IJBPAS, July, 2025, 14(7): 4146-4158

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

NUTRITIONAL STATUS AND FEEDING PROBLEMS IN CHILDREN WITH AND WITHOUT DEVELOPMENTAL DISORDER: A COMPARATIVE CROSS-SECTIONAL STUDY

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Received 24th March 2025; Revised 30th April 2025; Accepted 21st May 2025; Available online 1st July 2025

https://doi.org/10.31032/IJBPAS/2025/14.7.9273

ABSTRACT

Background: Developmental disorders, such as cerebral palsy and intellectual disabilities, are common causes of childhood disability globally and can severely affect physical growth and nutrition. Children with these disorders often face feeding difficulties, including poor oral-motor coordination, swallowing issues, and inability to self-feed, which can lead to undernutrition. These nutritional deficits may further impair growth, hinder development, and increase the risk of long-term health complications. Understanding the nutritional status and feeding problems in these children is essential for creating effective interventions to improve their health outcomes.

Objective: To assess and compare the nutritional status and feeding problems of children with

developmental disorders and their typically developing peers, and to identify the associated risk factors that affect nutrition in children with developmental disorders.

Study Design: Comparative cross-sectional study.

Methods: A comparative study was conducted among 250 children in the age group of 5-15 years. Demographic data along with anthropometric measurements were taken. Assessment of nutritional status were made using metrics such as z-scores for weight-for-age, height-for-age, and weight for height. Descriptive statistics (number and percentage) and analytical statistics were included.

Results: Among children with developmental disorders, 68 (27.2%) were underweight, 114 (45.6%) had short stature, and 38 (15.2%) had wasting. Obesity was found in 32 (12.8%), more prevalent in adolescent females. Feeding difficulties were reported in 117 (46.9%), with common issues being poor chewing/swallowing 76 (65%), inability to self-feed 67 (57.3%), and poor appetite 23 (20%). Undernutrition was observed in 47 (40.3%), and short stature in 83 (71.3%) of children with feeding difficulties. Statistically significant differences were found between children with developmental disorders and typically developing peers, with a higher prevalence of underweight (P = 0.000, 95% CI: 21.7–32.7), short stature (P = 0.001, 95% CI: 39.4–51.8), and obesity (P = 0.008, 95% CI: 8.6–17.0).

Conclusion: The children with developmental disorders were significantly undernourished as compared to normal children of same age group. The heights and weights of the children were significantly below standard as compared to normal children of same age group. Enhancing their nutritional status may contribute to improved overall health and support the development of greater functional independence.

Keywords: Anthropometry, Cerebral Palsy, Developmental Disabilities, Intellectual disability, Nutritional status

INTRODUCTION

Over the past two decades, India has witnessed a significant improvement in child survival, reflected in the marked decline in under-five mortality rates. While this is a welcome development, it has raised concerns that reduced child mortality may also result in an increase in children surviving with long-term developmental disabilities. These "sub-standard survivors," as some have termed them, include a growing number of children with developmental disorders, chronic conditions that originate during early development and persist throughout life **[1]**.

Developmental disorders affect a range of functional domains including

speech and language, motor coordination, cognition, behavior, and learning, and encompass conditions such as Intellectual Disability (ID), Specific Learning Disorder (SLD), Autism Spectrum Disorder (ASD), cerebral palsy, and sensory impairments like deafness and blindness **[2]**. These disorders not only affect the child's physical and mental development but also impose substantial emotional, financial, and social burdens on their families and communities. According to the 2011 Census of India, approximately 3.8% of the population lives with disabilities in intellectual, motor, visual, or communication areas, with cerebral palsy and intellectual disability forming a significant proportion of childhood disabilities **[3]**.

Emerging literature points to the fact that children with developmental disabilities are particularly vulnerable to nutritional problems due to a combination of feeding difficulties, limited mobility, dependence on caregivers, and underlying medical conditions. A study by Sullivan *et al*. (2000) highlighted that 60–90% of children with severe developmental disabilities experience feeding problems, which can lead to malnutrition, growth retardation, and further delay in development. Similarly, research in low- and middle-income countries underscores the double burden of undernutrition and overnutrition in this group, driven by poor access to tailored nutrition and healthcare support **[4]**. Despite these findings, there is a noticeable gap in Indian studies that systematically assess the nutritional status of children with developmental disabilities and address the contextual challenges faced by caregivers.

