

# Effect of palady and cup feeding on premature neonates' weight gain and reaching full oral feeding time interval

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## ABSTRACT

**Background:** Premature neonates' feeding is of great importance due to its effective role in their growth. These neonates should reach an independent oral nutrition stage before being discharged from the Neonatal Intensive care Unit. Therefore, the researcher decided to conduct a study on the effect of palady and cup feeding on premature neonates' weight gain and their reaching full oral feeding time interval.

**Materials and Methods:** This is a clinical trial with a quantitative design conducted on 69 premature infants (gestational age between 29 and 32 weeks) who were assigned to cup ( $n = 34$ ) and palady ( $n = 35$ ) feeding groups through random allocation. The first feeding was administrated either by cup or palady method in each shift within seven sequential days (total of 21 cup and palady feedings). Then, the rest of feeding was administrated by gavage.

**Results:** Mean hospitalization time (cup = 39.01 and palady = 30.4;  $P < 0.001$ ) and mean time interval to reach full oral feeding (cup = 33.7 and palady = 24.1;  $P < 0.001$ ) were significantly lower in palady group compared to cup group. Mean weight changes of neonates 7 weeks after the intervention compared to those in the beginning of the intervention were significantly more in palady group compared to the cup group (cup = 146.7 and palady = 198.8;  $P < 0.001$ ).

**Conclusions:** The neonates in palady group reached full oral feeding earlier than those of cup group. Subjects' weight gain was also higher in palady group compared to the cup group. Premature neonates with over 30 weeks of gestational age and physiological stability can be fed by palady.

**Key words:** Breastfeeding, cup feeding, Iran, neonate nursing, paladai feeding, palady feeding, premature neonates, weight gain

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## INTRODUCTION

Despite the fact that thanks to advancement in medicine, progression of treatment and care equipment, and the constant advancements in gynecology and obstetrics, premature neonates can have a better survival,<sup>[1]</sup> leading to positive outcomes in pregnancy, the problem of complications and premature neonates still exists.<sup>[2]</sup> Premature birth causes numerous challenges for the premature neonates leading to increased complications.<sup>[3]</sup>

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Although weight less than 1500 g occurs in only 1–2% of the neonates, it accounts for a high proportion of neonatal mortality, and short- and long-term complications of childhood such as developmental defects.<sup>[4]</sup> According to the latest reports of WHO in 2006, premature birth accounts for 31% of Iranian neonates' mortality.<sup>[5]</sup> This rate of low weight neonates' mortality can be reduced by prevention of infection and provision of appropriate nutrition.<sup>[6]</sup> Achievement of an appropriate and standard growth of neonates in a short time period and improvement of neural and physical development is among the important goals of premature neonates' feeding.<sup>[7]</sup> The important fact in premature neonates' nutrition is that in most of the cases, transfer of nutrients from the mother to the fetus occurs in the last gestational weeks leading to fetal weight gain; therefore, the neonates with premature birth are deprived of such nutrition based on their gestational age of birth and mostly experience after birth growth disorder. Among the major causes for after birth growth disorder is the low calorie and protein received by the neonates on the first days after birth, of which compensation is difficult and often leads to serious complications such as a lifelong disorder in neural development, cerebral palsy, and mental retardation.<sup>[8]</sup> The quality and quantity of nutritional support in the first weeks after birth not only lead to a higher survival of premature babies and neonates in a very critical condition, but also facilitate their brain and neural development.

