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Original Research Article

Effect of Synthetic Vitamin 'C' Supplementation on Growth and Food utilization in NB_4D_2 race of Silkworm *Bombyx mori* L.

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Abstract: Synthetic Vitamin C is a water soluble micro-nutrient. The chemical name for vitamins C is Ascorbic acid also known as hexuronic acid and antiscorbutic acid that is susceptible to oxidation. The present study was carried out to know the effect of synthetic vitamin C on NB_4D_2race of silkworm *Bombyx mori* L. fed ad libitum mulberry leaves Morus alba at different concentrations of Synthetic vitamin C. The study was conducted from hatching to pupation at 26^0+2^0 c with 80+10% Relative Humidity. The food utilization parameters like food intake, faeces defecation, assimilation, food converted, oxidation, feeding rate, assimilation rate, conversion rate, metabolic rate, and assimilation efficiency, conversion efficiency (K1 and K2) were studied. It has been observed that the 0.5% vitamin C treated group plays a significant role with an increase in growth and better food intake compared to control group and other vitamin C treated groups. Hence it is indicated that administration of vitamin C stimulate metabolic activity which is used to increase the Growth and feeding efficiency with reference to Silkworm rearing.
Keywords: Ascorbic acid, *Bombyx mori* L. Growth, Micronutrient, Mulberry leaves.

INTRODUCTION

The nutrients requirement depends upon the amount of absorbed nutrient that is necessary for maintaining the normal physiological functions of the body. The vitamins are accessory food factors which are organic in nature and must be supplied from outside example through foods. Nutrition plays an important role in Biological characteristics of silkworm. Silkworm is a monophagous insect derives almost all the nutrients required for its growth from the mulberry leaf Nasreen *et al.* [1]. The role nutrition's in silkworm physiology is considered as a major research area in sericulture field Legay [2].

As such it is important to study the influence of vitamin C on the food utilization budget, a great deal of information is available on the effect of Ascorbic acid and other nutrition's on various parameters. Balasundaram *et al.;* [3], Rahmathulla and suresh [4], Etebari *et al.* [5], Pallavi and kaliwal[6], Luciano cappellozza *et al.*[7]. The information related to study of Bioenergetics to know the effect of vitamin C is paucity. Hence the present study experiments were carried on different concentration to know the Synthetic Vitamin C supplementation on food utilization parameters inNB_4D_2race of silkworm Bombyx mori L. and the Growth activity of silkworm larvae fed ad libitum Morus Alba at 26^0+2^0 c with 80+10% Relative Humidity

MATERIALS AND METHOD

Diseases free egg lying of silkworm Bombyx mori L. namely NB_4D_2 race were obtained from Central Sericulture Research and Training Institution, Mysore. After the incubation period of 10 days, the freshly hatched larvae were transferred to enamel trays (36x 26 x4 cm) covered with paraffin paper to prevent loss of water from the leaf bed. The experiment were conducted in triplicate with 50 larvae in each group and the larvae from first to fifth in star was fed with ad libitum mulberry leaves Morus alba with the different concentrations of synthetic vitamin c i.e.(0.5%, 1.0%, 1.5% and 2.0% concentrations) at 26^0+2^0 c and relative humidity 80+10%. The larvae of experimental group was fed with mulberry leaves treated with different vitamin C concentration four times at 6.A.M, 11.A.M, 3.P.M and 8.P.M. Simultaneously, the larvae were reared under control at 26^0+2^0 c and R.H. 80+10%. Its effect on vitamin C concentration an food utilization was studied by using IBP formula and technology Petrusewicz and Mecfadyen [8]. Sacrifice method described by Mayanard and Loosli [9], for accessing the growth of laboratory Mammals and fishes Gerking [10], Menzel [11], Pandian [12] and insects Delvi [13].was employed in the present study. The difference between the final weight and initial weight is the Growth of insect in each in star. The data were analysed by using Mean, Standard deviation and Growth by using

ANOVA followed by Tukey's multiple range test [TMRT].