Purpose of the Study: Given this background, the present study aims to assess the nutritional status of children with developmental disabilities in the Indian context. It seeks to evaluate the prevalence of undernutrition and overnutrition, feeding difficulties, and other health-related factors contributing to poor nutrition. This study addresses a critical knowledge gap and aims to provide practical recommendations to improve the nutritional care and quality of life of these vulnerable children.

METHODOLOGY

Written-Informed consent was obtained from the parents of all participating children prior to inclusion in the study. Clinical and neurological examinations were conducted for each child, including anthropometric measurements such as weight, height, skin fold thickness, and mid-upper arm circumference, in the presence of their parents. The objectives and procedures of the study were explained at the time of registration and reiterated prior to the examinations.

The study employed a purposive

sampling method to recruit participants aged between 5 and 15 years. The children of less than 5 years and more than 15 years age group were excluded from the study as the number was quite less in the school. The study group consisted of 250 children who had been clinically diagnosed with developmental disorders. These children were enrolled from a special education school that caters specifically to individuals with developmental challenges. Mainly four major types of developmental disabled children were included for study. They were:

1. Intellectual disability with cerebral palsy/locomotor disorder
2. Intellectual disability without cerebral palsy/locomotor disorder
3. Down's syndrome
4. Deafness with or without intellectual disability

The control group comprised 250 typically developing children, who were selected from a mainstream school. Children in the control group were matched with those in the study group based on age and sex to ensure comparability between groups. This matching helped control for potential confounding variables and allowed for more accurate comparisons between the two groups. All participating children were from middle to upper-middle socio-economic backgrounds, contributing to a relatively homogeneous sample in terms of socio-economic status.

Parental Interviews and Data Collection

Information was primarily obtained through interviews with parents. In most cases, a single parent was present during the interview. The interviews focused on the child's current and past feeding difficulties, as well as any significant ongoing medical conditions. In instances where parents were unavailable, relevant information was initially obtained from the child's teacher and subsequently verified with the parents.

Data collection followed a structured format based on a standardized proforma. Feeding-related concerns specifically assessed included recurrent vomiting, dysphagia (difficulty in swallowing), aversive feeding behaviors such as turning the head away or crying during meals, inability to self-feed, and food aversions or lack of interest in eating.

Anthropometric Examination

Anthropometric measurements were conducted for all participating children following standard procedures. Body weight was measured using an electronic weighing scale, corrected for any calibration errors if present, and recorded to the nearest 0.5 kg. Height was measured to the nearest 0.5 cm using a standard stadiometer. For children with joint contractures or limb length discrepancies, composite measurements of

the trunk and head were taken to ensure consistency. Skinfold thickness was assessed at the triceps site using a calibrated skinfold calliper. Mid-upper arm circumference was measured with a non-stretchable measuring tape.

Measurements were rounded to the nearest 0.5 unit (kg or cm) to minimize observational and instrumental error, ensure uniformity, and enhance the reliability and reproducibility of data in paediatric field conditions where perfect precision may not always be feasible.

Reference Values

The values of weight for age, height for age and weight for height were presented as Z-scores based on National Centre for Health Statistics percentiles (NCHS). Children who are 2 SD below the reference median (i.e. Z-score of less than -2) was taken as underweight, short stature, wasted for weight for age, height for age & weight for height respectively **[5]**.

The height and weight of children with Down syndrome were plotted on height and weight percentiles specific for Down syndrome derived from study by Cronk *et al*. Individual Z-scores for weight for age and height for age were calculated. Weight for height were plotted on NCHS percentiles **[6]**.

Statistical Analysis

Data collected were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences version 20.0. Mann-Whitney U test used to assess the differences in variables among children of both the groups.

RESULTS

Demographics of the Children

There were 100 (40%) girls and 150 (60%) boys in both the study and control groups. The highest number of children belonged to the age group of 5-7 years, accounting for 74 (29.8%) of the total sample. The least number of children were in the 13-15 years age group, comprising 33 (13.4%). The male-to-female ratio was highest in the 7-9 years age group at 1.87:1 and lowest in the 13-15 years age group at 0.9:1. With regard to diagnosis, 87 (34.9%) children were diagnosed with intellectual disability with cerebral palsy, 88 (35.0%) children had intellectual disability alone, 49 (19.6%) were diagnosed with Down syndrome, and 26 (10.5%) children were deaf.

