CHAPTER V

DISCUSSION AND CONCLUSIONS
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Cognitive Ability Measures

A bivariate ANOVA performed on the nonverbal, abstract, intelligence scores, as measured by the RCPM, of four differential treatment groups of subjects revealed that the Grade/age and nutritional status (NS) yielded differential effects on the intellectual abilities or intellectual functioning of Oriya medium primary school children (see Table 3). In other words, the Grade II children (M = 17.53; SD = 5.19), irrespective of nutritional status, were found to be inferior to the Grade V children (M = 19.45; SD = 6.35), in their nonverbal, abstract, intellectual abilities. Similarly, the malnourished (MN) children (M = 13.70; SD = 2.59), irrespective of Grade/age, were found to be inferior to their wellnourished (WN) counterparts (M = 23.28; SD = 4.00) in their abstract intellectual functioning. These findings indicate that both higher Grade/age and wellnourishment had significant facilitatory effects on the nonverbal as well as abstract intellectual functioning of primary school children. However, the Grade was not found to have differential effects on both the levels of NS with regard to the performances of the subjects on RCPM, as evidenced by the nonsignificance of Grade x NS interaction effect (see Table 3).

Figure copying ability of children also measures their nonverbal intellectual ability. The two-way ANOVA performed on the figure copying scores of four
differential treatment groups of subjects revealed significant effects of Grade and NS (see Table 4). In other words, the Grade II children (M = 11.26; SD = 4.32), irrespective of nutritional status, showed poorer performance than the Grade V children (M = 12.95; SD = 3.74). Similarly, the malnourished children (M = 8.68; SD = 1.77) were poorer in their figure copying performances than their wellnourished counterparts (M = 15.54; SD = 2.66). These findings indicate significant facilitatory effects of both higher Grade/ age and wellnutrition on the figure copying abilities, and thus, on the nonverbal intellectual functioning of Oriya medium primary school children. However, the Grade was not found to have differential effects on both the levels of NS with regard to the performances of the subjects on FCT, as indicated by the nonsignificance of Grade x NS interaction effect (see Table 4).

Draw-a-child test also measures the nonverbal intelligence of children. The two-way ANOVA performed on the DACT scores of four differential treatment groups of subjects revealed the significant effects of Grade, NS, and Grade x NS interaction (see Table 5). In other words, the Grade II children (M = 9.49; SD = 3.98), irrespective of nutritional status, showed poorer performances in Draw-a-child test than the Grade V children (M = 11.73; SD = 4.64). Similarly, the malnourished children (M = 6.78; SD = 1.44) were inferior to their wellnourished counterparts (M = 14.44; SD = 2.85) in their DACT performances. In short, higher Grade/ age as well as wellnourishment had
significant facilitatory effects on draw-a-child abilities, and thus, on nonverbal intellectual abilities of children.

Grade was found to have differential effects on both the levels of NS, with regard to the draw-a-child performances of children, as evidenced by the significant Grade x NS interaction effect (see Table 5). The difference in the average DACT scores between the MN and WN children of Grade II was smaller than the difference between the MN and WN children of Grade V (see Figure 1). Moreover, the Scheffe test revealed that Grade V wellnourished children performed significantly better in draw-a-child task than the Grade V malnourished children, and also than the malnourished and wellnourished children of Grade II. Similarly, Grade II wellnourished children performed significantly better than the malnourished children of Grade II and Grade V in draw-a-child task. Moreover, Grade V malnourished children were superior to Grade II malnourished children in their DACT performance. In other words, higher grade and wellnourishment significantly positively interacted more in DACT performance of children compared to the performances G II-MN, G II-WN, and G V-MN groups of children as evidenced by the highest mean DACT scores of G V-WN children (see Table 2). In short, G V-WN children are more intelligent than the children of other three groups. Moreover, the better performances of G V-MN children than that of the G II-MN children showed that the adverse effect of early malnutrition has gradually dissipated over ages so that the malnourished children of Grade V showed superior performance.
Figure 1. Mean DACT scores of four differential treatment groups of subjects
A 2 x 2 factorial ANOVA performed on the nonverbal creative thinking fluency scores, as measured by TTCT - Figural Form-A, of four differential treatment groups of children revealed significant effects of both Grade and NS (see Table 7). In other words, Grade II children (M = 25.54; SD = 14.52), irrespective of nutritional status, were found to be inferior in nonverbal creative thinking fluency capacity than the Grade V children (M = 34.58; SD = 15.69). Similarly, the malnourished children (M = 18.68; SD = 7.42), irrespective of Grade/ age, were found to be inferior to their wellnourished counterparts (M = 41.44; SD = 13.45) in their nonverbal creative thinking fluency scores. These findings indicate that both higher Grade/ age and wellnourishment had significant facilitatory effects on the nonverbal fluency capacity of primary school children, as measured by the figural forms of TTCT. However, the Grade was found to have more or less similar effects on both the levels of NS with regard to the nonverbal creative thinking fluency scores of the subjects as evidenced by the nonsignificance of Grade x NS interaction effect (see Table 7).

