Def Sci J, Vol 39, No. 1, January 1989, pp 109–112

Alleviating Effect of High Protein Diet on the Toxic Effect of Organophosphorus Compounds on the Growth of Rats

A.K. Chatterjee and Smt. U. Kaveeshwar

Defence Research and Development Establishment, Gwalior-474 002

ABSTRACT

Elevation of protein in the diet from 19 to 59 per cent and kept isocaloric significantly improved the growth over a period of 20 days of male albino rats exposed to the toxic stress of DFP, EPN and Malathion.

Marked changes in the metabolism and pharmacotoxicological activity of drugs and xenobiotics have been reported due to alteration of the nutritional factors[1]. Dietary protein increases[2] the concentration of microsomal drug metabolising enzymes mainly localised in the liver microsomes which readily metabolise and detoxify[3] any xenobiotic. However, for a chemical that gets bioactivated or biotoxicated the test animal is exposed to the stress of a more toxic metabolite for a longer period when on High Protein Diet (HPD).

The present study deals with the effect of HPD on the growth rate of albino rats under toxicity of organophosphorus (OP) compounds like diisopropylphosphoro-fluoridate (DFP), o-ethyl o-(4-nitrophenyl) phenyl phosphonothioate (EPN) and Malathion [o, o-dimethyl S-(1, 2 -dicarbethoxy ethyl) phosphorodithioate]. Apart from DFP which undergoes direct detoxication in a living system and is a structural analogue of nerve gas Sarin (Methyl isopropyl phosphonofluoridate), EPN and Malathion undergoes biotoxication.

The aim was to find out whether HPD could be used as a prophylactic against nerve gas poisoning which are of organophosphorus origin[4]. Male albino rats of wistar strain (body wt. 130 ± 15 g) were divided into eight groups of eight animals each. Groups A and B were controls being given Standard Diet (SD) containing 19 per

Received 25 September 1987; revised 12 September 1988

cent protein and isocaloric HPD containing 59 per cent protein respectively. The composition of these two diets were as described by Purshottam & Kaveeshwar[5]. These groups received approximately the same quantity of diluants as the experimental animals, that were used for the dilutions of OP compounds.

The remaining six groups received apart from the two diets mentioned above, s.c. doses (5 per cent LD_{50}) values of DFP, EPN and Malathion respectively daily for 20 days. The dilutions of OP compounds were made in distilled water with 1.0 ml. of propylene glycol being initially added in each. The quantity of food given was 17 g/rat/day which had no leftover as studied by separate experiments (Fig. 1).

