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Original Article

Effect of maternal deprivation on growth of wistar rats in preweaning period

Dhungel S
Additional Professor, Department of Anatomy, BP Koirala Institute of Health Science, Dharan, Nepal

Abstract
Objective: The objective of this study was to observe the effect of maternal deprivation on somatic growth of wistar rat pups viz. Body weight, nose-rump length, tail length and head length.
Materials and method: 5 days old 50 rat pups were studied dividing equally into control and experimental groups. Experimental group (N=25) of rats were maternally deprived 1-4 hours twice daily till the weaning period. Body weight and measurement of body parts were recorded at 4 days interval till 29th day. Recorded parameters were statistically analysed.
Result: The result of this study revealed that maternal deprivation stress produces significant effect in the body weight, nose-rump length and tail length from D9 till the study period whereas head length insignificantly affected.
Conclusion: MD stress has profound effects on somatic growth and found irreversible even after withdrawal for a period of 8 days.

Key words: Maternal deprivation, stress, body weight, somatic growth, preweaning period

Growth and developmental processes are regulated by various molecules such as DNA, RNA, proteins and growth releasing hormone (GRH) released by hypothalamus which in turn influence the somatotrophs of pituitary gland. The somatotrophs contain somatotrophin granules in the cytoplasm which is secreted as growth hormone (GH) and regulates the growth under normal and stressed conditionss[1].

Maternal deprivation (MD) produces stress in the rat pups in various forms, viz. depression and anorexia nervosa resulting stress-induced reduction in food intake[2].

Maternal deprivation causes release of Ornithine decarboxylase (ODC)[3] and brings about decrease in the growth hormones (GH) of rat pups.

Rossi et al described stress of any kind including maternal deprivation in rats produces erosion of gastric mucosa and ultimately produces gastric ulcers in rat resulting reduced food intake and subsequently affecting somatic growth.[4]

The stress-induced reduction, in food intake has been demonstrated both as an maintained decrease in 24-h food intake during and after repeated daily stress [5,6,7] and as an acute response in the hours immediately after a single stress [4,5]. Weight loss, induced by repeated stress session, appears after the first stress session and the rat continue to loose more weight with each exposure to stress. However, once stress has ended, stressed (maternally deprived) rats fail to return to the body weight of controlled one.[3,4,5]

Aims and objectives
The present study was undertaken to observe the effect of maternal deprivation on somatic growth of wistar rat pups in terms of:

a. Body weight (BW)
b. Nose-rump length (NR-L)
c. Tail Length (TL)
d. Head Length (HL)

Material and method
Adult 10 male and 10 female albino rats were procured and allowed for mating. After confirmation of mating (i.e. demonstration of spermatozoa in vaginal smear) female pregnant rats were kept in a separate cage with food and water provided ad libitum. Rats were monitored at 8-hour interval to observe the time they deliver.

Correspondence
Shaligram Dhungel
Additional Professor
Department of Anatomy
BP Koirala Institute of Health Science, Dharan, Nepal
Mob: 9841263651
Off. Ph.: 025-525555 extn: 2443

After delivery, five days old 50 rat pups were equally divided into control and experimental groups. Experimental group (N=25) was maternally deprived throughout the preweaning period. Deprivation period increased from 1-4 hours twice daily as per the following schedule[8].

Body weight, nose-rump length, tail length and head length were recorded at four days interval till the 29th day (D29) post-natal in both groups. From D5 to D29, body weight (BW) was recorded at 4 days interval in a sensitive single pan balance and linear measurements of body parts were recorded by means of a vernier calliper.

Nose-rump length (NRL) was taken from shout to the centre of anal opening. The tail length (TL) was measured from the centre of anal opening to the tip of the tail. The head length (HL) was measured from snout to the posterior margin of the skull.

From D21 to D28, the experimental group of rats was allowed to live in normal condition in the same manner as in control. Recorded parameters were tested statistically (Students T test) among the groups and comparison was made to observe the effect of maternal deprivation.

Table 1: Schedule of stress presentation (maternal deprivation)

Age (days)	Duration	Total Stress Period
5-8	1:00 hours twice daily	2:00 hours
9-12	2:00 hours twice daily	4:00 hours
13-16	3:00 hours twice daily	6:00 hours
17-20	4:00 hours twice daily	8:00 hours

Result

Results from recorded BW (Table 1) and linear measurement of body parts (NRL, TL & HL-Table 1 & 2) induced by MD appears after four days of stress session. Experimental group of rats continue to lose more weight and decrease NRL & TL till the end of Withdrawal of MD stress on D21 does not bring about reversible changes within a period of 8 days. However, head length (HL) found to be decreased in experimental groups (Table 2), showing statistically not significant (Table 2)

Table 1: Changes in body weight and nose-rump length in pre-weaning period in control and experimental group of rat pups (values expressed as mean ±SD)