A two factorial ANOVA performed on the nonverbal creative thinking flexibility scores, as measured by the TTCT - Figural Form A, of four differential treatment groups of subjects showed that both Grade and NS yielded significant effects (see Table 8). In other words, Grade II children (M = 25.79; SD = 15.04), irrespective of nutritional status, showed poorer performance in nonverbal creative thinking flexibility ability than the Grade V children (M = 31.0; SD = 14.21). Similarly, the malnourished children (M = 17.30; SD = 7.13), irrespective of Grade/ age, performed poorly in the nonverbal creative thinking flexibility test compared to their wellnourished counterparts (M = 39.49; SD =
11.91). These findings indicate that higher grade or age and better nutrition had significant facilitatory effects on the nonverbal flexibility abilities of primary school children. However, the Grade/age was not found to have differential effects on both the levels of NS with regard to the nonverbal flexibility abilities of children as evidenced by the nonsignificance of Grade x NS interaction effect (see Table 8).

A two-way ANOVA performed on the nonverbal creative thinking originality scores, as measured by the TTCT - Figural Form A, of four differential treatment groups of subjects revealed the significant effects of NS, and Grade x NS interaction (see Table 9). However, the Grade main effect was not found to be statistically significant. In other words, both Grade II (M = 27.91; SD = 15.93) and Grade V children (M = 28.14; SD = 12.0), irrespective of nutritional status, were more or less equal in their nonverbal originality abilities as measured by TTCT. However, the malnourished children (M = 16.99; SD = 6.39), irrespective of Grade/age, were found to be inferior to the wellnourished children (M = 39.06; SD = 10.5), in their nonverbal originality abilities. These findings indicate that wellnourishment, but not Grade/age, had significant facilitatory effect on the nonverbal/figural originality abilities of primary school children, as measured by TTCT.

The Grade/age was found to have differential effects on both the levels of NS, as evidenced by the significant interaction effect of Grade x NS (see Table 9). The difference in the average nonverbal creative thinking originality scores
between the malnourished and wellnourished children of Grade II was greater than that of the difference between MN and WN children of Grade V (see Figure 2). Further analysis by Scheffe test showed that Grade II malnourished children were found to be inferior to the wellnourished children of both Grade II and Grade V, in their nonverbal originality abilities. Similarly, Grade II wellnourished children were better than the Grade V malnourished children in their nonverbal originality abilities. Moreover, Grade V malnourished children were found to be inferior to their wellnourished counterparts with regard to their nonverbal originality scores. In other words, lower grade was found to interact significantly positively with the wellnourishment in the nonverbal originality abilities of children as evidenced by the highest originality scores of GII-WN children (see Table 6). However, the nonsignificance of the difference in nonverbal originality scores between GII-MN and G V-MN children, though there was slight improvement in originality abilities of G V-MN children, indicates very negligible decrement of the adverse effects of early malnutrition on the nonverbal creative thinking originality abilities of children over age.

A bivariate ANOVA performed on the nonverbal creative thinking elaboration scores, as measured by the TTCT-Figural Form A, of four differential treatment groups of subjects revealed the significant effects of both Grade, and NS (see Table 10). In other words, Grade II children (M = 27.54; SD = 17.60), irrespective of nutritional status, showed poorer performance in nonverbal elaboration test than the children of Grade V (M = 35.14; SD = 17.07).
Figure 2. Mean nonverbal originality scores of creative thinking abilities of four differential treatment groups of subject as measured by TTCT -Figural Form
MEAN TTCT NONVERBAL ORIGINALITY SCORES

M - MN
W - WN

GRADE

MEAN TTCT NONVERBAL ORIGINALITY SCORES

GRADED

II

V

0 5 10 15 20 25 30 35 40 45

- M - MN
- W - WN
Similarly, the malnourished children (M = 17.24; SD = 7.43), irrespective of Grade/age, were found to be inferior to their wellnourished counterparts (M = 45.44; SD = 13.12) in their nonverbal elaboration abilities, as measured by the TTCT. These findings indicate that both higher grade and better nutrition had significant facilitatory effects on the nonverbal elaboration abilities of children. However, Grade was not found to have differential effects on both the levels of NS with regard to the nonverbal elaboration abilities of children as evidenced by the nonsignificance of Grade x NS interaction effect (see Table 10).