RESULTS AND DISCUSSIONS

The data on the influence of Synthetic Vitamin C on Growth and Bioenergetics of the Silkworm NB4D2 race are presented in Table 1, 2, 3 and 4. Food consumption indicates a good response to the quality of food consumed by Bombyx mori L. and has direct effect on growth, development and performance of the individual from first to fifth in star period of rearing. There was significant increase in larval growth in all the vitamin C treated groups compared to control group. These findings are in conformity with those of Mahmood[14], Rezunal Islam [15], who were recorded better body weight as well as length after feeding minerals, nitrogen, potassium, phosphorus and nickel chloride supplemented leaves. But higher concentrations of these will results in deleterious effects on the growth.

In the present study there was a significant increase in food intake/consumption of food in all four vitamin C treated groups i.e. 0.5%, 1.0%, 1.5% and 2.0%. It was highest at 0.5% concentration ranged to 6807.51 mg dry weight and started decreasing from 1.0%, 1.5% and 2.0% concentrations of Vitamin C and was minimum in control group, which is averaged to 3864.49 mg dry weight. The food consumption plays a very important direct relevance on the weight of the larvae. However, it has been suggested that the consumption and productivity varies depending on the type of nutrition[16, 17]. Feeding rate in the silkworm Bombyx mori decreased with increase in the body weight or age, irrespective of the factors like food quality, scotoperiod or photoperiod [18, 19]. Feeding rate can be modified by the worm depending on the amount of food consumed in Bombyx mori[20]. Increase in the food intake and decrease in the feeding rate may due to increase in body weight. Faeces defecated significantly increased in all the Vitamin C treated groups, it is the mirror image of food intake and the production of excreta depends on quality of food, rate of food intake and efficiency of digestion.

Food assimilation, assimilation rate and assimilation efficiency increased at 0.5% vitamin C treated group compared to control group and other vitamin C treated groups. Similarly food conversion, conversion rate and conversion efficiency was observed to be highest at 0.5% Vitamin C concentrated group and starts decreasing with the increase in vitamin C concentrations. The total oxidation and metabolic rate registered a slight increase over the control feeding at 26^0+2^0 c and RH 80+10%. From the data, it is evident that vitamin C plays a key role in silkworm physiology and that this role changes according to the development stage. During the hatching to pupation a stimulating effect was postulated by Ito [21]. Feeding trials conducted by several workers proved that the level of nutrient in different varieties of mulberry have significant influence on growth and development of silkworm and cocoon production Krishna swami *et al.* [22], Bari *et al.*[23], Machii and Kattagiri [24], Ganesh prabu *et al* [25]. Information about ascorbic acid biosynthesis capacity of insect tissue is scanty. Further it can be concluded that improvement in the quality of mulberry leaves by fortification methods with specific concentration of ascorbic acid can improve the economic parameters of Bombyx mori L.

Table: 1 Effect of Synthetic Vitamin 'C' on the total food intake, faeces defecated, assimilation, conversion and food oxidized from hatching to pupation in the silkworm Bombyx mori L. [NB_4D_2 race] fed ad libitum Morus alba at 26°± 2° C and the RH. 80 ± 10%. at different concentrations. The control worms were maintained at room temperature. All the values were expressed as mg dry weight per in star.

	Concentration				
	Control	0.5%	1.0%	1.5%	2.0%
Life Span	26.5	19	19	19	21.5
Food Intake	4395.23 +153.23	6807.51 ± 328.4	5351.89 ± 94.53	5116.58 ± 66.94	4997.06 ± 63.02
Faeces defecated	2389.9 +369.1	3232.3 ± 71.27	2676.3 ± 17.07	2588.6 ± 35.42	2535.6 ± 55.47
Food assimilated	2005.26 +54.231	3575.12 +75.241	2675.44 +45.21	2527.98 +143.2	2461.4 +56.26
Food converted	533.50 +74.56	741.63 ± 672.4	568.17 ± 766.7	551.31 ± 622.1	537.66 ± 383.4
Food oxidized	1471.7 +89.36	2833.4 +15.89	2107.3 +89.16	1976.7 ± 76.48	1923.7 ± 79.04

Table:2 Effect of Synthetic Vitamin 'C' on the total feeding rate, assimilation rate, conversion rate and metabolic rate from hatching to pupation in the silkworm Bombyx mori L. [NB_4D_2 race], fed adlibitum Morus alba at 26°± 2° C and the 80 ± 10% RH. at different concentrations. The control worms were maintained at room temperature. All the values were expressed in mg dry weight / mg live weight / insect / day.

