8. Kasahara, S., *Contr. Fish. Lab. Fac. Agric. Tokyo*, 1962, **3**, 103.
9. Lahav, M. and Shilo, M., *Bamidgeh*, 1964, **16**, 86.

VOLUME INDEX FOR DETERMINING THE NATURE OF ANAEMIA CAUSED BY HELMINTHIASIS IN POULTRY

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VOLUME index (VI) indicates the proportion of corpuscular volume to the percentage of red cells. The normal VI in man is 1 ranging from 0.85 to 1.5. If the VI is higher than the normal value, the resultant anaemia is macrocytic and if it is lower than the normal value, the resultant anaemia is microcytic. All aspects of the blood of the domestic fowl have been studied in the past[1] but no reference is available on VI in either sex, both in healthy and diseased conditions.

In the present study the effect of helminthiasis on VI of domestic fowl was assessed. The total erythrocyte count (TEC), and the haematocrit values were estimated in 400 birds, which include both healthy (uninfected) and helminthic infected fowls. From these values, VI of erythrocytes was calculated using the formula VI = % corpuscular volume/% red cells. The percentage of corpuscular volume was calculated by taking 45 ml of corpuscles per 100 ml of blood as 100%. The percentage of red cells was also calculated taking a count of 5 millions of red cells per mm^3 of the blood as 100%. The results are given in table 1.

(a) *Healthy fowls*: In the domestic fowl, VI is comparatively higher than that of the human beings. This confirm the fact that the avian red blood corpuscles are oval, biconvex, and larger than that of mammals. VI is significantly higher in pullets than in cockerels.

(b) *Diseased fowls:* (i) *In cockerels*: Infections with *Raillietina tetragona* and *Choanotaenia infundibulum* did not cause any significant variation in VI and suggests that there is no anaemia due to these infections. Infections with *Raillietina echinobothrida*, *Hymenolepis carioca* and *Ascaridia galli* show an increased VI value, the maximum increase being in *R. echinobothrida* infection indicating that these infections cause macrocytic anaemia in the fowl. In *R. cesticillus* infection, VI shows a significant drop in the value suggesting microcytic anaemia.

Table 1 *Volume index values of erythrocytes in the healthy (uninfected) and helminthic infected (natural infection) domestic fowl, Gallus domesticus, of 3–4 months age.*

Nature of infection	* Volume index	
	In cockerels	In pullets
None	1.28 ± 0.22	1.65 ± 0.48
Single infection[1] with		
Raillietina tetragona	1.30 ± 0.33	1.41 ± 0.57
Raillietina echinobothrida	1.95 ± 0.88	1.67 ± 1.00
Raillietina cesticillus	1.05 ± 0.17	1.44 ± 0.07
Choanotaenia infundibulum	1.24 ± 0.02	–
Hymenolepis carioca	1.37 ± 0.10	–
Ascaridia galli	1.65 ± 0.54	1.73 ± 1.52
Double infection[2]		
Group I	1.64 ± 0.10	1.89 ± 1.13
Group II	1.48 ± 0.35	1.35 ± 0.10
Triple infection[3]		
Group I	1.85 ± 0.72	1.35 ± 0.17
Group II	1.34 ± 0.05	1.30 ± 0.17
Quadruple infection[4]		
Group I	1.28 ± 0.13	1.30 ± 0.17
Group II	2.28 ± 1.43	–

* The data includes an average of 15–20 samples. Infection with 1. single species; 2. two different species; 3. three different species; 4. four different species. Group I infections resulting in Leucopenia. Group II infections resulting in Leucocytosis.

In Group I of quadruple infection, VI is normal suggesting no anaemia due to this infection. In the remaining multiple infections, VI shows a significant range except in group II of triple infection, where the increase is only marginal. Hence macrocytic anaemia results from these infections.

(ii) *Pullets:* Infections with *R. tetragona* and *R. cesticillus* resulted in microcytic anaemia, since VI registers a significant drop in the value. Although no significant difference was observed VI values obtained in the *R. echinobothrida* and *A. galli* infections and group I of double infection and the value obtained in the uninfected group, the standard deviation of VI values in these infections is high suggesting a high variation among VI values in the individual sample birds. This is due to abnormal values in one or two individual sample birds.

To summarize, helminthiasis results in macrocytic anaemia of cockerels and microcytic anaemia in pullets.

The authors are grateful to Prof. P. Narayan Rao, for facilities.