A two-way ANOVA performed on the total nonverbal creative thinking scores, as measured by TTCT-Figural Form A, of four differential treatment groups of subjects revealed significant effects of Grade and NS (see Table 11). In other words, Grade II children (M = 106.28; SD = 56.59), irrespective of NS, showed poorer performance in Figural TTCT than the Grade V children (M = 130.21; SD = 50.44). Similarly, the malnourished children (M = 70.95; SD = 22.57), irrespective of Grade/age, were inferior to their wellnourished counterparts (M = 165.54; SD = 31.59) in their nonverbal creative thinking total scores. These findings indicate that both higher grade and wellnourishment had significant facilitatory effects on the nonverbal creative thinking abilities of children. However, Grade was found to have more or less equal effects on both the levels of NS with regard to the nonverbal creative thinking abilities of children as evidenced by the nonsignificance of Grade x NS interaction effect (see Table 11).
A bivariate ANOVA performed on the NLWM scores, as measured by DCT, of four differential treatment groups of subjects, revealed significant effects of Grade and NS (see Table 13). In other words, the nonlanguage working memory capacity of Grade II children (M = 2.83; SD = 1.09), irrespective of NS, was lower than that of the Grade V children (M = 3.59; SD = 0.95). Similarly, the nonverbal working memory capacity of the malnourished children (M = 2.49; SD = 0.73), irrespective of Grade/age, was less compared to that of their wellnourished counterparts (M = 3.93; SD = 0.90). These findings indicate that higher the grade/age and better the nutrition, greater is the nonverbal working memory capacity of children. However, Grade was not found to have differential effects on both the levels of NS with regard to the NLWM capacity of children, as evidenced by the nonsignificance of Grade x NS interaction effect (see Table 13).

A two-way ANOVA performed on the language-based working memory (LBWM) scores, as measured by reading span task (RST) revealed significant effect of nutritional status (see Table 14). In other words, the verbal working memory capacity of Grade II children (M = 2.36; SD = 0.72), irrespective of NS, was more or less equal to that of the Grade V children (M = 2.50; SD = 0.68). However, the verbal working memory capacity of malnourished children (M = 1.90; SD = 0.44), irrespective of Grade/age, was lower than that of the wellnourished children (M = 2.96; SD = 0.48). The Grade was found to have similar effects on both the levels of NS with regard to the verbal working memory capacity of primary school children, as evidenced by the nonsignificance of Grade
x NS interaction effect (see Table 14). These findings indicate that better nutrition, but not higher Grade, had a significant facilitatory effect on the LBWM capacity of children.

A two factorial ANOVA performed on the short-term memory (STM) scores, as measured by digit span forward (DSF) test, of four differential treatment groups of subjects revealed significant effects of Grade, NS, and Grade x NS interaction (see Table 16). In other words, the Grade II children (M = 4.94; SD = 1.22), irrespective of NS, were found to be inferior to the Grade V children (M = 5.39; SD = 1.66) in their digit-span-forward capacities. Similarly, the malnourished children (M = 3.99; SD = 0.58), irrespective of Grade/ age, performed poorly on the digit-span-forward test compared to their wellnourished counterparts (M = 6.34; SD = 1.10). These findings indicate that both higher Grade/ age, and wellnourishment had significant facilitatory effect on the STM capacity, as measured by DSF test, of Oriya medium primary school children.