Age (days)	Body weight (gm)		Nose-rump length (cm)	
	Control	*Experimental*	*Control*	*Experimental*
5	8.20 ± 0.30	8.19 ± 0.25	5.40 ± 0.40	5.42 ± 0.15
9	12.40 ± 0.73	11.51 ± 0.61*	6.75 ± 0.22	6.02 ± 0.18*
13	20.66 ± 0.39	10.63 ± 1.48 ***	7.98 ± 0.19	6.63 ± 0.36*
17	23.27 ± 0.45	15.85 ± 1.60 ***	8.65 ± 0.35	7.60 ± 0.10*
21	25. 89 ± 1.31	20.41 ± 1.64 ***	9.32 ± 0.29	8.65 ± 0.11*
25	30.80 ± 1.75	23.24 ± 1.30 ***	10.55 ± 0.35	9.68 ± 0.29*
29	35.90 ± 1.68	28.2 ± 2. 2 **	11.80 ± 0.40	10.70 ± 0.18

* = P< 0.05; * * =P < 0.01; * * * = p < 0.001

Table: 2 Changes in tail and head length during pre-weaning period in control and experimental rat pups (values expressed as mean ± SD)

Age (Days)	Tail length (cm)		Head Length (cm)	
	Control	Experimental	Control	Experimental
5	2.32 ±0.10	2.33 ±0.11	1.60 ±0.05	1.60 ±0.05
9	4.80 ±0.20	4.20 ±0.35*	2.34 ±0.08	2.29 ±0.06 ^{NS}
13	5.82 ±0.16	5.35 ±0.36 *	3.06 ±0.05	2.95 ±0.10 ^{NS}
17	6.18 ±0.10	5.65 ±0.40 *	3.16 ±0.12	3.08 ±0.13 ^{NS}
21	6.55 ±0.15	5.90 ±0.45*	3.26 ±0.19	3.20 ±0.18 ^{NS}
25	7.50 ±0.45	6.98 ±0.18*	3.42 ±0.10	3.39 ±0.08 ^{NS}
29	8.60 ±0.23	8.00 ±0.20*	3.59 ±0.05	3.48 ±0.05 ^{NS}

*NS=Not significant; * =p<0.05,*

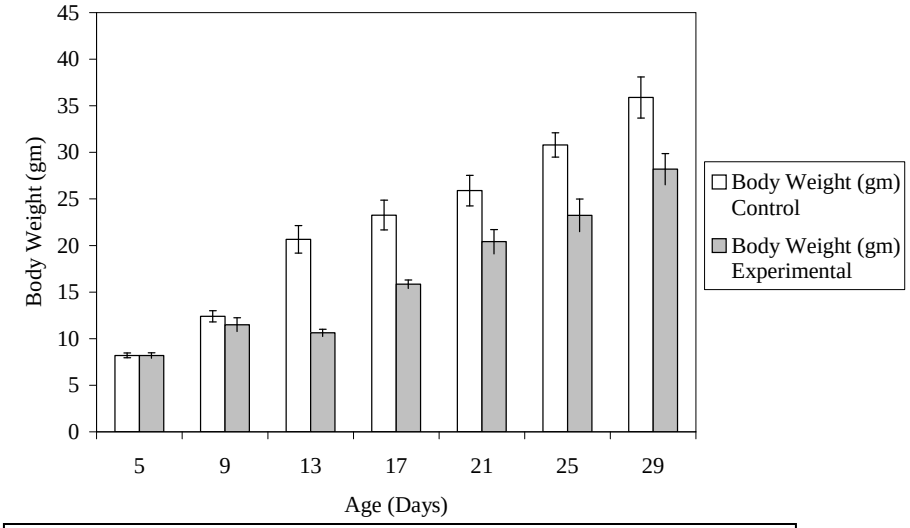

Fig 1: Graph showing changes in body weight in pre-weaning period in control and experimental group of rat pups

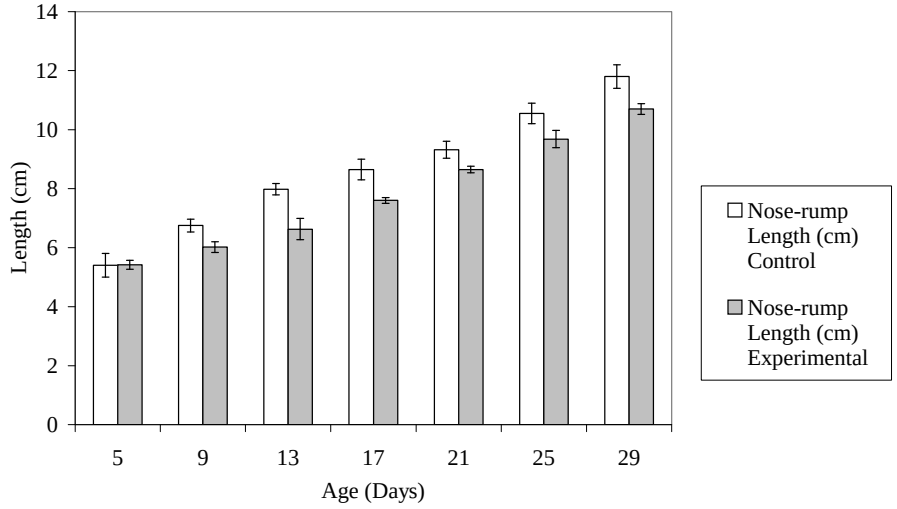

Fig 2: Graph showing changes in nose-rump length in pre-weaning period in control and experimental group of rat pups

