

The Effects of Massage on the Weight Gain of Preterm Infants: A Systematic Review

Preterm Bebeklere Uygulanan Masajın Kilo Alımı Üzerine Etkisi: Sistematik Derleme

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Received: 17.09.2018

Received in revised form: 03.12.2018

Accepted: 03.12.2018

Available online: 07.02.2019

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This study was presented orally at the
Congress of Pediatric Nursing
(01-03 June 2018, Athens, Greece).

ABSTRACT Objective: Along with the present systematic review, it was aimed to examine and discuss the effects of therapeutic massage implementations on weight gain of very low birthweight preterm infants in intensive care unit. **Material and Methods:** The relevant documents of the study were retrieved using keywords namely, preterm, massage and weight gain from PubMed, Google Scholar and ScienceDirect databases. Accordingly, a total of 5,453 documents were recorded. After inclusion criteria (experimental, semi-experimental and randomized controlled trials, full texts published) and exclusion of the duplicated articles, errata and undefined documents, we identified 18 relevant and available peer-reviewed publications from 2002 to 2017. PRISMA checklist was used for systematic review. **Results:** A total of 18 research articles examined the effects of therapeutic massage applications (Tactile kinesthetic practices, coconut, mineral oil and standardized massage) on weight gain. Of those studies, 15 research articles reported the positive effect of the massage on the weight gain but there were no remarkable effects of massage in the remained studies. Physiologically, any increment in weight gain resulting from massage has been attributed to improved conversion of food into growth coupled with the improved metabolic efficiency and attenuated stress. **Conclusion:** In general, we can deduce and conclude that therapeutic massage implementations on weight gain, which is of the growth and development parameters of preterm infants who are no matter from different physiological, sociological and cultural characteristics are effective. In this context, the present review study is considered to contribute to the research areas with respect to the massage implementations topics for preterm infants.

Keywords: Preterm; massage; weight gain; nurse

ÖZET Amaç: Mevcut sistematik derlemeyle birlikte, yoğun bakım ünitesinde çok düşük doğum ağırlıklı preterm bebeklerin kilo alımı üzerine uygulanan tedavi edici masaj uygulamalarının incelenmesi ve tartışılması amaçlanmıştır. **Gereç ve Yöntemler:** Pubmed, Google Scholar ve Science Direct veri tabanlarına preterm, massage, weight gain anahtar kelimeleri kullanılarak tarama yapıldı. Sonuç olarak, 5,453 adet çalışma bulunmuştur. Ancak, elde edilen bu çalışmalar dahil etme (deneysel, yarı deneysel ve randomize kontrollü araştırmalar ve tam metine erişilebilen) ve hariç tutma (düplasyon makaleler, hatalı makale ve tanımlanamayan makaleler) gibi kriterlerden sonra, 2002 ve 2017 yılları arasında 18 adet ilgili çalışma belirlenmiştir. Sistematik derleme için PRISMA kontrol listesinden yararlanılmıştır. **Bulgular:** Toplam 18 araştırma makalesi, terapötik masaj uygulamalarının (Dokunsal kinestetik uygulamalar, hindistan cevizi, mineral yağ ve standart masaj) kilo alımına olan etkisini incelemiştir. Bu çalışmalardan, 15 araştırma makalesinde masajın kilo alımına olumlu etkisi olduğu, ancak kalan çalışmalarda masajın kayda değer bir etkisi olmadığı bildirilmiştir. Fizyolojik olarak, masajdan kaynaklanan kilo artışındaki herhangi bir artış, artırılmış metabolik etkinlik ve zayıflatılmış stres ile gıdaların büyümeye dönüşümü ile açıklanmıştır. **Sonuç:** Genel olarak, terapötik masaj uygulamalarının farklı fizyolojik, sosyolojik ve kültürel özelliklerden bağımsız preterm bebeklerin büyüme ve gelişme parametrelerinden olan kilo alımında etkili olduğu sonucuna varabiliriz. Bu bağlamda, mevcut derleme çalışmasının, preterm bebekler için masaj uygulamalarına ilişkin araştırma alanlarına katkıda bulunduğu düşünülmektedir.