The Grade was found to have differential effects on both the levels of NS, as evidenced by the significant interaction effect of Grade x NS (see Table 16). The difference in the average DSF scores between malnourished and wellnourished children of Grade II was smaller than that of the difference between MN and WN children of Grade V (see Figure 3). Further analysis by Scheffe test revealed that malnourished children of Grade II (G II-MN) were found to be inferior to the wellnourished children of both Grade II and Grade V, in their DSF scores. G II-WN children were found to be superior to G V-MN children, but inferior to
Figure 3. Mean DSF scores of four differential treatment groups of subjects
G V-WN children in their STM capacities, as measured by DSF test. Moreover, the wellnourished children of Grade V performed better than their malnourished counterparts on DSF test. In other words, higher grade was found to interact significantly positively with the wellnourishment in the DSF capacities of children as evidenced by the highest STM scores, as measured by DSF test, of G V-WN children (see Table 15). However, the nonsignificance of the difference in DSF scores between G II-MN and G V-MN children indicates very slight decrement of the adverse effects of early malnutrition on the STM capacities, as measured by DSF test, of children over ages.

A two-way ANOVA performed on the STM scores, as measured by digit-span-backward (DSB) test, of four differential treatment groups of subjects showed significant effects of both Grade and NS (see Table 17). In other words, the Grade II children (M = 2.90; SD = 1.34), irrespective of NS, showed poorer performance on DSB test than the Grade V children (M = 3.54; SD = 1.23). Similarly, the malnourished children (M = 2.24; SD = 0.75), irrespective of Grade/age, performed poorly on the DSB test compared to their wellnourished counterparts (M = 4.20; SD = 1.0). These findings indicate that higher Grade/age and better nutrition had significant facilitatory effect on STM capacity, as measured by DSB test, of primary school children. However, the Grade was found to have more or less equal effects on both the levels of NS with regard to the DSB capacities of children as indicated by the nonsignificance of Grade x NS interaction effect (see Table 17).
A bivariate ANOVA performed on the total STM scores, as measured by both DSF and DSB tests, of four differentially treated groups of subjects yielded significant effects of Grade, and NS (see Table 18). In other words, the total digit span test scores of Grade II children (M = 7.84; SD = 2.34), irrespective of NS, were lower than those of Grade V children (M = 8.91; SD = 2.62). Similarly, the malnourished children (M = 6.23; SD = 0.97), irrespective of Grade/ age, performed poorly on both digit span tests (forward and backward) compared to their wellnourished counterparts (M = 10.53; SD = 1.61). These findings indicate that both higher Grade/ age, and better nutrition significantly facilitate the STM capacities of primary school children as measured by DSF and DSB tests. The Grade was not found to have differential effects on both the levels of NS with regard to the STM capacities, as measured by both DSF and DSB tests, of children as evidenced by the nonsignificance of Grade x NS interaction effect (see Table 18).

A two-way ANOVA performed on the STM scores, as measured by letter span forward (LSF) test, of four differential treatment groups of subjects revealed significant effects of both Grade and NS (see Table 19). In other words, Grade II children (M = 3.60; SD = 0.92), irrespective of NS, were found to be inferior to Grade V children (M = 3.88; SD = 0.92) in their LSF capacities. Similarly the malnourished children (M = 3.08; SD = 0.61), irrespective of Grade/ age, showed lower LSF capacities compared to their wellnourished counterparts (M = 4.40; SD = 0.69). These findings indicate that both higher Grade/ age and
wellnourishment significantly augment the STM capacities of primary school children, as measured by LSF test. The Grade was not found to have differential effects on both the levels of NS with regard to the LSF capacities of children, as evidenced by the nonsignificance of Grade x NS interaction effect (see Table 19).

A bivariate ANOVA performed on the Letter Span-Backward (LSB) scores of four differential treatment groups of subjects revealed that both Grade and NS main effects as well as Grade x NS interaction effect were significant (see Table 20). In other words, children of Grade II (M = 2.70; SD = 1.35), irrespective of nutritional status, performed poorly on LSB test compared to the children of Grade V (M = 3.20; SD = 0.92). Similarly, the STM capacities, as measured by LSB test, of malnourished children (M = 2.01; SD = 0.88), irrespective of Grade/ age, were lower than those of the wellnourished children (M = 3.89; SD = 0.50). These findings indicate that both higher Grade/ age and better nourishment significantly increase the STM capacities of children as measured by LSB test.

