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AGE RELATED EFFECT OF SODIUM HYPOPHOSPHITE ON THE PROTEIN CONTENTS OF *HENOSEPILACHNA VIGINTIOCTOPUNCTATA* (FABR.) (INSECTA)

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The concentration of protein contents increases with feeding of 10^3 μM conc. of Sodium hypophosphite to the adults of *Henosepilachna vigintioctopunctata* at all the age intervals. However, the pattern of increase and decrease in acidic and total protein content remains the same in case of SHP treated adults as was in normal adults. The females of normal as well as of treated group possess high concentration of protein contents than that of males at comparable age intervals.

INTRODUCTION

It has been reported by Bauman (1969), Levenbook & Krishna (1971), Blevins (1973), Ring (1973) and that protein synthesizing capacity declines with ageing in different insects studied by them. As synthesis of proteins involves the polymerization of amino acids, therefore, the changes in availability of amino acids may lead to the changes in protein structure and synthesis that may contribute to the ageing of an organism (Levenbook & Krishna, 1971). The feeding of favourable concentration of SHP removes the free radicals from the body which are responsible for causing ageing by the formation of altered protein molecules. Thus antioxidant SHP increases the protein synthesizing capacity of the adults. The objective of the paper is to find-out the effect of SHP antioxidant (10^3 μM) on protein contents during ageing of *H. vigintioctopunctata.*

MATERIAL AND METHODS

The insect under study was reared on fresh leaves of *Solanum melongena* Linn. at 30 ± 2^0C Temperature and 70-75% Relative humidity in BOD incubator. The cultures ranging from 0-day uptill death were maintained for experimentation, one of normal adults and the other one of SHP treated cohorts. The colorimetric estimation of protein contents was done by the method of Lowry *et al.* (1951).

RESULTS AND DISCUSSION

Age-related variations in total protein contents as well as of acidic protein contents of normal and treated group are tabulated in Table I-III. It is very much clear from the Table I & III that value of total as well as acidic protein contents is more at all the age intervals as compared to its value in the normal adults. However, the pattern of changes remains the same as was in normal adults.

Table I. Acidic protein contents of normal and Sodium hypophosphite ($10^3 \mu$M conc.) treated adult of *H. vigintioctopunctata* (Fabr.).

Age in days	Acidic protein in mg/g wet body weight ± S.D.			
	Normal		SHP treated	
	Male	Female	Male	Female
0	175.26 ± 0.08	180.34 ± 0.02	187.20 ± 0.06*	192.46 ± 0.06*
4	132.37 ± 0.06[a]	140.42 ± 0.06[a]	148.23 ± 0.12[a*]	154.28 ± 0.08[a*]
% dec.	-24.47	-22.13	-20.81	-19.83
8	170.56 ± 0.12[a]	180.32 ± 0.08[a]	172.26 ± 0.20[a*]	182.32 ± 0.02[a*]
% Inc.	+28.85	+28.41	+16.21	+18.17
12	150.24 ± 0.18[a]	158.56 ± 0.16[a]	160.32 ± 0.02[a*]	165.52 ± 0.16[a*]
16	132.41 ± 0.16[a]	140.18 ± 0.18[a]	150.48 ± 0.18[a*]	156.16 ± 0.26[a*]
20	64.54 ± 0.22[a]	66.22 ± 0.22[a]	85.32 ± 0.06[a*]	122.22 ± 0.32[a*]
% dec.	-62.15	-63.27	-50.47	-
24	115.56 ± 0.30[a]	80.32 ± 0.26[a]	120.48 ± 0.02[a*]	89.26 ± 0.34[a*]
% dec.	-	-	-	-51.04
28	120.24 ± 0.26[a]	126.36 ± 0.32[a]	122.12 ± 0.18[a*]	129.32 ± 0.18[a*]
32	126.32 ± 0.18[a]	130.42 ± 0.18[a]	128.42 ± 0.24[a*]	134.48 ± 0.16[a*]
% Inc.	+95.72	+96.94	+52.85	+50.66
36	98.93 ± 0.20[a]	104.12 ± 0.09[a]	127.26 ± 0.26[a*]	134.18 ± 0.12[a*]
40	90.42 ± 0.08[a]	112.16 ± 0.06[a]	127.18 ± 0.32[NS*]	133.22 ± 0.26[a*]
44	-	98.14 ± 0.12[a]	126.84 ± 0.12[NS*]	133.02 ± 0.32[NS]
47	-	-	126.26 ± 0.18[b*]	-
48	-	-	-	132.92 ± 0.40[NS]
50	-	-	-	-
52	-	-	-	132.32 ± 0.32[NS]
% dec.	-28.41	-24.75	-1.68	-1.38
Overall dec.	-84.84	-82.20	-60.94	-60.14

S.D. Denotes Standard Deviation of the means; $a_p < 0.005$ Highly significant; $b_p < 0.01$ Very significant; $c_p < 0.05$ Significant; NS = Not significant as compared to the reading preceding it in the column.

