Neurobehavioral Toxicology, Vol. 1, pp. 1–4. Printed in the U.S.A.

Reproductive Dysfunction in Male Rats Following Neonatal Administration of Monosodium L-Glutamate

WILLIAM J. PIZZI, JUNE E. BARNHART AND JAMES R. UNNERSTALL

Department of Psychology, Northeastern Illinois University, Chicago IL

(Received 20 March 1978)

PIZZI, W. J., J. E. BARNHART AND J. R. UNNERSTALL. *Reproductive dysfunction in male rats following neonatal administration of monosodium L-glutamate*. NEUROBEHAV. TOXICOL. 1(1) 1–4, 1979—. Monosodium glutamate (MSG) was administered to neonatal rats according to an increasing dose schedule from days 2–11 after birth. Adult MSG-treated male rats showed reproductive deficits along with stunted body lengths and reduced testes weights. These results demonstrate that MSG is capable of producing reproductive deficits in the rat similar to those seen in the mouse. These results are discussed in light of the methodological differences between those studies reporting positive or negative findings on reproductive function in MSG-treated mice and rats.

Monosodium glutamate Reproductive dysfunction Reduced body length

THE first report demonstrating monosodium glutamate (MSG)-induced brain damage also described a number of somatic, endocrine and behavioral disturbances in treated mice [21]. Since this report, numerous studies have confirmed the glutamate syndrome which includes central nervous system (CNS) damage, particularly lesions in the arcuate nucleus of the hypothalamus [2, 8, 9, 10, 15, 22, 23, 24, 25], obesity [2, 5, 7, 10, 17, 18, 21, 26, 27], stunted body length [2, 5, 8, 10, 17, 21, 26, 27, 28, 32], abnormal activity levels [2, 21, 26], deficits in discrimination learning [4,30], along with endocrine and reproductive dysfunction [8, 12, 13, 18, 19, 20, 21, 24, 27, 32, 36].

The original findings generated an immediate controversy because of the widespread use of MSG as a food additive. This controversy was heightened by several reports of a failure to replicate. Of interest to this study are those reports which fail to demonstrate reproductive deficits in the mouse [6, 11, 33, 34], and particularly, in the rat [1, 16, 31, 33, 35, 37]. This report concerns itself with one of these areas; namely, reproductive deficits in the rat.

A careful analysis of the literature regarding MSG-induced reproductive deficits reveals that many studies reporting negative results in MSG-treated animals differ from those yielding positive findings on several crucial variables, including method of administration, age of treatment and length of follow-up period. As a result, the present study was undertaken to examine the effect of neonatal administration of MSG on the male rat employing the design which has been shown to consistently produce developmental and behavioral abnormalities in adult mice following neonatal exposure to MSG.

METHOD

Animals

Animals were 26 BLU:LE hooded male rats (Blue Spruce Farms, Altamont NY). All animals were born in the laboratory and housed in polycarbonate cages with their dams. They were given free access to food and water, and maintained on a 12-hour light-dark schedule. All newborn animals were kept with their dams until weaning at 30 days of age.

Drug Treatment

Rat pups were injected subcutaneously for 10 consecutive days with an aqueous solution (10% w/v, pH 6.80) of monosodium L-glutamate (Sigma Chemical Company, St. Louis, MO) following the dose schedule of Potts, Modrell and Kingsbury [29]. This schedule calls for the subcutaneous administration of a gradually increasing dose of MSG beginning at day 2 after birth with a dose of 2.2 mg/g body weight and ending at day 11 with a dose of 4.4 mg/g body weight. Control animals received equal volumes of bacteriostatic saline.

Somatic Evaluation

At weaning, and every 20 days thereafter, the animals were weighed to a tenth of a gram. Growth curves were followed for a minimum of 288 days and a maximum of 323 days. At the conclusion of all experiments the animals were anesthetized and body length was determined as the distance from the tip of the snout to the anal orifice.