The Grade was found to have differential effects on both the levels of nutritional status, as evidenced by the significant interaction effect of Grade x NS (see Table 20). The difference in the average LSB scores between malnourished and wellnourished children of Grade II was greater than that of the difference between the malnourished and wellnourished children of Grade V (see Figure 4). Further analysis by Scheffe test showed that the malnourished children of Grade II (G II-MN) were found to be inferior to the wellnourished children of Grade II.
Figure 4. Mean LSB scores of four differential treatment groups of subjects
(G II-WN) as well as to both malnourished and wellnourished children of Grade V (G V-MN; G V-WN) in their LSB test scores. On the other hand, the wellnourished children of Grade II (G II-WN) and Grade V (G V-WN) were superior to the malnourished children of Grade V (G V-MN) in their LSB capacities. However, the G II-WN and G V-WN children did not differ from each other with regard to their performances on LSB test. In other words, higher grade was found to interact significantly positively with the wellnourishment in the STM capacities of children as evidenced by the highest STM scores, as measured by the LSB test, of G V-WN children (see Table 15). Moreover, the significance of the difference in LSB test scores between G II-MN and G V-MN children indicates that the adverse effect of early malnutrition on the STM capacities, as measured by LSB test, of children gradually dissipates over ages.

A bivariate ANOVA performed on the total STM scores, as measured by both LSF and LSB tests, of four differential treatment groups of subjects revealed significant effects of both Grade, and NS (see Table 21). In other words, the total letter span test scores of Grade II children (M = 6.30; SD = 2.04), irrespective of NS, were lower than those of Grade V children (M = 7.08; SD = 1.66). Similarly, the malnourished children (M = 5.09; SD = 1.14), irrespective of Grade/ age, were inferior to their wellnourished counterparts (M = 8.29; SD = 0.86) in their total STM scores, as measured by both LSF and LSB tests. These findings indicate that both higher Grade/ age and better nourishment significantly increase the STM capacities of primary school children as measured by both LSF and LSB tests. However, the Grade was not found to have differential effects on both the levels of NS with regard to the STM capacities, as measured by both LSF
and LSB tests, of children as evidenced by the nonsignificance of Grade x NS interaction effect (see Table 21).

A two-way ANOVA performed on the long-term memory (LTM) scores, as measured by story telling-I task, of four differentially treated groups of subjects showed significant effects of both Grade and NS (see Table 23). In other words, the children of Grade II (M = 5.19; SD = 2.50), irrespective of NS, were found to have lower LTM capacity than the children of Grade V (M = 6.11; SD = 2.10). Similarly, the malnourished children (M = 3.73; SD = 1.40), irrespective of Grade/age, were found to be inferior to the wellnourished children (M = 7.58; SD = 1.29) in their LTM capacities. These findings indicate that both higher Grade/age, and better nutrition significantly facilitate the LTM capacities of Oriya primary school children, as measured by ST-I task. However, the Grade was not found to have differential effects on both the levels of NS with regard to the LTM capacities of children as evidenced by the nonsignificance of Grade x NS interaction effects (see Table 23).

A bivariate ANOVA performed on the LTM scores, as measured by ST-II task, of four differential treatment groups of subjects showed that both Grade and NS main effects were significant (see Table 24). In other words, the LTM capacities of Grade II children (M = 4.70; SD = 2.24), irrespective of NS, were lower than those of Grade V children (M = 6.73; SD = 2.33). Similarly, the malnourished children (M = 3.88; SD = 1.43), irrespective of Grade/age, were found to have more limited capacities of LTM compared to their wellnourished counterparts (M = 7.55; SD = 1.91). These findings indicate that both higher
Grade/ age and better nutrition significantly augment the LTM capacities of primary school children, as measured by ST-II task. However, the Grade was not found to have differential effects on both the levels of NS with regard to the LTM capacities, measured by story telling task-II, of children as evidenced by the nonsignificance of Grade x NS interaction effect (see Table 24).

**Reading Abilities Measures**

A two-way ANOVA performed on the oral reading correct response/ scores of four differential treatment groups of subjects revealed significance of Grade, and NS main effects as well as Grade x NS interaction effect (see Table 26). In other words, Grade II children (M = 93.98; SD = 25.90), irrespective of NS, made less number of correct responses in oral reading task compared to Grade V children (M = 291.26; SD = 97.18). Similarly, the malnourished children (M = 135.36; SD = 68.18), irrespective of Grade/ age, were found to be inferior to the wellnourished children (M = 249.88; SD = 136.14) in their number of correct responses as measured by the Reading Ability Task (RAT). These findings indicate that both higher Grade/ age and better nourishment significantly increase the reading abilities of Oriya medium primary school children.

