24	699 $\pm$ 72
<i>d</i> -Amphetamine, 30.0 mg. per 70 Kg.	13	3.85 $\pm$ 0.42†	10.6 $\pm$ 1.4	74 $\pm$ 12	221 $\pm$ 20	679 $\pm$ 86
Placebo	12	1.95 $\pm$ 0.28	9.4 $\pm$ 1.5	101 $\pm$ 26	274 $\pm$ 56	563 $\pm$ 45
<i>d</i> -Methamphetamine, 7.5 mg. per 70 Kg.	12	3.41 $\pm$ 0.37†	13.3 $\pm$ 2.3	153 $\pm$ 45	242 $\pm$ 28	647 $\pm$ 83
<i>d</i> -Methamphetamine, 15.0 mg. per 70 Kg.	12	3.80 $\pm$ 0.46†	8.8 $\pm$ 0.6	94 $\pm$ 20	225 $\pm$ 13	730 $\pm$ 113
<i>d</i> -Methamphetamine, 30.0 mg. per 70 Kg.	12	4.35 $\pm$ 0.67†	10.2 $\pm$ 1.2	75 $\pm$ 11	225 $\pm$ 26	767 $\pm$ 101†
Placebo	12	1.70 $\pm$ 0.18	9.0 $\pm$ 1.5	99 $\pm$ 27	267 $\pm$ 57	528 $\pm$ 53
Ephedrine, 75 mg. per 70 Kg.	12	3.03 $\pm$ 1.01	8.8 $\pm$ 0.6	79 $\pm$ 15	246 $\pm$ 16	489 $\pm$ 83
Ephedrine, 150 mg. per 70 Kg.	12	3.94 $\pm$ 0.46†	13.3 $\pm$ 1.5	103 $\pm$ 17	249 $\pm$ 17	559 $\pm$ 82
Placebo	12	1.70 $\pm$ 0.18	9.0 $\pm$ 1.5	99 $\pm$ 57	267 $\pm$ 57	528 $\pm$ 53
Methylphenidate, 15 mg. per 70 Kg.	12	2.99 $\pm$ 0.42†	10.7 $\pm$ 1.0	139 $\pm$ 45	256 $\pm$ 29	542 $\pm$ 69
Methylphenidate, 30 mg. per 70 Kg.	12	3.50 $\pm$ 0.43†	12.3 $\pm$ 0.2	77 $\pm$ 6	231 $\pm$ 17	572 $\pm$ 84
Methylphenidate, 60 mg. per 70 Kg.	12	4.62 $\pm$ 0.57†	10.9 $\pm$ 0.8	68 $\pm$ 5	252 $\pm$ 13	487 $\pm$ 66
Placebo	12	1.70 $\pm$ 0.18	9.0 $\pm$ 1.5	99 $\pm$ 27	267 $\pm$ 57	528 $\pm$ 53
Phenmetrazine, 35 mg. per 70 Kg.	12	2.55 $\pm$ 0.40†	9.7 $\pm$ 1.0	76 $\pm$ 10	245 $\pm$ 19	450 $\pm$ 55
Phenmetrazine, 70 mg. per 70 Kg.	12	3.57 $\pm$ 0.43†	8.4 $\pm$ 1.0	72 $\pm$ 10	244 $\pm$ 19	507 $\pm$ 70

The results are expressed as the mean plus or minus one standard error.

* $p < 0.005$: Different from placebo by a paired comparison *t* test.

† $p < 0.001$: Different from placebo by a paired comparison *t* test.

‡ $p < 0.05$: Different from placebo by a paired comparison *t* test.

parameters. The quantity of norepinephrine excreted under all drug conditions was not significantly different from the placebo condition, although the slope of the dose-response line for ephedrine was statistically significant. Dopamine excretion was not altered by any of the drug conditions when compared to the placebo condition; however, the regression coefficients for the dopamine dose-response relationship for methamphetamine and methylphenidate had a significant negative slope.

Discussion

The mode of action of amphetamine-like drugs in producing central nervous system effects is not known; therefore, at this time classifications of these drugs

must be based on similarities of drug syndromes.

On the basis of physiologic responses as well as subjective changes, amphetamine and methamphetamine were equipotent with respect to most parameters, and no evidence was obtained that supported the view that the central stimulatory actions of methamphetamine relative to its peripheral effects are greater than those of amphetamine in man when the two drugs are administered subcutaneously.

Aside from the fact that phenmetrazine was $\frac{1}{3}$ to $\frac{1}{4}$ as potent as either amphetamine or methamphetamine, it seemed to be qualitatively similar to amphetamine and methamphetamine.

Methylphenidate differed from amphet-