The maximum time interval of human brain growth is between the first trimester and 18 months post birth. There are evidences showing that the brain is more vulnerable to nutritional deprivation and that not providing nutrients may lead to lowered IQ and behavioral disorders in the long term.<sup>[9]</sup>

To receive correct nutrition and with regard to lack of coordination in their sucking and swallowing, premature neonates need to receive adequate fluid and energy either through a venous line or gavage. They also need a strong sucking ability, coordination in swallowing, blocking larynx and nasopharynx with epiglottis and uvula, and natural movements of the esophagus for oral feeding.<sup>[10]</sup> In addition, any feeding method not involving oral nutrition deprives the infant from experiencing sucking and swallowing opportunities and hungry–sated natural cycle; the longer the non-oral feeding, the more difficult the nutritional problems.<sup>[11]</sup> Unfortunately, most of the premature neonates do not receive adequate amounts of protein and calorie after birth and are involved in growth limitation and malnutrition, which leave notable effects on their height, weight, and nervous system.<sup>[12]</sup> Inappropriate weight gain leads to prolonged hospitalization of neonates in the ward and, consequently, more risk of sepsis.<sup>[13]</sup> The

risk of nutritional problems in neonates and, consequently, the incidence or progression of low weight due to premature birth, or treatment and care processes all act as a barrier in independent oral feeding of neonates. For instance, tube feeding lowers sucking function and its motor development in premature neonates. This type of feeding also prevents appropriate mother–neonate interaction during feeding.<sup>[14]</sup> Before discharge, the infants are usually able to take all of their needed nutrients through breastfeeding, which needs an intervention to facilitate their nutritional progression and to let them be discharged from the hospital earlier. The time interval between initiation of oral feeding and full oral feeding can be a few days or months in premature neonates, leading to a prolonged hospitalization and mothers' anxiety. Prolongation of hospitalization may also result in higher financial burden to the family and health system.<sup>[3]</sup> During premature neonates' hospitalization period in Neonatal Intensive care Unit (NICU), their feeding method may need a change in cases such as low-volume milk feeding, taking complements with milk, or cessation of mother's milk due to prolonged hospitalization. In these cases, feeding should be administered through another method and not through breastfeeding. The feeding method is replaced by cup methods.<sup>[15]</sup> Cup feeding is applicable for the neonates who, despite having proper swallowing ability, do not have appropriate sucking. It is also recommended for those neonates who cannot be breastfed well to reinforce their sucking power.<sup>[16]</sup> Palady is similar to a teaspoon with a tongue stud and is used for the neonates who cannot be directly breastfed. This tool is traditionally used in India to feed the neonates<sup>[17]</sup> and is very healthy.<sup>[18]</sup> A study conducted in 2012 in India showed that preterm healthy neonates over 30 weeks of gestational age could be fed by palady and reach oral feeding earlier leading to their earlier transfer from NICU to their mothers. There were no complications reported, such as vomiting and aspiration, among the neonates fed by palady and breastfeeding. Therefore, it seems that palady method has no conflict with breastfeeding.<sup>[17]</sup> In a study conducted in England in 2007, the results showed that the neonates received a lower volume of milk in palady method compared to bottle feeding (due to high amount of wasted milk) and more time was consumed in palady method to feed the neonate. Palady also imposes more stress to the neonates.<sup>[19]</sup> A study in India showed that the infants fed by palady received the maximum volume of milk in the shortest possible time, and cup feeding had the highest milk wastage. The infants also experienced a longer period of calmness.<sup>[20]</sup> With regard to the controversial results of studies conducted on the volume of mother's milk received through palady and cup methods, and as the neonates are fed by cups in few NICUs and no study aiming at comparison of the two feeding methods concerning weight gain and reaching full oral feeding

was found, the researcher conducted the present study to investigate the effect of palady and cup feeding methods on premature neonates' weight gain and their reaching full oral feeding time interval.

## MATERIALS AND METHODS

This is a clinical trial IRCT registration number IRCT2015090518561N4 that was conducted on 69 premature neonates in the NICUs of Al-Zahra and Shahid Beheshti hospitals of Isfahan in May–September 2014 after obtaining an informed consent from the subjects. The researcher paid close attention to ethical considerations in all steps of the study. The study was conducted on 69 premature neonates aged 29–32 gestational weeks, selected through convenient sampling. The subjects were assigned to cup ( $n = 34$ ) and palady ( $n = 35$ ) feeding groups by random allocation (lotto). Inclusion criteria were: Birth weight 900–1000 g, gestational age 29–31 weeks (fertilization age was 32 weeks and did not exceed 33 weeks), exclusive breastfeeding or feeding with enriched mother's milk, neonates' hemoglobin not lower than 8 mg/dl and hematocrit not less than 30, Iranian nationality, absence of severe disabling conditions such as cerebral hemorrhage (grade II and III), or congenital defects, and no limitation in feeding with mother's milk.