Nutritional Status of the Children

Nutritional status is the condition of the body as influenced by the diet, levels of nutrients in the body, and the body's ability to maintain normal metabolic integrity (WHO, 2021). It is a key indicator of overall health, growth, and well-being, and poor nutritional status—whether due to undernutrition or overnutrition—can significantly affect a child's cognitive

development, immunity, physical growth, and future productivity **[7]**

In the study group, 68 (27.2%) children were found to be underweight. In which, 42 (47.8%) Children with intellectual disability and locomotor disorders and 28 (32%) children with severe intellectual disability without locomotor disorders were undernourished. A higher proportion of underweight children was observed in the younger age groups. Short stature was observed in 114 (45.6%) children in the study group. This included 39 (34.5%) males and 75 (65.5%) females. A significant proportion: 55 (63.2%) of children diagnosed with intellectual disability and locomotor disorders were short statured. Wasting was present in 38 (15.2%) children, while 32 (12.8%) were obese. Wasting was more commonly observed in younger age groups, whereas obesity was more prevalent among females in the 13-15 years age group. **Table 1** shows a significant difference in underweight status between the study and control groups across different age ranges (5–15 years). In every age group, the percentage of underweight children is markedly higher in the study group than in the control group. For instance, among children aged 5–7 years, 46.1% in the study group were underweight compared to only 2.6% in the control group. Similar trends are observed in other age brackets, with all differences being statistically significant ($P < 0.05$). Overall, 27.2% of children in the study group were underweight, versus just 2.4% in the control group. This highlights a strong association between being in the study group and a higher risk of underweight status.

Table 1: Age-wise comparison of Underweight Status between Study and Control Groups

Age Group (Years)	Total (n)	Study Group n (%)	95% CI (Study)	Control Group n (%)	95% CI (Control)	P-value
≥5 - ≤7	76	35 (46.1%)	34.8–57.3%	2 (2.6%)	0.3–6.2%	<0.05 †
≥7 - ≤9	41	11 (26.8%)	13.3–40.4%	1 (2.4%)	0.4–7.2%	<0.05 †
≥9 - ≤11	63	7 (11.1%)	3.4–18.9%	1 (1.6%)	0.1–4.7%	<0.05 †
≥11 - ≤13	40	8 (20.0%)	7.6–32.4%	1 (2.5%)	0.4–7.3%	<0.05 †
≥13 - ≤15	30	7 (23.3%)	8.2–38.5%	1 (3.3%)	0.7–9.8%	<0.05 †
Total	250	68 (27.2%)	21.7–32.7%	6 (2.4%)	0.5–4.3%	<0.05 †

(† Statistically significant at $P < 0.05$)

Table 2 highlights a significant age-wise difference in the prevalence of short stature between the study and control groups among children aged 5–15 years. In all age groups, the study group consistently shows a much higher percentage of short stature compared to the control group. In the 5–7 year age group, 50.0% of the study group had short stature, while only 3.9% in the control group did. Similar trends are observed across all other age brackets, with differences being statistically significant ($P < 0.05$). Overall, 45.6% of children in the study group had short stature compared to 2.8% in the control

group. These findings suggest a strong and consistent association between being in the study group and a higher risk of short stature.

Table 2: Age-wise comparison of Short Stature between Study and Control Groups

Age Group (Years)	Total (n)	Study Group n (%)	95% CI (Study)	Control Group n (%)	95% CI (Control)	P-value
≥5 - ≤7	76	38 (50.0%)	38.8–61.2%	3 (3.9%)	0.8–8.3%	<0.05 †
≥7 - ≤9	41	19 (46.3%)	31.1–61.6%	1 (2.4%)	0.6–7.2%	<0.05 †
≥9 - ≤11	63	20 (31.7%)	20.3–43.2%	1 (1.6%)	0.1–4.7%	<0.05 †
≥11 - ≤13	40	22 (55.0%)	39.6–70.4%	1 (2.5%)	0.6–7.3%	<0.05 †
≥13 - ≤15	30	15 (50.0%)	32.1–67.9%	1 (3.3%)	0.9–9.8%	<0.05 †
Total	250	114 (45.6%)	39.4–51.8%	7 (2.8%)	0.8–4.8%	<0.05 †