The Grade was found to have differential effects on both the levels of NS, as evidenced by the significance of Grade x NS interaction effect (see Table 26). The difference in the average correct responses between malnourished and wellnourished children of Grade II was smaller than that of the difference between
the malnourished and wellnourished children of Grade V (see Figure 5). Further analysis by Scheffe test revealed that Grade II - malnourished children made fewer number of correct responses than the Grade II - wellnourished, Grade V - malnourished, and Grade V - wellnourished children. Similarly, the number of correct responses made by Grade II - wellnourished children was less in comparison to those of the Grade V - malnourished and Grade V - wellnourished children. Moreover, Grade V - malnourished children were found to be inferior to their wellnourished counterparts in the number of correct responses made by them while performing the RAT. In other words, higher Grade/ age was found to interact significantly positively with the wellnourishment in reading abilities of children as evidenced by the highest number of correct responses made by Grade V - wellnourished (GV-WN) children (see Table 25). Moreover, the significance of the difference in the number of correct responses between GII-MN and GV-MN children indicates that the adverse effect of early malnutrition/ undernourishment on the reading abilities of children gradually dissipates over ages, so that the malnourished children of Grade V showed better performances than the malnourished children of Grade II.

A 2 x 2 factorial ANOVA performed on the number of incorrect responses made by the subjects of four differential treatment groups while reading the task revealed significant effects of both Grade and NS (see Table 27). In other words, Grade II children (M = 17.98; SD = 15.06), irrespective of NS, made fewer number of incorrect responses compared to Grade V children (M = 85.14;
Figure 5. Mean correct responses of four differential treatment groups of subjects as measured by Reading Ability Test
MEAN CORRECT RESPONSES IN RAT

GRADE

- MN
- WN

MEAN CORRECT RESPONSES IN RAT

GRADE
The malnourished children (M = 93.25; SD = 67.52), irrespective of Grade/age, made more number of incorrect responses than their wellnourished counterparts (M = 9.86; SD = 10.06). These findings indicate that both lower Grade/age and better nourishment significantly decrease the number of incorrect responses made by the subjects while reading the task, which measures their reading abilities.

The Grade was found to have differential effects on both the levels of NS, as evidenced by the significant Grade x NS interaction effect (see Table 27). The difference in the average number of incorrect responses between malnourished and wellnourished children of Grade II was less compared to that of the difference between malnourished and wellnourished children of Grade V (see Figure 6). Further analysis by Scheffe test revealed that the malnourished children of Grade II were found to be inferior to the wellnourished children of Grade II and Grade V in their reading ability, as measured by the number of incorrect responses. The wellnourished children of both Grade II and Grade V performed better than the malnourished children of Grade V on the reading ability test. However, the GII-WN and GV-WN children did not differ from each other with regard to their number of incorrect responses; the reading ability of these two groups of children are more or less equal. In other words, higher Grade/age was found to interact significantly positively with the malnourishment in reading abilities of children as evidenced by the highest number of incorrect responses made by Grade V - malnourished (GV-MN) children (see Table 25). Moreover, the significance of the difference in the number of incorrect responses between GII-MN and GV-MN
Figure 6. Mean incorrect responses of four differential treatment groups of subjects as measured by Reading Ability Test
children indicates that the adverse effect of early malnutrition on the reading abilities of children did not show any decrement over ages, so that the malnourished children of Grade V showed poorer performances than the malnourished children of Grade II.

A bivariate ANOVA performed on the number of additions made by the subjects of four differential treatment groups while reading the task revealed significant effects of only NS (see Table 28). In other words, the number of additions made by the children of Grade II (M = 0.56; SD = 0.82), irrespective of NS, was more or less equal to that of the children of Grade V (M = 0.79; SD = 1.36), as indicated by the insignificant effect of Grade (see Table 28). However, the number of additions made by the malnourished children (M = 1.05; SD = 1.40), irrespective of Grade/age; was greater than that of the wellnourished children (M = 0.30; SD = 0.56). More number of additions signifies poor reading ability. Thus, the Grade II and Grade V children did not differ from each other with regard to their reading abilities. However, the malnourished children were found to be inferior to the wellnourished children in their reading abilities. The Grade was not found to have differential effects on both the levels of NS as indicated by the nonsignificance of Grade x NS interaction effect (see Table 28).

