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Application Value of Intelligence Nursing Training Combined with Phased Nutrition Guidance in Nursing Care of Premature Infants

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Abstract

Objective: To explore the effects of mental nursing training combined with phased nutritional guidance on the growth and development, neuropsychology and mental sports development of premature infants. **Methods:** 72 premature infants admitted to our hospital from January 2018 to December 2018 were selected as the control group, and 72 premature infants admitted to our hospital from January 2019 to December 2019 were selected as the observation group. The control group used conventional feeding guidance and family training, and the observation group used mental nursing training and phased nutritional guidance. The growth and development, neuropsychological development, intelligence and sports development of the two groups were compared. **Results:** At the 12 months corrected age (CA), the body length, head and tail and weight of the two groups were apparently higher than those at birth ($p < 0.05$), and the observation group was apparently higher than those in the control group ($p < 0.05$); at the 12 months CA, the scores of gross motor, fine motor, adaptive behavior, language, personal-social behavior scores, sports development index (PDI), and mental development index (MDI) in the observation group were apparently higher than those in the control group ($p < 0.05$). **Conclusion:** Mental nursing training combined with phased nutritional guidance can effectively promote the growth and development of premature infants, and promote neuropsychological and intellectual motor development.

1 Introduction

Preterm infants, defined as neonates born before 37 weeks of gestation, typically weigh less than 2.5 kg and exhibit immature organ function, underdeveloped nervous systems, and poorer adaptive capabilities compared to term infants, consequently facing elevated risks of language disorders, neurological impairments, and intellectual disabilities that impose significant burdens on both families and society [1,2]. Clinical evidence indicates that the period from birth to one year of age constitutes a critical window for neurodevelopment [3,4], during which effective interventions can substantially enhance neurological maturation and improve cognitive and motor outcomes. The intellectual-nursing training program, incorporating multisensory stimulation through music, visual tracking with red balls, tactile exercises via massage, and coordinated physical activities, is designed to promote intellectual and motor development of infant; while phased nutritional interventions provide stage-specific dietary support to optimize physical growth and neural development of infant. At present, the intervention effect of phased nutritional guidance combined with intellectual care training applied to premature infants remains to be studied. Based on this, this study explores the effects of phased nutritional guidance and intellectual care training on the physical, neuropsychological and intellectual motor development of premature infants, with the aim of providing a reference for theW clinical intervention of premature infants.

2 Materials and methods

2.1 General information

A total of 72 preterm infants admitted to our hospital from January to December 2018 were selected as the control group, while another 72 preterm infants admitted between January and December 2019 served as the observation group. The two groups showed no statistically significant differences in gender, gestational age, birth weight, or cesarean section rate ($p > 0.05$), ensuring comparability, as detailed in Table 1. This study was approved by the hospital's ethics committee, with written informed consent obtained from all parents of the preterm infants. Inclusion criteria comprised: gestational age ranging from 31 to 37 weeks (excluding 37 weeks) with birth weight between 2000 g and 2500 g; complete clinical documentation. Exclusion criteria included: major organ dysfunction involving the heart, liver, or kidneys; severe congenital malformations or inherited metabolic disorders; significant brain injuries such as severe hypoxic-ischemic encephalopathy, intracranial lesions, or hydrocephalus; severe birth asphyxia; or low parental compliance. Withdrawal criteria encompassed: loss to follow-up; or premature discontinuation due to various factors.

Table 1 Comparison of general data between two groups.

Group	Cases	Gender (cases)		Gestational age (w)	Birth weight (kg)	Caesarean section (cases)
		Male	Female			
Observation group	72	40	32	32.84 ± 1.35	2.14 ± 0.35	39
Control group	72	38	34	33.12 ± 1.27	2.09 ± 0.31	42
χ^2/t		0.112		-1.282	0.907	0.254
p		0.738		0.202	0.366	0.614

2.2 Methods

2.2.1 Control group

The control group received routine feeding guidance combined with home-based training. Family training: During the period from the stabilization of vital signs to the corrected gestational age (CGA) of 40 weeks for premature infants, guide caregivers to provide family accompaniment to ensure adequate sleep for preterm infants; from 40 weeks CGA up to 12 months corrected age (CA), caregivers were guided to engage in parent-infant interactions at home, including sensory stimulation, skin touch, scientifically validated massage, and visual-auditory-language activities, with all procedures strictly adhering to medical instructions.