Rates	Concentration				
	Control	0.5%	1.0%	1.5%	2.0%
Feeding Rate	0.74283 +75.63	1.58007 ± 0.087	1.4442 ± 0.075	1.3184 ± 0.067	1.16725 ± 0.071
Assimilation Rate	0.5743 +13.29	1.3529 ± 0.11	1.2204 ± 0.073	1.1034 ± 0.069	0.9835 ± 0.1276
Conversion Rate	0.03356 +45.37	0.0464 +89.43	0.0476 ± 0.047	0.0473 ± 0.002	0.0399 ± 0.004
Metabolic Rate	0.5406 +78.91	1.3064 ± 0.081	1.1729 ± 0.072	1.0720 ± 0.070	0.9436 ± 0.055

Table-3 Effect of Synthetic Vitamin 'C' on the total Assimilation Efficiency, Cross Conversion Efficiency (K1), and Net Conversion Efficiency (K2) from hatching to pupation in the silkworm Bombyx mori L. [NB_4D_2 race], fed ad libitum Morus alba at 26°± 2° C and the 80 ± 10% RH. at different concentrations. The control worms were maintained at room temperature. All the values were expressed in percent.

Efficiencies	Concentration				
	Control	0.5%	1.0%	1.5%	2.0%
Assimilation Efficiency	61.54 ± 15.19	69.65 ± 63.02	67.33 ± 35.42	67.17 ± 15.19	68.06 ± 75.61
Gross conversion Efficiency (K1)	8.5 ± 71.03	7.16 ± 55.47	7.48 ± 94.53	7.60 ± 321.5	7.42 ± 76.27
Net Conversion Efficiency (K2)	17.87 ± 76.48	13.33 ± 79.04	14.41 ± 71.03	14.78 ± 384.3	14.40 ± 32.56

Table-4 Effect of Synthetic Vitamin 'C' on growth of silkworm Bombyx mori L. (NB_4D_2 race) from hatching to pupation, fed ad libitum Morus alba at 26°± 2° C and the 80 ± 10% RH. At different concentrations. The control worms were maintained at room temperature. The values are expressed in mg wet weight per insect.

Growth	Concentration					F - Value
	Control	0.5%	1.0%	1.5%	2.0%	
1st instar after hatching	0.100 ± 0.0057	0.1833 ± 0.6009	0.1667 ± 0.04410	0.1600 ± 0.04163	0.1033 ± 0.133	0.983 P = 0.459
2nd instar after hatching	3.5773 ± 0.2659	4.6667* ± 22.048	4.6067* ± 2053	4.5833* ± 20480	4.43261 ±0.24	4.433 P=0.026
3rd instar after hatching	24.7367 ± 0.9551	38.386* ± 1.46112	38.136* ± 1.27960	37.75* ± 1.2847	36.630* ± 1.587	19.310 **P=0.000
4th instar after hatching	92.4267 ± 1.93702	144.073* ± 4.4171	143.4867* ± 4.45784	139.03* ± 4.376	133.07* ± 6.1735	23.428 **P=0.000
5th instar after hatching	474.466 ± 2.9172	673.815* ± 2.9542	677.190* ± 6.17661	668.51* ± 2.1400	650.34* ± 2.8996	166.112 **P=0.000
Pre-pupation Period	1810.683 ± 5.1929	3701.536* ± 9.165	3694.293* ± 7.367	3623.12* ± 5.93	3473.58* ± 0.058	25.051 P=0.000

Values are expressed as mean and standard error mean of each stage. The data were analysed using one-way ANOVA and the groups were compared by Turkey's multiple range Test (TMRT).Post. Hoc. Statistically significant variations are expressed as *P<0.05, **P<0.01.