Exclusion criteria were: Parents' loss of interest to continue in the study, neonates' death or critical clinical conditions, neonates' discharge before the end of study, and a sudden change affecting neonates' nutritional status, such as cerebral hemorrhage or intestinal problems such as necrotizing enterocolitis. Researcher began the intervention after explanation of the research goal and method to neonates' parents and obtaining their consent. Data collection tool was a demographic information record note, neonates' feeding checklist, and neonates' weight monitoring checklist. From the first day after birth, intravenous full nutrition or total parental nutrition (TPN) was started based on a standard protocol for the neonates in both groups. The subjects meeting the inclusion criteria received either cup or palady feeding according to relevant physician's order recorded in neonates' medical file.

In each shift, one oral feeding was administrated (3 times a day) for seven sequential days (total of 21 feedings through cup or palady method). Then, rest of the feeding was conducted by gavage. It should be noted that according to physician's order, breastfeeding was not administered at all during 7 days of the study. Before intervention, the researcher washed hands and hugged the neonate in semi-follower's position based on Hands Hygiene Compliance Instruction and used a neonate apron around the neonates' neck.

The cup and palady were filled more than half. The cup was gently laid on neonate's lower lip so that the milk would touch the neonate's lip in a way that the neonate could actively swallow milk. This process continued until the entire required amount of milk was taken. For palady method, the researcher washed hands, and palady was held by its side and laid on neonate's mouth corner. Then, the neonates were gently fed. The neonates also frequently underwent tube feeding in addition to these two methods. Full oral feeding refers to 8 times of oral feeding in a day with observation of no oxygenation disorder, apnea, and bradycardia in neonates during feeding. The neonates were weighed in equal conditions with identical scales (Seca digital scales, made in Germany; with an accuracy of  $\pm 10$  g) in NICU before they were fed and while they were not wearing apron, and their weights were recorded.

Data were analyzed by descriptive (frequency distribution tables, distribution, mean, and SD) and inferential (Chi-square, Mann–Whitney, and independent *t*-tests) statistical tests in SPSS 14. *P* value less than 0.05 was considered significant.

## Ethical considerations

The present study was approved by the ethics committee of Isfahan University of Medical Sciences and all ethical considerations including subjects' volunteer participation and confidentiality of their data were respected.

## RESULTS

The results showed a significant difference in subjects' demographic variables such as sex, gestational age, number of phototherapy days, rank of birth, delivery mode, mother's disease, multiple neonates, mother's smoking and addiction, type of feeding, phototherapy, and antibiotic therapy between two groups (Mann–Whitney, Chi-square, and independent *t*-tests). Independent *t*-test showed that mean length of hospitalization and the time interval to reach full oral feeding were significantly lower in palady group compared to the cup group ( $P < 0.001$ ) [Table 1]. Independent *t*-test showed that mean weight change in neonates was significantly higher 7 days after intervention in the palady group than in cup group, compared to the beginning of intervention ( $P < 0.001$ ) [Table 2].

## DISCUSSION

The present study investigated the effect of palady and cup feeding on premature neonates' weight gain and reaching full oral feeding time interval. Results show that weight gain and the time interval to reach full oral feeding were significantly lower in palady group compared to

**Table 1: Means of hospitalization length and time interval to reach full oral feeding**

Variable	Cup		Palady		Independent t-test	
	Mean	SD	Mean	SD	t	P
Hospitalization length	39.1	9.1	30.4	8.2	4.01	P<0.001
Time interval to reach full oral feeding	33.7	8.1	24.1	7.8	4.99	P<0.001

SD: Standard deviation

**Table 2: Comparison of weights 1 and 7 days after intervention in the two groups, time to reach full oral feeding compared to the first day after intervention, weight on the 7<sup>th</sup> day after birth compared to birth weight in the two groups**