*P < 0.005 Highly significant; Difference between values in the rows; P = Values have been calculated by applying students 't' test; (Inc. = Increase; Dec. = Decrease)

The fall in protein contents between 0-4 days, 8-20 days and the fall in it during 4-8 days and 20-32 days is more pronounced in normal adults as compared to the SHP treated adults (Table I & III).

The increase in protein contents with antioxidant feeding may be due to the increase in protein synthesizing capacity and decrease in protein degradation. This observation points-out that during the normal metabolism, a lot of free radicals are produced which result in the decline in protein synthesis and increase the degradation of proteins with the result, level of protein contents goes down in comparison to that of treated cohorts, in which free radicals are quenched with antioxidant SHP. As the changing trend of protein contents remains the same in treated adults as was in normal adults, so these changes do not disturb the biological expression of different phases of life cycle.

Table II. Basic protein contents of normal and Sodium hypophosphite (SHP, 10^3 μM conc.) treated adults of *H. vigintioctopunctata* (Fabr.).

Age in days	Basic protein in mg/g wet body weight ± S.D.			
	Normal		SHP treated	
	Male	Female	Male	Female
0	11.02 ± 0.28	14.98 ± 0.01	$9.12 \pm 0.83^{*}$	$8.00 \pm 0.10^{*}$
4	15.86 ± 0.92^{a}	9.68 ± 0.02^{a}	$12.33 \pm 0.21^{a}*$	$10.06 \pm 0.12^{a*}$
8	15.09 ± 0.82^{NS}	13.24 ± 0.12^{a}	$18.02 \pm 0.62^{a}*$	$17.50 \pm 0.18^{a*}$
12	10.08 ± 0.24^{a}	11.26 ± 0.16^{a}	$10.02 \pm 0.28^{a}*$	$12.74 \pm 0.10^{a*}$
16	9.77 ± 0.02^{NS}	8.02 ± 0.20^{a}	$12.42 \pm 0.34^{a*}$	$14.02 \pm 0.16^{a*}$
20	11.08 ± 0.81^{c}	24.14 ± 0.10^{a}	$20.16 \pm 0.38^{a*}$	$7.20 \pm 0.20^{a*}$
24	12.78 ± 0.26^{c}	12.10 ± 0.12^{a}	$13.60 \pm 0.42^{a*}$	$20.16 \pm 0.22^{a*}$
28	10.28 ± 0.16^{a}	15.84 ± 0.16^{a}	$18.22 \pm 0.16^{a*}$	$19.10 \pm 0.14^{a*}$
32	9.96 ± 0.82^{NS}	17.76 ± 0.20^{a}	$27.20 \pm 0.22^{a*}$	$25.82 \pm 0.18^{a*}$
36	9.61 ± 0.76^{NS}	14.20 ± 0.24^{a}	$27.56 \pm 0.18^{NS*}$	$24.98 \pm 0.22^{a*}$
40	8.96 ± 0.24^{NS}	10.24 ± 0.24^{a}	$26.80 \pm 0.12^{a*}$	$25.20 \pm 0.26^{NS*}$
44	-	12.14 ± 0.26^{a}	26.62 ± 0.08^{NS}	$25.20 \pm 0.30^{NS*}$
47	-	-	26.58 ± 0.04^{a}	-
48	-	-	-	$25.02 \pm 0.12^{NS*}$
50	-	-	-	-
52	-	-	-	25.34 ± 0.16^{a}
Overall Inc./Dec.	-2.06	-2.84	+17.46	+17.34

S.D. Denotes Standard Deviation of the means; $a_p < 0.005$ Highly significant; $b_p < 0.01$ Very Significant; $c_p < 0.05$ Significant.

NS = Not significant as compared to the reading preceding it in the column; $^{*}p < 0.005$ highly significant; Difference between values in the rows; P = Values have been calculated by applying students's t-test.

The decline in protein contents during 0-4 days in normal as well as in treated cohorts may be due to the breakdown of unused larval proteins which remain unused during metamorphosis. Similar observations have been made by Chen (1972) in *Drosophila melanogaster* and Sidhu & Kumar (1980) in *Chilomenes sexmaculata*. However, during this period the lesser decrease in protein contents in treated group of adults may be due to the fact that in treated adults, shaping up of the adults gets completed at an early stage after emergence leaving beind less unused larval proteins which on the other hand in normal individuals get degraded, subsequently pushing the level of proteins downward (Table I & II).

The increase in protein contents during 4-8 days in normal and treated group of adults may be due to the period of attainment of sexual maturity, as the proteins are needed to acquire full reproductive potential by the adults of this insect. In females, the upward trend justifies the process of incorporation of proteins in the maturing oocytes and in males for the production of viable sperms. Moreover, it has also been observed the synthesis and release of yolk proteins during sexual maturity. Similarly observations have been made by Sifat & Mumtaz (1974) in *Dysdercus cingulatus*, Dejmal & Brokes (1968) in *Leucophora maderae*, Bell (1969) in *Periplaneta americana* and Stay & Coop (1973) in *Diploptera punctus*. However, the increase in total and acidic proteins during this period is more pronounced in normal adults as compared to the treated adults. This

may be due to the fact that in treated group maturing of adults takes place earlier at the time of emergence, hence increase in protein contents is less during this period. Secondly as in normal adults some proteins are required to compensate the effect of free radicals, which are no where in treated adults.