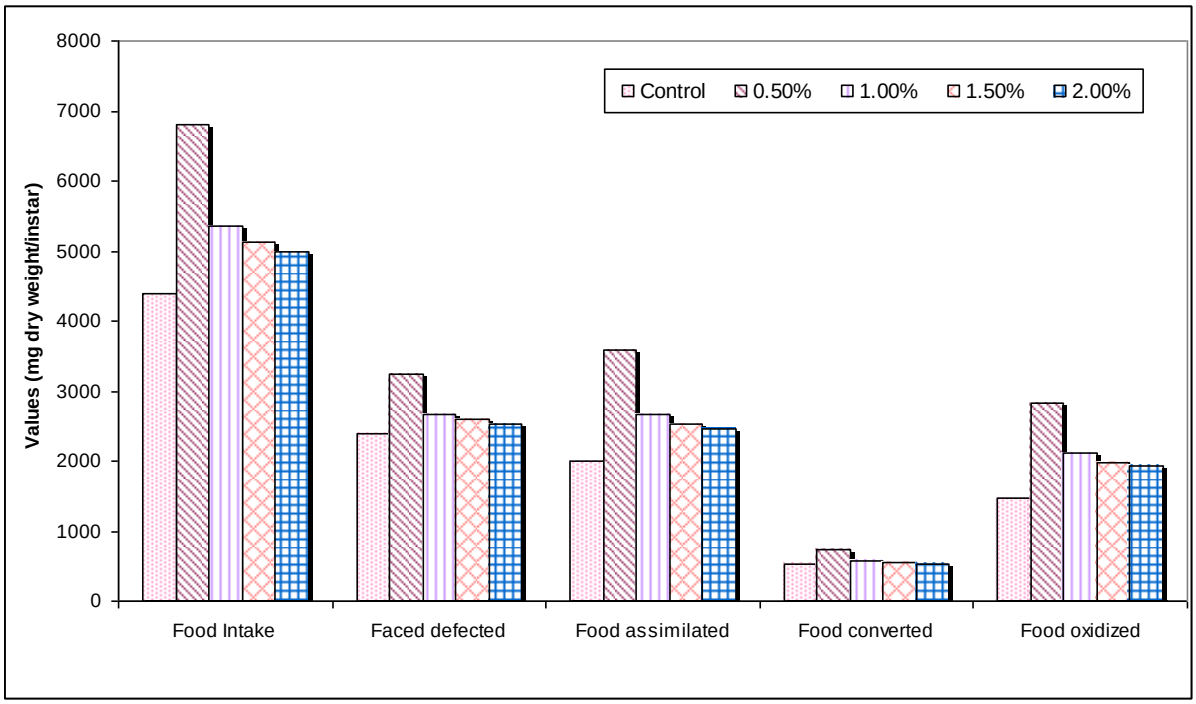

Fig-1:Effect of synthetic vitamin C on the total food intake, faeces defecated, assimilation, conversion and food oxidized from hatching to pupation in the silkworm Bombyx mori L. [NB_4D_2 race].