Anahtar Kelimeler: Preterm; masaj; kilo alımı; hemşire

Childbirth mortality rate relatively high in especially in developing countries. Of those high morbidity and mortality rates, preterm births are considered as of the major problems in those countries. According to the reports disseminated by WHO and related organizations, 15 million preterm infants are born too early each year and one million preterm died due to complications. It is worthy to note that the number of the prematurity is unfortunately increasing day by day.¹

Since the infants in Neonatal Intensive Care Units (NICU) are considered to be subject to stressful environment, the role of massage in alleviation of the stress through providing tactile stimulation has been well documented. Albeit that massage is defined as any form of systematic tactile stimulation by human hands, the type of massage implemented for neonatal care is gentle and slow stroking. Therefore, in order to promote the growth and development of infants and low-birth weight infants, massage has been recommended as an intervention.² The first developing sense is the “sense of touch” in working preterm that have completed the developmental process due to the immaturity of sensory organs. It led to such as vision, hearing senses and the interaction with the environment after birth is realized. Premature birth breaks mother-infant contact early. This process is based on touch therapy massage therapy in terms of therapeutic treatment. Massage implements decrease the stress, sleep-nonsleep balance bring to maturity, rise mother-baby connection, contributing to the development of preterm, drop the hyperbilirubinemia, weight gain, late period neonatal sepsis prevention.³⁻⁹

It is important to note that weight gain, which is of the growth and development parameters, may greatly mitigate the number of preterms requiring examinations. Moreover, it is emphasized that optimal weight gain is deemed to be linked with the insulin-like growth factor-1 (IGF-1) that possesses roles in regulation of activation of retinal vascular endothelial growth factor by IGF-1 and retinal vascular growth early in postnatal life.¹⁰⁻¹⁴

Any increment in weight gain resulting from massage has been attributed to improved conversion of food into growth coupled and shunted with the improved metabolic efficiency.¹⁵⁻¹⁸ Furthermore, an explanation on improved weight gain was associated with the reduced overt signs of the stress.¹⁹ The weight gain mechanism is well-described by Field et al. (2008), suggesting that preterm infant weight gain shunted with massage therapy were associated with augmented vagal activity that suggests the reduced stress, and gastric motility, which might have plausible roles in con-

tribution of more efficient food absorption.²⁰ Moreover, it is highlighted that weight gain was associated with the increase in levels of serum insulin and IGF-1 levels following massage therapy. Also, the regulatory role of massage was postulated, proposing that the massage improves autonomic nervous system function as measured by heart rate variability in preterm infants.²¹ In addition to physiological and neurological contributions of massage, infant massage might lead to earlier discharge and reduced hospital costs.²²

Herewith the study, we aimed to analyze and discuss the original researches concerned with the effects of massage on the weight gain of the preterm infants in intensive care unit. Specific to the weight gain, the physiological explanations on the weight gain were also reported herein.

MATERIAL AND METHODS

Search Strategies: The relevant documents of the study were retrieved using keywords namely, preterm, massage and weight gain from PubMed, Google Scholar and ScienceDirect databases. Accordingly, a total of 5,453 documents were recorded. After inclusion criteria (experimental, semi-experimental and randomized controlled trials, full texts published) and exclusion (duplicated articles, errata and undefined documents, unpublished thesis, review articles, meta-analyses, congress proceedings, case presentations and articles published in non-refereed journals), 18 relevant articles were included in this systematic review.²³ The detailed for screening and retrieving documents are given in (Figure 1).

RESULTS AND DISCUSSION

Along with the present review, the studies concerned with the massage and weight gain interaction were examined. In this context, 18 relevant documents were analyzed. Of experimental design of the studies, randomized controlled trial (N=14), non-randomized blinded clinical trial (N=2) and quasi-experimental trial (N=2) were recorded. A total of 1035 preterms have been included (N= 593 in experimental group and N=442 in control group).¹⁰⁻²⁷ Herewith the analyzed studies, the ex-

