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Relation of physiological and psychological effects of lysergic acid diethylamide.

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The purpose of this report is to show the relationship that exists between a number of physiological measures and concomitant psychological effects of lysergic acid diethylamide (LSD).

LSD and other centrally acting drugs will produce a variety of physiological and psychological changes in man; however, there has been no attempt to determine whether the persons who show the greater physiological changes also show the greater psychological changes. It is usually assumed that when two subjects receive a drug the subject who shows the greater physiological change will also report that he is more affected by the drug, and that if his behavior were measured he would also show the greater impairment in this behavior. In the present study data will be presented to show that this is only partially true.

Methods

Ten normal volunteers between the ages of 18 and 23, six male and four female, served as subjects. All the subjects had little or no previous experience with centrally acting drugs. Each subject received 100γ of LSD and, on separate days, two placebos. Both LSD and the placebos were administered orally in identical capsules; the "double-blind" technique was employed throughout. Seventy-five minutes after ingesting the drug each subject received the following psychological tests: addition, both three and nine digits, pursuit rotor, digit symbol test, speed of copying numbers, tachistoscopic discrimination, and tactual perception.

Scores were expressed as a per cent of the mean of two control scores, and then an overall mean per cent score for all tests was obtained. This score will be referred to as the objective psychological score. The detailed de-

scription and results of the effect of LSD on these tests have been previously reported.[3]

In addition, a 47-item symptom questionnaire was given at 30, 90, 150, and 210 minutes after the ingestion of the drug. This questionnaire was specifically designed [2] to elicit the subjective effects of LSD. The score on this questionnaire was the total number of symptoms checked for the four periods. This score will be referred to as the subjective psychological score.

The following physiological measures were recorded at approximately 140 minutes after the ingestion of the drug: pulse, respiration, oral temperature, and blood pressure. These were recorded after the subject had remained supine for five minutes.

Correlations between the extent of each of these physiological measures and the extent of objective and subjective effects of LSD were computed by means of the product-moment method.[5] To test the significance of the difference between the effects of LSD and a placebo, the Dunnett *t*-test was employed.[4]

Results

Table 1 shows the psychological and physiological effects of LSD and a placebo. All of these LSD scores were significantly different from the placebo scores ($P<0.05$).

Table 2 shows the correlations between the two types of psychological effects and each of the physiological measures. The subjective effects fail to correlate significantly with any of the physiological measurements, while the objective psychological effects correlate significantly with all the measures with the exception of respiratory rate.

Comment

The results indicate that there is a significant relationship between some physiological effects of LSD and its objective psychological effects. However, there is no significant relationship between any of the measured physiological changes and the total of the symptoms produced. It is of interest that the symptom questionnaire supposedly samples many things that should reflect the physiological changes, i. e., "Do you feel ill;

TABLE 1.—*Mean Psychological and Physiological Effects of LSD and a Placebo*

	Physiological				Psychological	
	Blood Pressure, Systolic	Pulse, per Min.	Respiration, per Min.	Temperature, Degrees (C)	Objective*	Subjective†
LSD	123.4‡	87.6‡	21.4‡	37.0‡	74.0‡	31.5‡
Placebo	110.1	68.7	17.8	36.7	101.0	3.4

* Per cent of the mean of two control days (the smaller the number, the greater the deficit).
† Mean number of plus responses on the symptom questionnaire.
‡ $P<0.05$ between placebo and LSD.

are you nauseated; are you hot; are you cold; are you sweating; are your palms moist; do you feel weak?" This suggests that the subjective effects are to some degree related to some factor or factors that are independent of the somatic pharmacological activity, whereas the objective effects are more closely related to the somatic pharmacological action of this drug. In a previous report it was shown that these subjective effects are related to a number of personality variables.[5] The greater the personality deviation of the subject, the greater the subjective effect of the drug. This is true for the objective psychological effects but not to the same degree.

Generalization of this finding to other drugs must be questioned, for it may be argued that the failure of the subject to perceive accurately the extent of his own physiological change is a function of the distortions in perception caused by LSD.

TABLE 2.—*Coefficient of Correlation Between Physiological and Psychological Effects of 100γ of LSD*

	Blood Pressure	Pulse	Respiration	Temperature
Objective psychol.	0.65*	0.68*	—0.03	0.86†
Subjective psychol.	—0.12	—0.51	—0.15	0.42

* $P<0.05$.
† $P<0.01$.

Summary

Ten subjects were given 100γ of lysergic acid diethylamide (LSD), as well as two placebos on separate days. A number of physiological measures were recorded, as well as objective and subjective psychological effects of this drug. The results indicate that the physiological effects of LSD are significantly correlated with objective psychological effects, but not with subjective psychological effects.

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(Beziehungen zwischen somatischen und psychischen Wirkungen des LSD)

10 gesunde Vpp. erhielten 100 γ LSD oral und - an anderen Tagen - 2 Placebos. Zwischen den somatischen Wirkungen des LSD und den objektiv erkennbaren - jedoch nicht den rein subjektiven - psychischen Symptomen bestand eine signifikante Korrelation.

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(Relation entre les effets somatiques et psychiques du LSD)

On administre à 10 sujets normaux 100 γ de LSD per os et d'autres jours 2 placébos. Les effets physiologiques du LSD montrent des relations nettes avec les effets psychologiques objectifs, mais non avec les effets psychiques subjectifs du LSD.

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