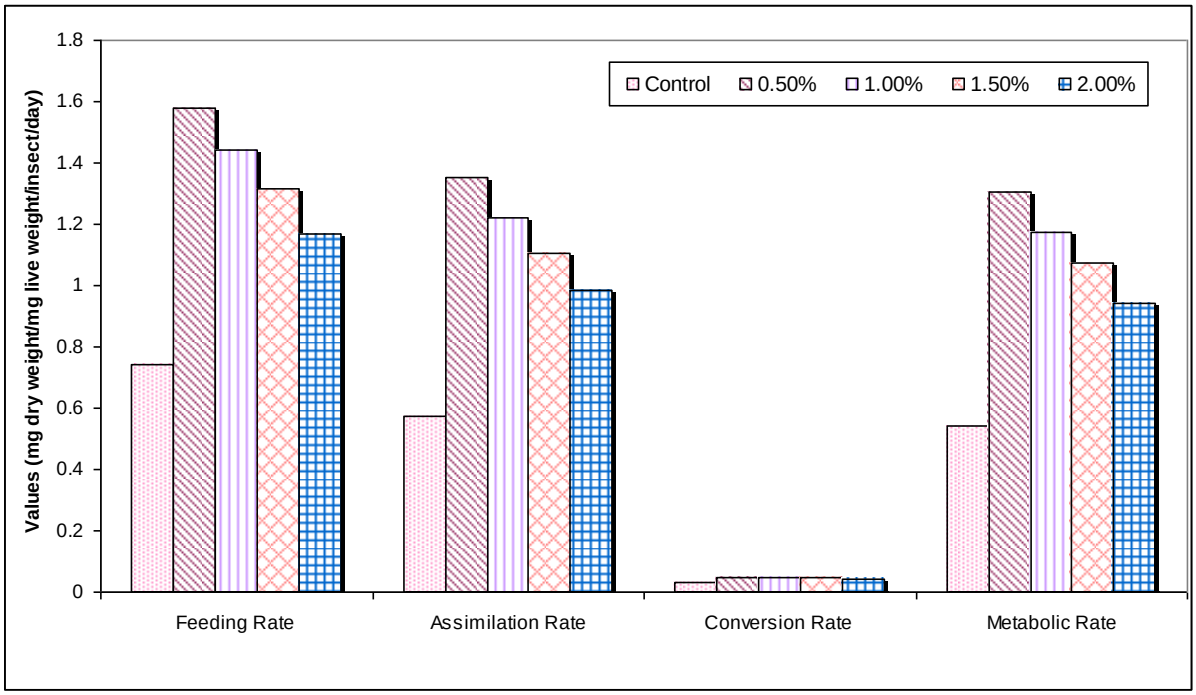

Fig-2:Effect of Synthetic Vitamin 'C' on the total feeding rate, assimilation rate, conversion rate and metabolic rate from hatching to pupation in the silkworm Bombyx mori L. [NB_4D_2race]