A two-way ANOVA performed on the oral reading omissions scores of four differential treatment groups of subjects showed significant effects of Grade, NS, and Grade x NS interaction (see Table 29). In other words, Grade II children (M = 0.73; SD = 1.03), irrespective of NS, made fewer number of omissions compared to Grade V children (M = 4.52; SD = 9.03). However, the
malnourished children (M = 4.79; SD = 8.94), irrespective of Grade/age, committed more number of omissions than their wellnourished counterparts (M = 0.46; SD = 0.76). These findings indicate that both lower Grade/age and better nutrition significantly decrease the number of omissions made by the subjects while reading the task. Less number of omissions signifies better reading abilities. Thus, the Grade II, and wellnourished children are better in their reading abilities than the Grade V, and malnourished children, respectively.

The Grade was found to have differential effects on both the levels of NS, as evidenced by the significance of Grade x NS interaction effect (see Table 29). The difference in the average number of omissions between malnourished and wellnourished children of Grade II was less than that of the difference between the malnourished and wellnourished children of Grade V (see Figure 7). Further analysis by Scheffe test revealed that Grade V-malnourished children made significantly greater number of omissions in comparison to the GII-MN, GII-WN, and GV-WN children. In other words, the GV-MN children have poorer reading abilities than the other three groups of children, as measured by the number of omissions committed by them while reading the task which measures their reading abilities. However, GII-MN, GII-WN, and GV-WN children did not differ significantly from each other with regard to the number of omissions made by them while reading the task. In other words, higher Grade/age was found to interact significantly positively with the malnutrition in reading abilities of children as evidenced by the highest number of omissions made by GV-MN children.
Figure 7. Mean omission scores of four differential treatment groups of subjects as measured by Reading Ability Test
MEAN OMISSION SCORES IN RAT

GRADE

MN
WN

MEAN OMISSION SCORES IN RAT
(see Table 25). Moreover, the significance of the difference in the number of omissions between GII-MN and GV-MN children indicates that the adverse effect of early malnutrition on the reading abilities of children did not show any dissipation over ages, so that the malnourished children of Grade V performed poorly on the reading ability task compared to the Grade II malnourished children.

A two-factorial ANOVA performed on the number of failure responses made by the subjects of four differential treatment groups while reading the task revealed the significant effects of Grade, NS, and Grade x NS interaction (see Table 30). In other words, the number of failure responses made by the children of Grade II (M = 8.48; SD = 18.82), irrespective of NS, was fewer than that of the children of Grade V (M = 21.11; SD = 28.32). Similarly, the wellnourished children (M = 0.70; SD = 1.28), irrespective of Grade/ age, made less number of failure responses compared to that of the malnourished children (M = 28.89; SD = 28.86). More number of failure responses signifies poor reading ability. Thus, the Grade II and wellnourished children were found to have better oral reading abilities than the Grade V and malnourished children, respectively.

Grade was found to have differential effects on both the levels of NS, as evidenced by the significance of Grade x NS interaction effect (see Table 30). The difference in the average number of failure responses between malnourished and wellnourished children of Grade II was less than that of the difference between malnourished and wellnourished children of Grade V (see Figure 8). Further analysis by Scheffe test revealed that malnourished children of Grade II (GII-MN)
Figure 8. Mean failure responses of four differential treatment groups of subjects as measured by Reading Ability Test
MEAN FAILURE RESPONSES IN RAT

\[ \bullet \text{MN} \]
\[ \square \text{WN} \]

MEAN FAILURE RESPONSES IN RAT

GRADE
were found to be inferior to the wellnourished children of Grade II (GII-WN) and Grade V (GV-WN), but superior to the malnourished children of Grade V (GV-MN), in their reading abilities, as measured by the number of failure responses made by them while reading the task. Similarly, the wellnourished children of both Grade II and Grade V (GII-WN, GV-WN) showed better performances on the reading ability task than the malnourished children of Grade V (GV-MN), measured in terms of number of failure responses. However, GII-WN and GV-WN children did not differ significantly from each other with regard to their number of failure responses. In other word, higher Grade/ age was found to interact significantly positively with the malnourishment in reading abilities of children as evidenced by the highest number of failure responses made by GV-MN children (see Table 25). Moreover, the significance of the difference in the number of failure responses between GII-MN and GV-MN children indicates that the adverse effect of early malnourishment on the oral reading abilities of children did not show any decrement over ages, so that the malnourished children of Grade V showed poor performance on the oral reading ability task in comparison to the malnourished children of Grade II.