2.2.2 Observation group

The observation group received staged nutritional guidance and intellectual-nurturing training. (1) Staged Nutritional Guidance: (a) At 1 month CA, if daily weight gain was < 20-30 g, weekly length increase was < 0.8 cm or below the 25th percentile, human milk fortifiers or post-discharge preterm formula were supplemented. (b) At 2-3 months CA, if daily weight gain was <15 g or weekly length increase was < 0.8 cm/below the 25th percentile, fortifiers or post-discharge formula were continued. (c) At 4-6 months CA, if weight and length growth reached the 25th percentile, exclusive breastfeeding or standard formula was permitted, with iron-fortified cereals introduced at 6 months CA. (d) At 7-9 months CA, if growth parameters met the 25th percentile, breastfeeding/standard formula continued alongside gradual introduction of iron-fortified porridge, rice cereal, vegetables, fruits, egg yolk, and organ meats, with training for grasping finger foods. (e) At 10-12 months CA, give the premature baby exclusive breast milk or regular formula milk, and moderately increase the intake of chopped vegetables, fruits, noodles and meat. Also, guide the premature baby to eat with a spoon and drink milk from a cup, etc. (f) At 1 week after birth, premature infants were given 1500U/d of vitamin A and 1000U/d of vitamin D. The dosage of vitamin d was changed to 400U/d at 3 months CA until 12 months CA. When premature infants were born from 2 to 4 weeks, 2 mg/kg of ferrous gluconate was given daily until 12 months CA. (2) Intellectual-Nurturing Training: (a) At 1-2 months CA, visual, auditory training and tactile stimulation are carried out. Visual training: When the premature infant is awake, a red picture card or a red sphere is shaken left and right 20 cm in front of the premature infant. The initial training duration is 15 seconds. Later, the duration is gradually increased according to the specific condition of the premature infant. The maximum training duration is 2 minutes per session, 3 times a day; auditory training: When the premature baby is awake, play soothing music indoors and gently shake a sand hammer 20 cm away from the premature baby's ear to attract the premature baby to turn their head. The maximum training duration is 2 minutes per session, 3 times a day. Tactile stimulation: Parents need to touch premature babies in a reasonable way. (b) At 3-4 months CA: Balance, prone/roll-over, grasping, and hand-eye-mouth coordination drills (7-8 ×/day), with parental use of smiles/exaggerated expressions/toys for engagement. (c) At 5-6 months CA: Sitting practice (10 min/session, 5 ×/day). (d) At 7-8 months CA: Crawling (50-100 m/day); object retrieval (3 × /day); fine motor pincer-grasp training. (e) At 9-10 months CA: Assisted standing/squatting (20 reps/session, 3 × /day); vocalization prompts (e.g., "mama," "papa"). (f) At 11-12 months CA: Independent standing/cruising/walking (2-4 × /day) with toy assistance. Both groups underwent bimonthly outpatient follow-ups (6 total sessions).

2.3 Observing indicators

2.3.1 Growth and development

At birth and 12 months CA, the length, head circumference and body weight of two groups of premature infants were measured.

2.3.2 Neuropsychological development

At 12 months CA, neuropsychological development was assessed in both groups using the Gesell Developmental Scale [5], which evaluates five domains: gross motor skills, fine motor skills, adaptive behavior, language, and personal-social behavior. Each domain is scored on a scale of 0-100, with higher scores indicating better developmental outcomes.

2.3.3 Intellectual and motor development

At 12 months CA, intelligence and motor development outcomes were assessed using the Bayley Scales of Infant Development (BSID) [6], which mainly includes intelligence and motor scales. Among them, the intelligence scale includes three aspects: language, exploration and adaptive ability, and the evaluation results are represented by the Intelligence Development Index (MDI). The exercise scale mainly includes body control, muscle movement and finger operation ability, and the evaluation results are represented by the Motor Development Index (PDI). Scoring criteria were standardized as: excellent ($\geqslant$ 120), average (80-119), or delayed ($\leqslant$ 79) for both MDI and PDI.

2.4 Statistical analysis

Statistical analysis was performed using SPSS 20.0, with categorical variables compared by χ^2 test and continuous variables expressed as mean ± standard deviation and analyzed by t-test, with $p < 0.05$ considered statistically significant.

3 Results

3.1 Comparison of growth and development between the two groups

At birth, no statistically significant differences were observed between the two groups in length, head circumference, or body weight ($p > 0.05$); compared to birth measurements, both groups showed significant improvements in these parameters at 12 months CA ($p < 0.05$), with the observation group demonstrating significantly higher values than the control group ($p < 0.05$), as detailed in Table 2.

Table 2 Comparison of growth and development between the two groups.

Group	Cases	Height (cm)		Head circumference (cm)		Weight (kg)	
		Birth	At 12 months CA	Birth	At 12 months CA	Birth	At 12 months CA
Observation group	72	43.75 ± 2.33	75.46 ± 3.85 *	28.85 ± 2.65	46.65 ± 2.13 *	2.14 ± 0.35	9.56 ± 1.54 *
Control group	72	44.21 ± 2.52	72.64 ± 4.12 *	29.12 ± 2.74	43.38 ± 2.45 *	2.09 ± 0.31	8.46 ± 1.60 *
t		-1.137	4.243	-0.601	5.547	0.907	4.203
p		0.257	0.000	0.549	0.000	0.366	0.000

Note: Compared with birth: * $p < 0.05$.

3.2 The two groups were compared in terms of neuropsychological development at 12 months CA

At 12 months CA, the observation group demonstrated significantly higher scores than the control group in gross motor, fine motor, adaptive behavior, language, and personal-social behavior domains ($p < 0.05$), as shown in Table 3.

Table 3 Comparison of neuropsychological development status between the two groups at 12 months CA (scores).