27 October 1984

1. Shekhar, P. C., Ph.D. thesis submitted to Osmania University, 1982, 95.

RADIORESPONSE OF RESTING PRIMARY SPERMATOCYTES IN THE PRESENCE OF S-2(3-AMINOPROPYLAMINO) ETHYL PHOSPHOROTHIOIC ACID

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RESTING primary spermatocytes are highly prone to the radiation-induced damage and constitute one of the most radiosensitive components of the testis[1]. S-2-(3-aminopropylamino) ethylphosphorothioic acid, also known as WR-2721, is a thiophosphate radio-protector having bright prospects for clinical use. The present investigation is an attempt to study the protective effect of WR-2721 on the response of resting primary spermatocytes (R) of the mouse testis after exposure to moderate doses of gamma radiation.

Adult male Swiss albino mice were irradiated with 3, 6 and 8 Gy of ^{60}Co gamma rays in three groups with and without intraperitoneal injection of WR-2721 (400 mg/g b.w.), 15–30 min before irradiation. Testes were removed from the animals, autopsied at 1/4, 1, 2, 4, 7, 10, 14 and 28 days after irradiation, and fixed in the Bouin's fluid. Paraffin sections were cut at 5 μ thickness and stained with PAS-haematoxylin stain. Resting primary spermatocytes were counted from the tubules at stage VIII and the counts were corrected by the Aberchrombie's formula[2]. Identification and selection of the tubular cross sections for counting were based on the classification of Oakberg[3] and the duration of the various stages of the cycle was described by Oakberg[4] and Clermont and Trott[5].

The observations revealed that R spermatocytes were highly radio-sensitive as indicated by the large scale immediate cell death. This is also reported elsewhere[6–8]. It has been noticed that the number of R spermatocytes is directly affected by the damage to the spermatogonial population as they are formed by the differentiation of spermatogonia B.

After radiation exposure, the number of R spermatocytes decreased with time and with the increase in the dose of radiation upto day 1, reaching negligible quantities at day 2. Their number remained either zero or nearly zero upto day 7. At day 10, while it started to increase in a dose-dependent manner after exposure to 3 and 6 Gy, it continued to remain around zero upto day 14 in the 8 Gy treated group. At day 28 the quantity of R spermatocytes recovered to a significant extent. The experimental values were always found higher than their respective controls. The maximum number of R spermatocytes was observed in the testes treated with 3 Gy, lower in 6 Gy and lowest in the 8 Gy groups at all the intervals.

Table 1 *Variations in the percentage of resting primary spermatocytes per tubule C.S. in the testes of mouse after irradiation with (E) and without (C) WR-2721 pretreatment (mean ± S.E.)*

Treatment		Post irradiation time							
		1/4 day	1 day	2 day	4 day	7 day	10 day	14 day	28 day
3 Gy	C	92.13 ± 1.29	54.60 ± 1.40	2.40 ± 0.53	0	0	6.66 ± 0.51	29.44 ± 1.32	86.90 ± 1.75
	E	98.34 ± 1.63 *p* 0–01	65.11 ± 1.86 *p* 0.001	6.10 ± 0.42 *p* 0.001	0	0	13.07 ± 1.38 *p* 0.001	40.59 ± 1.77 *p* 0.001	97.55 ± 1.69 *p* 0.001
6 Gy	C	73.42 ± 2.17	50.13 ± 1.46	0.80 ± 0.20	0	0	3.02 ± 0.43	15.64 ± 0.90	74.53 ± 2.15
	E	81.96 ± 2.64 *p* 0.02	57.19 ± 1.85 *p* 0.01	4.27 ± 0.13 *p* 0.001	0	0	10.15 ± 0.80 *p* 0.001	25.48 ± 1.22 *p* 0.001	88.25 ± 2.99 *p* .001
8 Gy	C	63.72 ± 2.11	40.11 ± 1.38	0	0	0	0	0	60.79 ± 1.72
	E	70.16 ± 2.50 *p* 0.05	54.13 ± 1.45 *p* 0.001	0	0	0	0	0	72.18 ± 1.64 *p* < 0.01

1. Number of resting primary spermatocytes in the testes of normal, sham-irradiated mouse = 18.22 ± 0.67 per tubule C.S.
2. Figures represented in the table are based on arithmetic mean of 50 readings.
3. All probabilities (*p*) refer to *p* < . . . the value indicated.