Variable	Cup		Palady		Independent t-test	
	Mean	SD	Mean	SD	t	P
Comparison of weights 1 and 7 days after intervention in two groups	39.4	29.0	98.5	40.1		0.000
Time to reach full oral feeding compared to the first day after intervention	146.7	57.9	198.8	54.7		0.000
Weight on the 7 <sup>th</sup> day after birth compared to birth weight in two groups	219.7	76.4	270.5	75.5		0.007

SD: Standard deviation

the cup group. Mean weight change in neonates was significantly higher in palady group 7 days after beginning the intervention, compared to the cup group. A study in 2012 showed that premature neonates with gestational age of 30 weeks could be fed by palady from the second day after birth. The authors reported that palady feeding could improve premature neonates' nutritional function within a couple of days, so that they could be transferred to their mothers.<sup>[17]</sup> The fact reported in the study that premature neonates fed by palady could reach full oral feeding earlier is in line with the present study. The authors suggested feeding the neonates with physiological stability and a gestational age of 30 weeks through palady method from the second day post birth. In the present study, the neonates with approximately 30 weeks of gestational age were started on palady feeding based on relevant physician's order. there is no comparison about palady and cup feeding in this study.

Most of the studies have investigated the volume of milk taken and the amount of mother's milk wasted in palady and cup feeding. Narayanan *et al.* showed that the neonates on palady feeding had more weight gain as they received the highest amount of milk in the shortest time and had longer periods of calmness. The highest wastage of milk was found in neonates fed through cup feeding,<sup>[20]</sup> which is consistent with the present study result. But the time interval of reaching full oral feeding was not compared in neonates being fed by palady and cup methods.

Meanwhile, Aloysius *et al.*, in a pilot study on premature neonates, concluded that the neonates received lower volume of milk in palady method compared to bottle feeding, and palady method took more time that could lead to less weight gain,<sup>[19]</sup> which is not in line with the present study result. A study conducted in Turkey in 2013 showed no significant difference in the neonates fed by cup and bottle concerning weight gain, nutritional problems, and the time consumed for feeding. The authors also reported that cup feeding significantly increased the probability of exclusive feeding with mother's milk in premature neonates 3 and 6 months after discharge. They suggested using cup feeding as a transitive traditional method to feed premature neonates during their hospitalization.<sup>[21]</sup> Neide *et al.* compared the effects of bottle and cup feeding on oxygenation and weight gain in premature neonates and reported no significant difference between groups in the weight gained during the first week of oral feeding. Meanwhile, better effect of cup feeding, compared to bottle feeding, was revealed when the neonates were discharged and they showed more interest in breastfeeding.<sup>[22]</sup> A study in Tabriz, Iran, conducted in 2012 showed that the group that had increased milk volume of 30 ml/kg/day fared better concerning the time needed for reaching birth weight and full oral feeding, compared to the other group.<sup>[12]</sup> Although there is a bulk of research on premature neonates' feeding, there is no consensus on the feeding methods and the age of beginning oral feeding in premature neonates. Our obtained results show that the time interval to reach full oral feeding was shorter in palady group compared to cup feeding. Change in mean weight was higher in palady group subjects 7 days after beginning the intervention, compared to that at the beginning of intervention and the cup group. Therefore, palady method is suggested to feed premature neonates with stable physiological condition from the second day after birth or with a gestational age of 30 weeks.

Meanwhile, further studies with a larger sample size of premature neonates are needed before recommending this method as a routine. Lesser number of subjects was a limitation in the present study. Therefore, conducting another study with a higher number of subjects and focusing on low birth weight infants, and comparing its results with the present study are suggested.

## CONCLUSION

Based on the obtained results, it can be concluded that administration of palady feeding for premature neonates with physiological stability at 30 weeks of gestational age in NICU leads to increased weight gain and a shorter time interval to reach full oral feeding.

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## Conflicts of interest

There are no conflicts of interest.

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