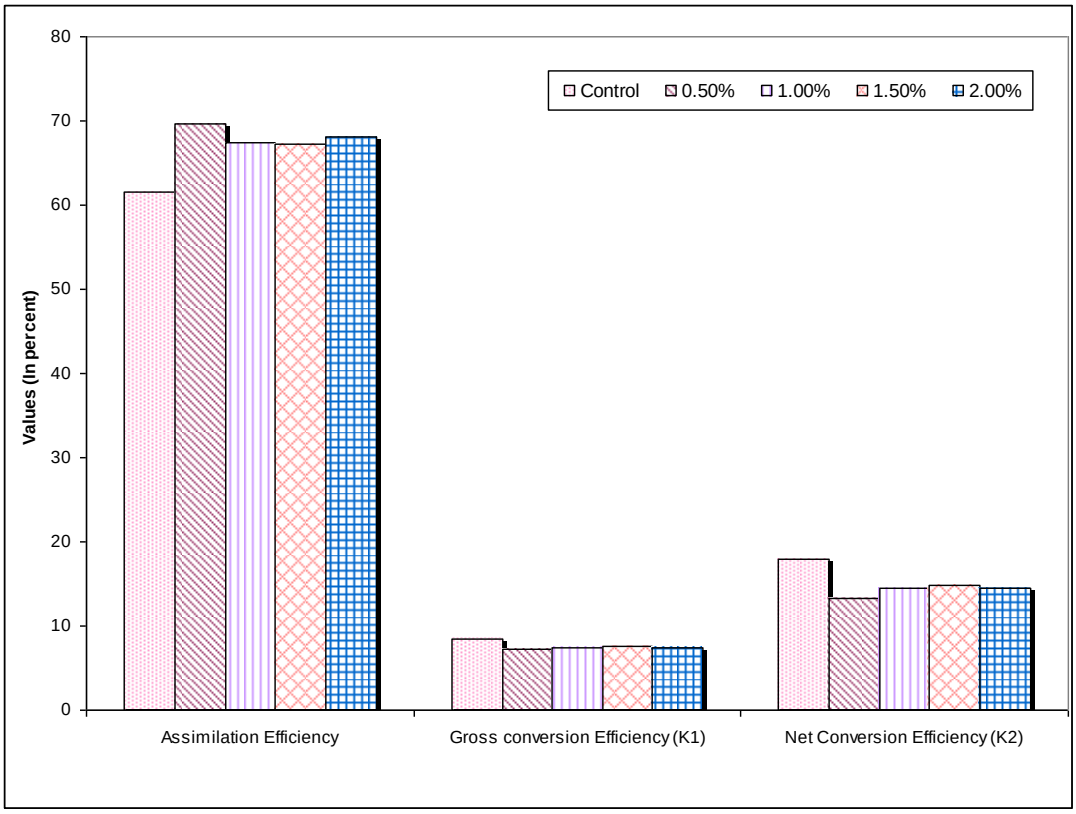

Fig-3: Effect of Synthetic Vitamin 'C' on the total Assimilation Efficiency, Cross Conversion Efficiency (K1), and Net Conversion Efficiency (K2) from hatching to pupation in the silkworm Bombyx mori L. [NB_4D_2 race].

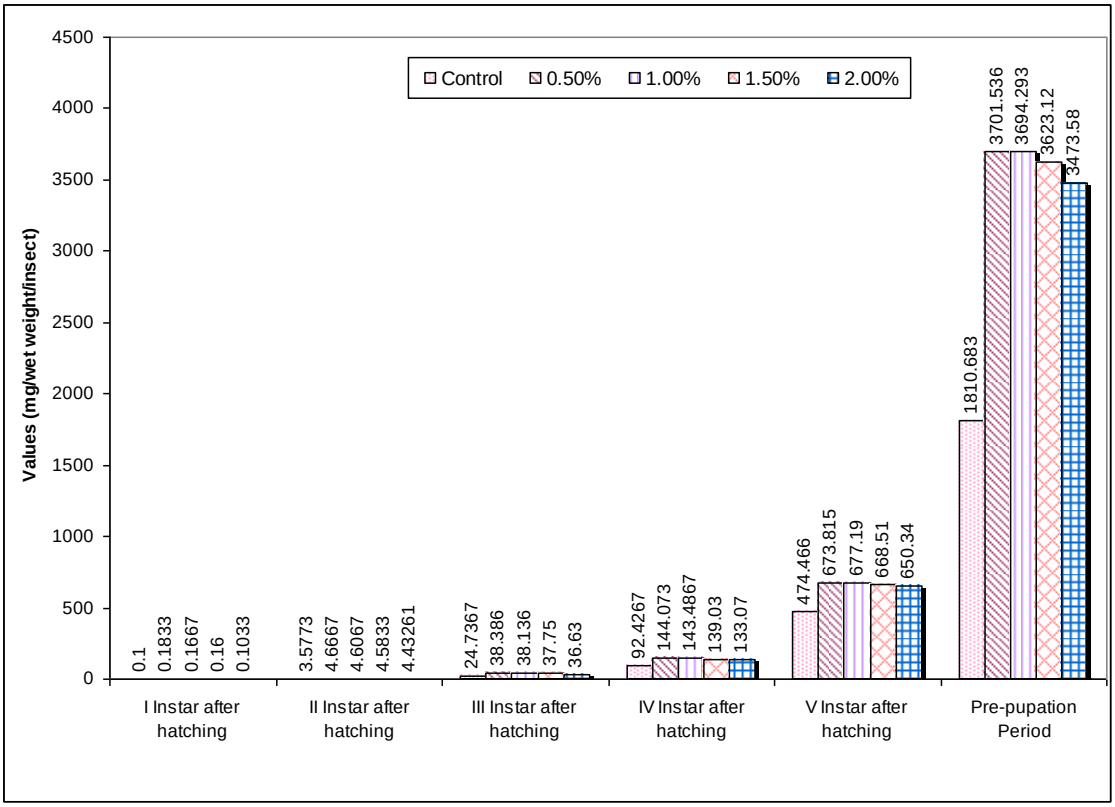

Fig-4: Effect of synthetic vitamin c on Growth of silkworm NB4D2 race from hatching to pupation fed ad libitum Morus alba at 26°± 2° C and the 80 ± 10% RH. At different concentrations

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