Table III. Total protein contents of normal and Sodium hypophosphite (SHP, 10^3 μM conc.) treated adults of *H. vigintioctopunctata* (Fabr.).

Age in days	Total protein in mg/g wet body weight ± S.D. Normal		SHP treated	
	Male	Female	Male	Female
0	186.28 ± 0.36	195.32 ± 0.03	196.32 ± 0.89*	200.46 ± 0.16*
4	148.23 ± 0.98^{a}	150.10 ± 0.08^{a}	160.56 ± 0.08^{a*}	164.34 ± 0.33^{a*}
% dec.	-20.42	-23.15	-18.21	-18.01
8	180.65 ± 0.94^{a}	193.56 ± 0.20^{a}	190.28 ± 0.82^{a*}	199.82 ± 0.20^{a*}
% Inc.	+21.87	+28.95	+18.51	+21.58
12	160.32 ± 0.42^{a}	169.82 ± 0.32^{a}	170.34 ± 0.30^{a*}	178.26 ± 0.26^{a*}
16	142.18 ± 0.18^{a}	148.20 ± 0.38^{a}	162.90 ± 0.52^{a*}	170.18 ± 0.42^{a*}
20	85.62 ± 1.03^{a}	90.36 ± 0.32^{a}	105.48 ± 0.44^{a*}	129.42 ± 0.52^{a*}
% dec.	-52.60	-53.31	-44.56	-
24	128.34 ± 0.56^{a}	92.42 ± 0.38^{a}	134.08 ± 0.44^{a*}	109.42 ± 0.66^{a*}
% dec.	-	-	-	-45.24
28	130.52 ± 1.20^{a}	142.20 ± 0.48^{a}	140.34 ± 0.34^{a*}	148.42 ± 0.32^{a*}
32	136.28 ± 1.00^{a}	148.18 ± 1.38^{a}	155.62 ± 0.46^{a*}	160.30 ± 0.34^{a*}
% Inc.	+59.16	+63.98	+47.53	+46.49
36	108.54 ± 0.96^{a}	118.32 ± 0.31^{a}	154.82 ± 0.44^{c*}	159.16 ± 0.34^{a*}
40	99.38 ± 0.32^{a}	112.40 ± 0.30^{a}	153.98 ± 0.44^{c*}	158.42 ± 0.52^{NS*}
44	-	110.28 ± 0.38^{a}	153.46 ± 0.20^{NS}	158.22 ± 0.62^{NS*}
47	-	-	152.84 ± 0.22^{b}	-
48	-	-	-	157.94 ± 0.52^{NS}
50	-	-	-	-
52	-	-	-	157.66 ± 0.48^{NS}
% dec.	-27.08	-1.78	-25.57	-1.64
Overall dec.	-86.90	-43.48	-85.04	-42.80

S.D. Denotes Standard Deviation of the means; $a_p < 0.005$ Highly significant; $b_p < 0.01$ Very significant; $c_p < 0.05$ Significant;

NS = Not significant as compared to the reading preceding it in the column.

*P < 0.005 Highly significant; Difference between values in the rows.

P = Values have been calculated by applying students 't' test.

(Inc. = Increase Dec. = decrease)

The decline in protein contents during reproductive period (8-20 days) justifies their role during active oviposition in females and formation of viable sperms in males. Kumar *et al.* (1988) had made similar observations in the insects studied by them. However, the quantum of decrease is more in normal adults as compared to that of SHP treated adults. Furthermore, in case of treated females, the egg laying period is prolonged. This may be due to the fact that treated females have more efficient

homeostatic mechanism to make them able to resist the changes in the environment. This is also responsible for their longer life span.

During the period ranging between 20-32 days the protein contents increase. This may be due to the attempt made by the female to evade death. The increase is more in normal group of adults. This can be explained by saying that as loss of proteins is less in treated adults, because of the presence of lesser free radicals hence to compensate this loss, lesser proteins are required in treated individuals.

At the end of adult life *i.e.* after 32 days, the value of proteins once again declines. This decrease is due to the decline in protein synthetic capacity in both the sexes. The decline during this period is more and abrupt in normal adults as compared to the treated adults. As in case of normal adults protein synthesizing capacity is reduced abruptly due to the action of free radicals which is less so in treated adults.

The basic protein contents remain constant throughout the adult life span of *H. vigintioctopunctata* (Table III). Rath & Patnaik (1980) remarked that the basic proteins in the tissues is a crude measure of its amount in nucleoproteins and it is also known that in these proteins, the variability with respect to age is least, because they are conserved during evolution and involved in maintaining the structural and fuctional integrity of genetic material that's why, in the present insect also, they show a constant level throughout the life span in both the sexes (Table III). The same is the reason that the effect of antioxidant is also least on these proteins.

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