(† Statistically significant at P < 0.05)

Table 3 presents an age-wise comparison of obesity prevalence between the study and control groups among children aged 5–15 years. In younger age groups (5–11 years), the prevalence of obesity is similar between groups and not statistically significant. However, in older age groups (11–15 years), obesity is significantly more common in the study group—with 20.0% in ages 11–13 and 33.3% in ages 13–15, compared to only 5.0% and 6.7% in the control group, respectively (P < 0.05). Overall, 12.8% of the study group were obese compared to 4.8% of the control group, a statistically significant difference. These results suggest that obesity becomes increasingly prevalent in the study group with age, particularly in adolescence.

Table 3: Age-wise comparison of Obesity between Study and Control Groups

Age Group (Years)	Total (n)	Study Group n (%)	95% CI (Study)	Control Group n (%)	95% CI (Control)	P-value
≥5 - ≤7	76	3 (3.9%)	0.8–11.5%	3 (3.9%)	0.8–8.3%	<0.1
≥7 - ≤9	41	2 (4.9%)	0.6–8.3%	2 (4.9%)	0.6–11.5%	<0.1
≥9 - ≤11	63	9 (14.3%)	5.6–22.9%	3 (4.8%)	1.0–10.0%	<0.1
≥11 - ≤13	40	8 (20.0%)	7.6–32.4%	2 (5.0%)	0.6–11.8%	<0.05 †
≥13 - ≤15	30	10 (33.3%)	16.5–50.2%	2 (6.7%)	0.8–15.6%	<0.05 †
Total	250	32 (12.8%)	8.6–17.0%	12 (4.8%)	2.2–7.4%	<0.05 †

(† Statistically significant at P < 0.05)

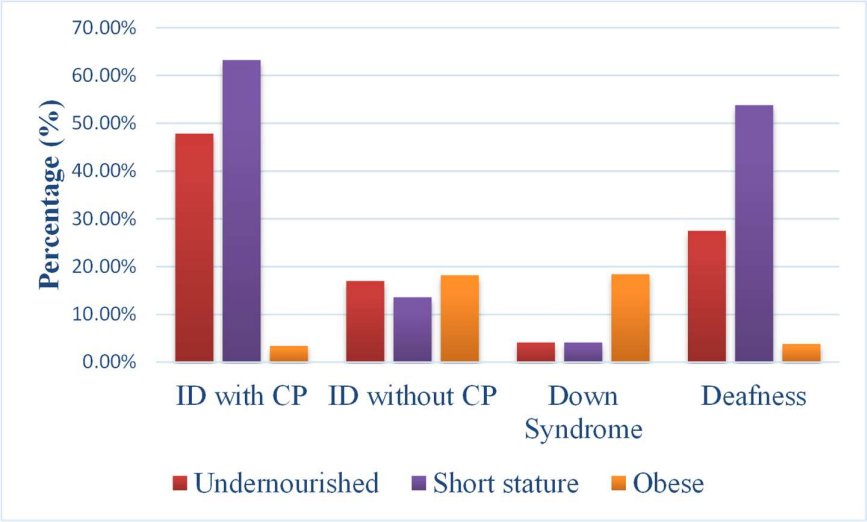

Figure 1: Diagnosis-wise Comparison of Nutritional Status

Feeding Difficulties and Associated Problems in Children

Feeding and associated problems in children refer to difficulties or disorders related to the intake, chewing, swallowing, or digestion of food, as well as the complications that arise due to improper or inadequate feeding. These problems can be behavioral, physiological, or medical and are more common in children with developmental delays or chronic illnesses **[8]**.

Feeding difficulties were reported in 117 (46.9%) children in the study group. Among these, 76 (65%) exhibited poor chewing or swallowing abilities, while 23 (20%) had a poor appetite. Additionally, 67 (57.3%) of children with feeding difficulties were unable to self-feed. Approximately 4 (3.4%) reported food aversion, and a similar proportion experienced frequent vomiting. Undernutrition was observed in 47 (40.3%) of children with feeding difficulties, and 83 (71.3%) were short statured. Furthermore, over 88 (75%) of children with any feeding difficulty exhibited short stature, indicating a strong association between feeding challenges and impaired growth. The findings suggest that children with developmental disorders frequently present with feeding problems, which may act both as a contributing factor to and consequence of undernutrition.