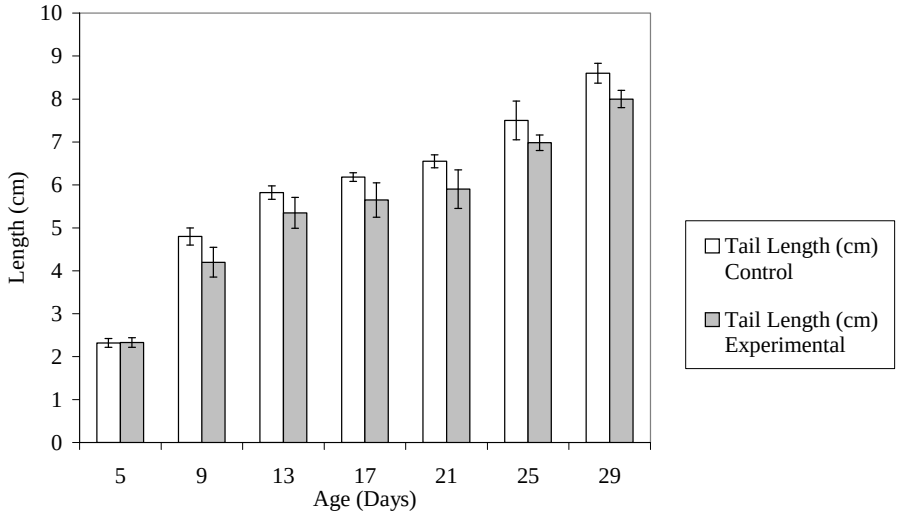

Fig 3: Graph showing changes in tail length during pre-weaning period in control and experimental rat pups

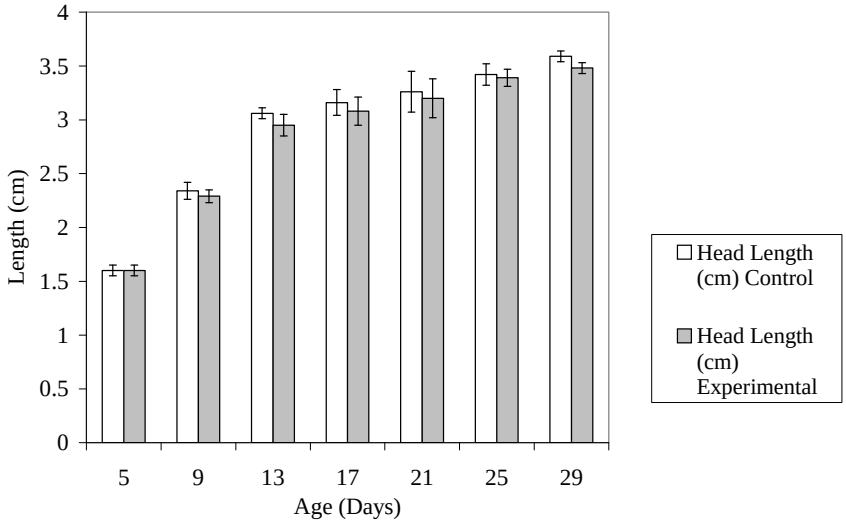

Fig 4: Graph showing changes in head length during pre-weaning period in control and experimental rat pups

Discussion

Experiment clearly demonstrates BW loss and decreased NRL, TL and HL in experimental group. Based on the established and pre-existing fact that MD causes a release of Ornithine decarboxylase3 which depressed serum growth hormone level of rat pups, significantly affected BW, NRL & TL in pre-weaning rats and beyond. Central mechanism involved in the stress-induced inhibition of food intake have not been fully elucidated, but certain peptides and neurotransmitter are thought to be involved in response. It is well established that monoaminers[11] and CRH [6,7] influence feeding behaviour and affects the body as a whole as well as individuals organs depending upon the type and intensity of stress.[5,9,10.]

Observation in a study[12] on sprague-Dawley rats indicate that change in the growth pattern of preweaning rats can be attributed to genetic endowment and maternal deprivation. In this study genetic endowment could not be assessed but maternal deprivation has demonstrated the attribution made by Park *et al.*

Conclusion

Maternal deprivation stress in pre-weaning period of rat pups has profound effect on somatic growth and found to be irreversible even after withdrawal for a period of 8 days.

These experimental findings may be correlated with similar growth pattern in human. Therefore it is not wrong to comment that mother should not be away from the newborn children.

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