From the discussions about the results made above, it is quite evident that the malnourished children performed poorly in all the tests of cognitive abilities used in the present study in comparison to their wellnourished counterparts. In other words, the malnourished children were found to be inferior to their wellnourished counterparts in their nonverbal intellectual abilities, Torrance test of nonverbal/ figural creative thinking abilities, nonlanguage and languaged based working memory capacities, and both short-term and long-term memory capacities. Thus, the cognitive abilities of malnourished Oriya medium primary school
children, in general, are poorer than those of the wellnourished children. The present findings regarding the adverse late effects of malnutrition on the cognitive abilities of children are supported by the findings of some earlier studies (Aboud et al., 1991; Grander et al., 1995; Grantham-McGregor et al., 1994; Ichitani et al., 1992; Jemima, Mohan, & Sheela, 1992; Kalra, 1994; Lopez et al., 1993; Noreiga et al., 1990; Sankar et al., 1994; Sigman, 1995; Walter, 1991). However, the present results on the cognitive abilities of children contradict the results of some previous studies (Barbara et al., 1990; Gregory et al., 1993; Gupta, 1990; Harens et al., 1992; Nelson, 1992; Nelson et al., 1990; Oyarzum et al., 1991).

With regard to the reading abilities, the malnourished children were found to be poor readers in comparison to the wellnourished children. The present results regarding the adverse effects of malnutrition on the reading abilities of children are in accordance with the results of some previous studies (Cravioto, 1971; Pollitt et al., 1993; Wing, 1990), and are in contradiction to the findings of some few earlier studies (Grieve, 1988; Nayak & Dash, 1987).

The poor cognitive abilities and reading abilities of the malnourished children might be attributed to their poor home environmental variables. Moreover, they belong to the less privileged or impoverished sections of the society. A good home environment is a prerequisite for higher cognitive functioning. Moreover, the family has a pervasive and lasting influence on the cognitive development of children; parental education, family income, and caste group affiliation showed significant relationship with the accelerated mental development. The malnourished children have adverse home conditions, and they also belong to the less privileged or deprived sections of the society. Their adverse
home/ family conditions might be responsible for their depressed cognitive functioning and retarded reading abilities/ proficiency.

With regard to the cognitive abilities and reading abilities of children, age yielded differential effects on some measures of cognitive and reading abilities used in the present study, except the TTCT - Originality, language - based working memory, and number of additions during reading the task. In other words, Class V (higher age) children were found to be better than Class II children in their cognitive and reading abilities as measured by a variety of measures. Moreover, the adverse effects of early malnutrition on cognitive and reading abilities of children dissipated over ages as indicated by a majority of measures used for measuring both cognitive and reading abilities of children. Furthermore, the decrement of the adverse effects of malnutrition on the cognitive and reading abilities of children with the increment in age might be attributed to the parent-child interaction; it is the quality rather than quantity of the parent-child interaction which augments the development of cognitive and reading abilities of children. In other words, older the children more is the parent-child interaction, and thus, better is the mental development of children.

Basing on the findings of the present study the following conclusions are drawn:

i) The malnourished primary school children, who were hospitalized for severe malnutrition in their early years of life, are worse than the wellnourished children in their cognitive abilities (i.e., in nonverbal intelligence, figure copying, draw-a-child, nonverbal TTCT, nonverbal and verbal working memory, STM and LTM).
ii) The malnourished children, irrespective of their grade/ age, are inferior to the wellnourished children in their reading abilities.

iii) Children of higher age group (i.e., Grade V) are not better than the children of lower age group (i.e., Grade II) in all measures of cognitive and reading abilities.

iv) Unlike malnutrition, grade/ age as an independent variable, has no definite, consistent facilitatory or inhibitory effect on various measures of cognitive and reading abilities of children used in the present study.

v) The deleterious or detrimental effects of early malnutrition on the later cognitive and reading abilities of children become even greater in conjunction with lower age/ grade in some but not all measures of cognitive and reading abilities used in the present study.

vi) There is no consistent dissipation of the adverse effects of early malnutrition on the later cognitive and reading abilities of children as measured by a variety of tests used in the present study.

vii) The interaction between malnutrition and age/ grade is not always either positive or negative. In other words, there is not systematic or consistent interaction effects between malnutrition and age with regard to the cognitive and reading abilities of children.