Table 4 compares the prevalence of various associated health problems between the study and control groups (n = 250 each). The study group shows a significantly higher frequency of nearly all listed conditions. Notably, seizures (20.4% vs. 0.4%), recurrent upper respiratory tract infections (URTI) (48.0% vs. 8.0%), recurrent gastroenteritis (20.4% vs. 0.8%), and tuberculosis (5.2% vs. 0.4%) are markedly more common in the study group ($P < 0.05$ to < 0.001). Other conditions like worm infestation, asthma, and pallor are also more prevalent in the study group. Congenital heart disease was reported only in the study group (3.2%) and not at all in the control group. These findings indicate that children in the study group are at greater risk for multiple comorbid health problems**,** reflecting a higher overall burden of disease.

Table 4: Comparison of associated problems between Study and Control Groups (n = 250)

Associated problems	Study Group n (%)	Control Group n (%)	P-value
Seizures	51 (20.4%)	1 (0.4%)	<0.001 †
Recurrent URTI	120 (48.0%)	20 (8.0%)	<0.05 †
Recurrent Gastroenteritis	51 (20.4%)	2 (0.8%)	<0.001 †
Worm infestation	58 (23.2%)	15 (6.0%)	<0.05 †
Asthma	11 (4.4%)	6 (2.4%)	<0.05 †
Congenital heart disease	8 (3.2%)	—	—
Pallor	13 (5.2%)	10 (4.0%)	<0.05 †
Tuberculosis	13 (5.2%)	1 (0.4%)	<0.001 †

(† Significance: P < 0.05)

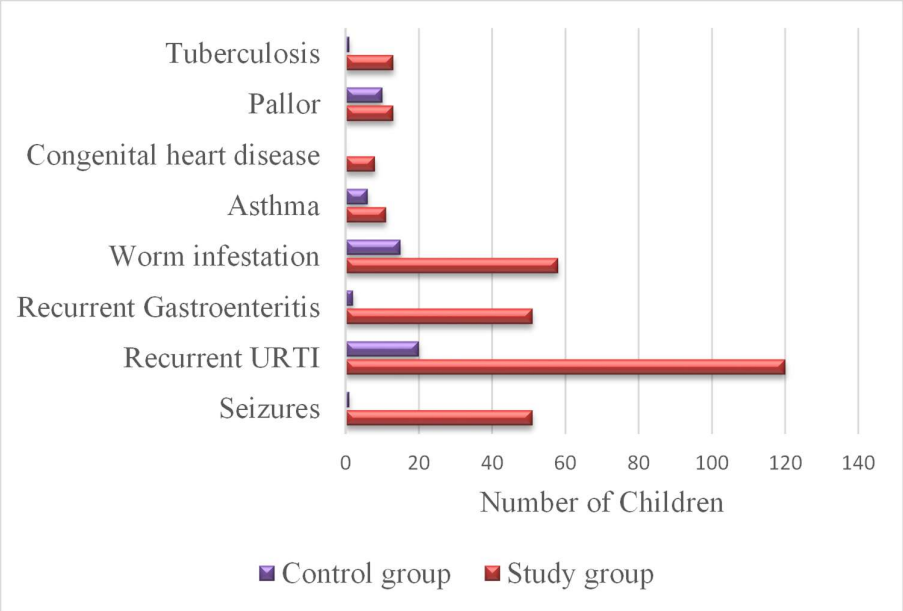

Figure 2: Comparison of Associated Problems (Study vs. Control Groups)

DISCUSSION

The purpose of this study was to identify the prevalence of under or over nutrition, feeding problems, and other significant problems contributing to the nutritional status of children with developmental disorders towards an aim to improve their functional status and quality of life (QOL). In this study we found that the children with developmental disorders were significantly undernourished as compared to normal children of same age group. In the smaller age group, the undernourishment was more as compared to other age group and those who had severe disabilities and associated problems. The heights and weights of the children were below standard as compared to normal children of same age group. Short stature was maximum in the smaller age group. Children with cerebral palsy were most short stature as compared to other group without locomotor disorders. Girls were more short stature as compared to boys of similar age group. Children with Down syndrome of more than ten years of age had significant obesity as compared to others. Children with developmental disorders had significant feeding and other problems like upper respiratory tract infection, gastroenteritis, worm infestation and pallor, which may be cause/effect of malnutrition. Children having asthma, congenital heart disease and tuberculosis were all malnourished.