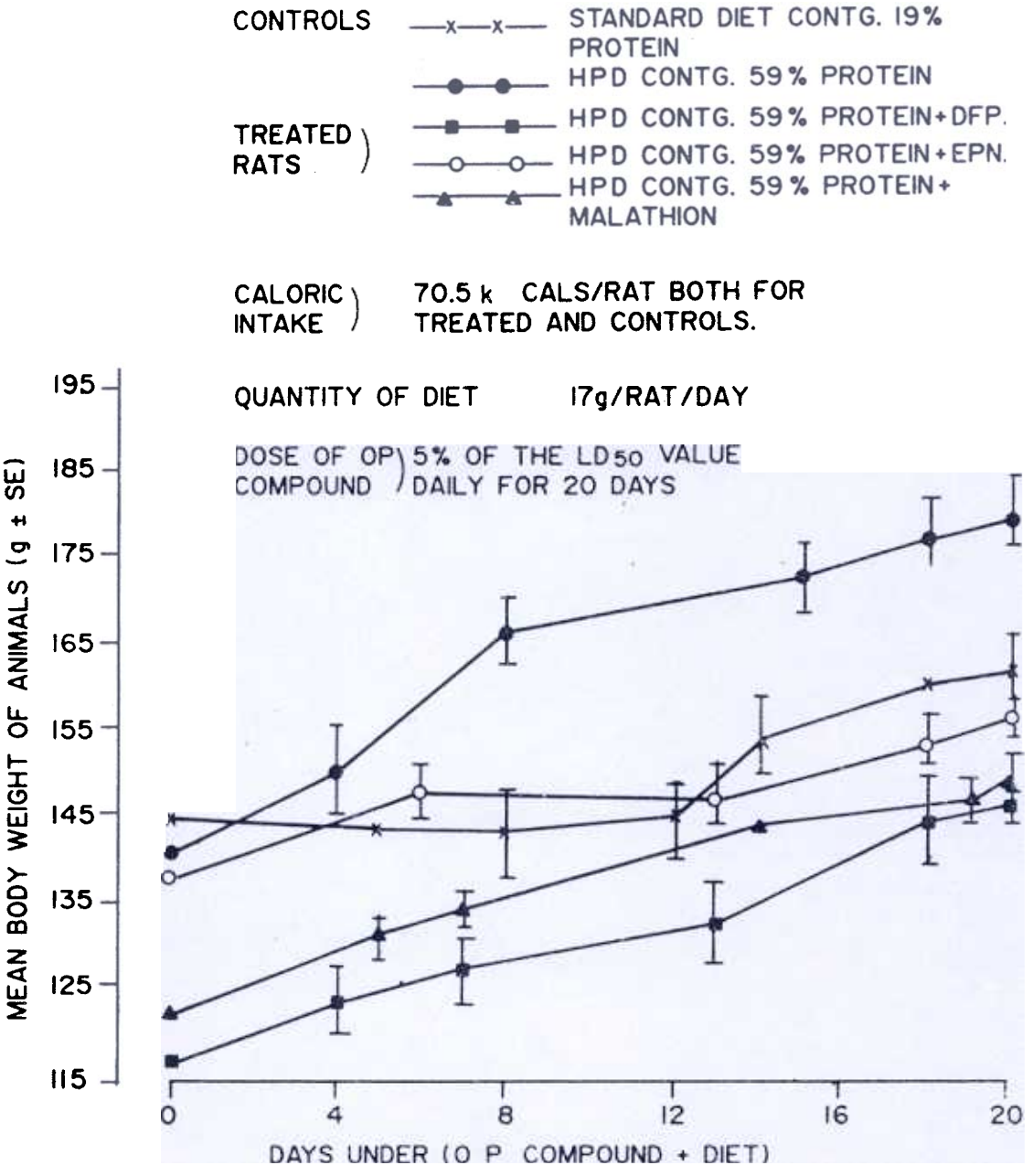

Figure 1. Growth rate of rats under high protein diet combined with various organophosphorus compounds.

The results are ennumerated in Table 1. It can be seen from groups A and B that both SD and HPD are growth promoting recording increase in body weights. Growth rate of rats receiving 59 per cent protein in diet was also higher in the toxic

Table 1. Per cent elevation/depression in growth rates of rats on 19 and 59 per cent isocaloric protein diets subjected to subcutaneous toxic stress of OP compounds

Gps.	Treatment	Mean ± S.E. wt. of animals on day 1 (g)	Mean ± S.E. wt. of animals on day 20 (g)	Per cent elevation/ depression in growth rates as compared to group A
A.	Standard diet contg. 19% protein			
B.	High protein diet contg. 59% protein	140.3 ±5.90	178.5±11.0	134.3 (Elevation)
C.	A+DFP (5% LD_{50}) daily for 20 days	122.6 ± 3.0	142.6± 5.0	22.7 (Elevation)
D.	B+DFP" daily for 20 days	116.75±6.2	145.5± 5.0	76.4 (Elevation)
E.	A+EPN" daily for 20 days	130.2 ±4.0	140.7± 3.0	35.5 (Depression)
F.	B+EPN" daily for 20 days	137.5 ±4.0	154.8± 3.0	6.1 (Elevation)
G.	A+Malathion daily for 20 days	125.0 ±5.0	133.0± 5.2	50.9 (Depression)
H.	B+Malathion daily for 20 days	123.25±4.0	148.0± 1.0	51.8 (Elevation)

stressed animals as compared to the groups receiving only 19 per cent protein under similar conditions of treatment. In case of DFP combined with HPD the elevation was 76.4 per cent, for EPN 6.1 per cent and for Malathion 51.8 per cent respectively (compare groups D, F and H versus group A).

The beneficial effect of HPD in alleviating toxicity is obvious. The protective action is most pronounced in case of DFP and least in case of EPN toxicity. It may be due to the difference in the mode of their biotransformations under HPD.

HPD can probably prove effective against toxicity of Sarin also. Similar studies with High Carbohydrate (HCD) and High Fat Diets (HFD) under the toxicity of DFP, EPN and Malathion showed mostly depressions in growth rates proving their unsuitability in comparison to HPD.

ACKNOWLEDGEMENTS

The authors wish to record their thanks to Dr. P.K. Ramachandran, Director, Defence Research and Development Establishment, Gwalior for his keen interest in the work.

REFERENCES

1. Campbell, T.C. & Hayes, J.R., *Pharmacol. Rev.*, **26** (1974), 71.
2. Kato, R., Chiesara, E. & Vassanelli, P., *Biochem. Pharmacol.*, **11** (1962), 211.
3. Sato, A. & Nakajima, T., *Nutr. Cancer.*, **6** (1984), 121.
4. Eto, M., Organophosphorus Pesticides : Organic and Biological Chemistry, (CMC Press Inc., Cleveland, Ohio, USA), 1974, p.74.
5. Purshottam, T. & Kaveeshwar, U., *Aviation Space and Environmental Medicine*, June (1979), 581.