Group	Cases	Gross movement	Fine movement	Adaptive behavior	Language	Individual-social behavior
Observation group	72	95.46 ± 5.22	92.46 ± 7.27	93.45 ± 6.75	94.34 ± 5.76	92.77 ± 7.24
Control group	72	86.34 ± 9.52	85.34 ± 9.58	86.37 ± 8.25	88.74 ± 7.62	87.76 ± 8.52
t		7.128	5.024	5.636	4.975	3.802
p		0.000	0.000	0.000	0.000	0.000

3.3 Comparison of PDI and MDI scores between the two groups at 12 months CA

At 12 months CA, PDI and MDI scores in the observation group were significantly higher than those in the control group ($p < 0.05$), as shown in Table 4.

Table 4 Comparison of PDI and MDI scores of the two groups at 12 months CA (scores).

Group	Cases	PDI	MDI
Observation group	72	96.38 ± 12.44	98.78 ± 10.46
Control group	72	87.68 ± 14.25	88.64 ± 12.38
t		3.903	5.309
p		0.000	0.000

4 Discussion

Compared with term neonates, preterm infants often exhibit incomplete brain development, which may lead to delayed intellectual and motor development or even cerebral palsy, seriously compromising their health [7,8]. Globally, approximately 15 million preterm infants are born annually, with China ranking second in preterm birth rates [9], highlighting the urgent need for early intervention and functional training to improve their quality of life-a key global health priority. Studies by Wang et al [10] demonstrated that ultra-early comprehensive interventions promote early intellectual development in preterm infants, while Wang et al [11] reported that combined motor training and nutritional guidance significantly enhances physical and intellectual development. Building on this evidence, our study implemented staged nutritional guidance and intellectual-nurturing training, demonstrating their efficacy in improving physical growth and promoting neuropsychological and motor-intellectual development in preterm infants.

4.1 Combined intellectual-nurturing training and staged nutritional guidance effectively promotes preterm infant growth

The significant postnatal nutritional transition from intrauterine environment frequently leads to growth retardation and neurodevelopmental impairment in preterm infants when feeding practices are suboptimal [12]. Our findings demonstrate substantial improvements in length, head circumference, and body weight at 12 months CA across both groups, with the observation group exhibiting significantly greater gains than controls, confirming the efficacy of this combined intervention in enhancing physical development. The infant period represents a critical growth phase where optimized nutritional management is particularly crucial for preterm infants. Our staged nutritional protocol dynamically monitored growth velocity at successive corrected age intervals, enabling precise feeding regimen adjustments to meet evolving nutritional requirements. Complementary tactile stimulation and massage interventions enhanced peripheral circulation and vagal tone,

creating favorable conditions for nutrient absorption while concurrently modulating neurological, immune, and endocrine systems. These multimodal effects collectively improved sleep quality and contributed to accelerated somatic growth.

4.2 Combined intellectual-nurturing training and staged nutritional guidance enhances neuropsychological and psychomotor development in preterm infants

Premature separation from the maternal environment results in structural and functional brain impairments, leading to neurodevelopmental immaturity and subsequent delays in cognitive and motor development. Research indicates [13] that the first postnatal year represents the most rapid period of brain development, during which neural plasticity is maximal, making targeted stimulation and functional training particularly impactful for cerebral development. Our results demonstrate significantly higher scores in gross motor, fine motor, adaptive behavior, language, and personal-social domains, along with superior PDI and MDI scores in the observation group at 12 months CA, confirming the efficacy of this combined approach. According to the requirements of different corrective months of age, this study formulated a rigorous, meticulous and scientific nutritional feeding plan, which is conducive to the normal physical and neurological development of premature infants. In addition, in this study, by providing corresponding stimuli and functional training to premature infants at different correction ages, and using methods such as red spheres, sand hammies, music, and touch at 1-2 months CA, the vision, hearing, and touch of premature infants can be trained, which can excite the cerebral cortex of premature infants and improve their neuropsychological and intellectual levels. At the same time, as the corrected age of premature infants increases, gradually add training such as balance, supine position, turning over, grasping, hand-mouth-eye coordination, sitting position, picking up, language and fine motor skills of finger grasping. This can positively stimulate the development of active and passive muscle tone, language development, cognitive function, etc. of premature infants, and promote the neuropsychological and intellectual motor development of premature infants.

In conclusion, staged nutritional guidance combined with intellectual-nurturing training demonstrates significant efficacy in improving physical growth and enhancing neuropsychological and psychomotor development in preterm infants.

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Not applicable.

Conflicts of Interest

All authors declare that the research was conducted in the absence of any commercial or fnancial relationships that could be construed as a potential confict of interest.

Author Contributions

Y.Y. and X.L. conceptualized the trial with support from co-authors. X.L. and S.L. participated in creating the study design. Y.Y. made the first draft of the manuscript. X.L., S.L. and Q.C. participated in creating the statistical analysis plan. All authors reviewed and revised the manuscript critically for important intellectual content. All authors reviewed the final manuscript as submitted. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

This study was approved by the hospital's ethics committee, with written informed consent obtained from all parents of the preterm infants.

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Availability of Data and Materials

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding authors.

Supplementary Materials

Not applicable.

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