The similar findings were noted by Eddy TP *et al*, Culley WJ *et al*, and Pryor HB *et al* in their study **[9, 10, 11]**. The most undernourished children are the most severely affected children as seen by Roberts GE *et al* that support the findings of

this study **[12]**. The results also coincide with the findings of other study that indicate under nutrition, short stature and obesity are widely prevalent in the disabled population. Pesce KA *et al* studied nutritional status of institutionalized children with developmental disabilities and found that children were adequately nourished. This was the only study in which no under nutrition disabled children was reported, may be these children were adequately cared for and we would try to achieve to such results in our population **[13]**.

Suzuki *et al* in their study of disabled children including deaf, blind mentally retarded observed slightly below the standard but not significantly undernourished children. The physically disabled children had significant under nutrition. Obesity was prevalent in many different types of disabled children and especially those who were mentally retarded. The prevalence of obesity was much more in female adolescents. Their nutritional status and requirement depend on the physical activity, which was assessed by using a pedometer scale **[14]**.

Jackson *et al* had suggested that mentally retarded individuals have general characteristics of overeating and sedentary life style, resulting in obesity **[15]**. Down syndrome children have a tendency to be overweight beginning in infancy as suggested by Cronk *et al*. Obesity is not a natural consequence of syndrome, but more than half of children with Down syndrome are overweight. Possible etiologies include over-eating, under activity and undetected hypothyroidism. In our study 15% children with Down syndrome were obese possible etiologies have to be looked for **[6]**.

There was a significant association found between presence of feeding problems and under nutrition as studied by Krick J *et al* and Thommassaon M *et al*. The occurrence of feeding and nutritional problem in children with CP varies between different studies, probably reflecting the fact that CP is a heterogeneous condition with different subgroup and wide range of severity. In several studies it has been found that both feeding problems and nutritional problems are most frequent among severely disabled children. It has also been found that children with dystonic CP are at high risk of developing feeding problems **[16]**.

Feeding problems were specially associated with poor ability in communication. These problems with inhibited requests for food and a lack of self-feeding skills may have consequences on child's self-confidence and in a further long term perspective, which contributes to distorted feeding situation.

Nutritional improvement with age most likely reflects improvements in health status, gross motor function and oral motor

skills. The children with developmental disorders wellbeing may strongly be influenced by their nutritional status. The child's behavior also improved as nutrition improved. Better nutrition brought a general improvement in health that results in enhancement of quality of life (QOL) and overall development in the children with developmental disorders.

CONCLUSION

This comparative cross-sectional study demonstrates that children with developmental disorders exhibit significantly poorer nutritional status and more frequent feeding-related difficulties than their typically developing peers. Undernutrition was especially prevalent among younger children, those with severe disabilities, and individuals experiencing feeding problems and associated complications. Female children in the developmentally disordered group were disproportionately affected. Conversely, children with mild intellectual disabilities and those with Down syndrome were less likely to be undernourished; however, a concerning prevalence of overweight and obesity was identified in these subgroups, particularly among older females and children above 10 years of age with Down syndrome.

The findings underscore the critical importance of early identification and effective management of nutritional deficiencies and feeding difficulties in children with developmental disorders. Implementing targeted interventions within the framework of integrated, multidisciplinary care is essential for reducing morbidity and promoting better health outcomes in this vulnerable population. Further research is needed to investigate the underlying etiological factors and to inform the development of evidence-based nutritional support strategies tailored to the specific needs of children with developmental disabilities.

ACKNOWLEDGMENTS

The author appreciates all those who participated in the study and helped to facilitate the research process. The author gratefully acknowledges Bharathidasan University, Tiruchirappalli for providing the opportunity to conduct the study, and to the supervisor and co-supervisor for their invaluable guidance throughout.

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