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Effect of Gelatine Feeding upon Cases of Pseudohypertrophic Progressive Muscular Dystrophy.*

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The beneficial effects of glycine feeding upon several cases of muscular dystrophy reported by Milhorat, Techner and Thomas[1] prompted the writers to investigate the effect of prolonged gelatine feeding upon 3 boys,[2] well advanced cases of pseudohypertrophic progressive muscular dystrophy, patients in the Shriners' Hospital for Crippled Children.† The boys, C.E., M.S., and D.G. were 11, 9 and 8 years of age, respectively. D.G. was able to walk but could not arise from a sitting position; C.E. and M.S. were unable to walk and could move only by sitting and pushing themselves along with their hands. The boys were removed from bed each morning and encouraged to exercise as much as they would during the day. The period of study extended throughout most of one year and included a preliminary control period on a meat-free diet, a prolonged period of gelatine feeding without meat, followed by a period without gelatine. Creatinine and creatine determinations were run on carefully collected daily urine samples. At intervals the ability of the 3 children to exercise was determined by having them walk (or slide if unable to walk) until exhausted, a record being kept of the distance covered. A tabulation of data on C.E., the most severe case, is given in Table 1 as illustrative of the findings in all these cases. Gelatine feeding markedly increased the excretion of creatine in all cases as previously found by Gibson and Martin.[3] The increase was greatest in C.E., the most severe case, and least in D.G., the mildest case. An increase followed by a decrease was observed as found by Milhorat, Techner and Thomas during glycine

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1 Milhorat, A. T., Techner, F., and Thomas, K., PROC. SOC. EXP. BIOL. AND MED., 1932, **29**, 609.

2 Freiberg, I. K., and West, E. S., *J. Biol. Chem.*, 1933, **101**, 449.

† These cases were used by Freiberg and West in a study of glycine synthesis under benzoate stimulation. The writers are indebted to Dr. C. H. Crego, Jr., and his staff of the Shriners' Hospital for Crippled Children in St. Louis for making these cases available, and for excellent coöperation in the study.

3 Gibson, R. B., and Martin, T. F., *J. Biol. Chem.*, 1921, **49**, 319.

feeding. The creatine excretion on a meat-free and gelatine-free diet after the period of gelatine feeding was essentially as in the control period before gelatine feeding. The creatinine coefficients before and after feeding gelatine were for C.E., 3.7 and 1.76‡; for M.S., 2.9 and 1.66; and for D.G., 3.5 and 2.6 respectively, representing a definite decrease in each case. Harris and Brand[4] have pointed out the correlation of a low creatinine coefficient and the severity of the disease. We have observed the same thing in 3 other cases (boys in the same family), in which the creatinine coefficients were inversely proportional to the severity of the condition.

TABLE I.

C. E., male, age 11 years.* Could not walk or rise from sitting position. Muscular weakness from infancy progressively becoming worse.

Periods days	Diet	Creatinine Mg. 24 hr. Aver.	Creatine Mg. 24 hr. Aver.	Exercise‡ Slid Feet	Exercise‡ in min.
24†	No meat, no gel.	247	400	182	15
24	" " 18 gm. gel.	233	527	161	20
13	" " 28 " "	243	790	364	25
16	" " 42 " "	214	808	298	15
3	" " 28 " "	246	692	1456	100
7	" " no gel.	247	641	1820	107
18	" " 28 gm. gel.	243	698	1456	135
14	Same	230	672	364	50
13	"	237	713	1456	142
17	"	191	660	546	110
17	No meat, no gel.	157	467	1638	150
24	Same	172	401	1350	175
20	Hospital diet	214	508	1456	200
12	No meat, no gel.	193	459	455	120

*Weight increased progressively from 25 kilos on 7-12-32 to 36 kilos on 3-30-33. Much of the increase was due to fat.

†Began 7-13-32. Periods continuous until 2-10-32, with the exception of a day or two between some of the periods. 20 days elapsed between periods 11 and 12, but the diet was unchanged. 2½ months elapsed between periods 13 and 14.

‡Exercise tests were given at intervals of 3 to 4 weeks, and included the interval between 9-22-32 and 10-11-33.

The last column of Table 1 gives the results of exercise tests on C.E., throughout and following gelatine feeding. Such tests have serious disadvantages, yet probably indicate something as to relative muscular ability. As judged by this test all showed considerable improvement during the gelatine feeding and 2§ maintained it for sometime after gelatine was discontinued.

Clinical examination of the muscles throughout the period of

‡ He had become quite fat during the experiment.

[4] Harris, M. M., and Brand, E., *J. A. M. A.*, 1933, **101**, 1047.

§ D. G. became unable to walk during April of 1933. Gelatine feeding was discontinued 1-24-33 in all cases.

observation showed little change with possibly some further degeneration. The creatine and creatinine excretions also indicate that the condition did not improve and probably became worse. Notwithstanding these facts, the general condition of the patients appeared some better during the gelatine feeding.

Fifteen gm. of glycine were fed daily beginning 7-16-'33, and continuing for 3 months in the case of M.S., 2 months in the case of D.G. and 2½ months in the case of C.E. The characteristic increase in creatine excretion was observed, the increase being little greater than caused by 28 gm. of gelatine (equivalent to about 7 gm. of glycine). This suggests that constituents in gelatine other than glycine caused considerable of the increased creatine excretion. The glycine feeding had no apparent beneficial effect.

The peculiar muscular sensations noted by Milhorat, Techner and Thomas during glycine feeding were not observed at any time in our cases.

The administration of ephedrine sulfate (4 doses of 3/8 grain at 3 hour intervals) to the cases while on a meat-free diet did not significantly change the creatine or creatinine excretion. Reinhold and others[5] reported the creatine excretion of a dystrophy case (type of dystrophy uncertain) as doubled by ephedrine administration while receiving glycine.

D.G. excreted 72% of 1.0 gm. of creatine when ingested after breakfast on a meat-free diet. C.E. and M.S. excreted 87 and 65% respectively.

Conclusions. Cases of pseudohypertrophic progressive muscular dystrophy seemed to be somewhat improved, as judged by exercise tests, by prolonged gelatine feeding. The improvement, if any, was of a temporary nature and the progress of the condition was not arrested. The creatinine coefficients were lower at the end of the gelatine feeding than before and the creatine excretion showed little change. We believe that gelatine feeding affords as much stimulation as glycine feeding in this condition.

[5] Reinhold, J. G., Clark, J. H., Kingsley, G. R., Custer, R. P., and McConnell, J. W., *J. A. M. A.*, 1934, **102**, 261.