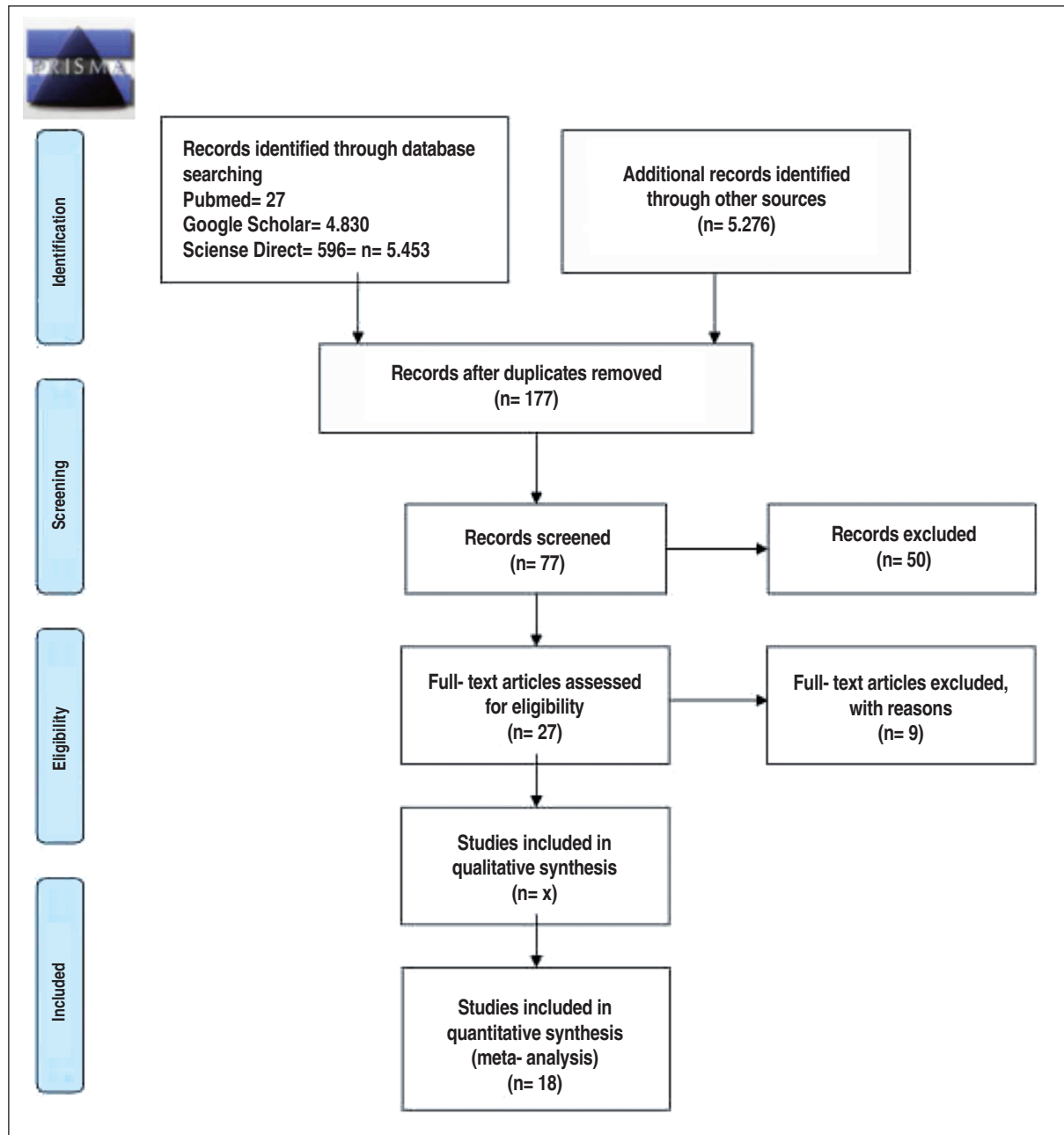


FIGURE 1: PRISMA 2009 Flow Diagram.²³ For more information, visit www.prisma-statement.org.

periments were performed with infant's gestation week ≤ 32 and an average of 1000 gram or more.

Along with the analyzed articles for the current study, the effects of different therapeutic massage applications (tactile kinesthetic practices, coconut, mineral oil and standardized massage) on weight gain have been examined. The massage implementation was found to possess positive effect on weight gain.^{20,22,24-36} whereas there were no sig-

nificant effects on weight gain.^{21,37,38} Evidence-based care guidelines for preterm infant massage is defined gastric motility and weight gain among preterm infants. Infant's gestational age must be equal to or greater than the corrected age of 32 weeks and its weight must be greater or equal to 1000 g.³⁹ These findings are consistent with the literature.

According to the detailed [Table 1](#), the selected and analyzed studies were presented with their de-

tails including “author, year, country, journal, method, sample, implementation, evaluation and conclusions”. Herewith, we can deduce and conclude that the affirmative influence of the massage on the weight gain, which is supported with the basic and advanced physiological parameters, regardless of the geographical origin of the preterm infants, weight of the infants, duration of the massage therapy and massage practitioners (specific nurse, a trained massage therapist, registered nurses in the NICU who were trained by the same licensed massage therapist or mothers).

Many explanations on mechanisms have been postulated, providing basis for the benefits of massage in the promotion of growth and subsequently weight gain. Massage implementations as a non-nutritive sucking approach leads to stimulation of proprioceptors in the oral mucosa, which then increase gastrin, insulin and cholecystokinin release.⁴⁰ Apart from hormonal changes, the stress behaviors are diminished with the massage through attenuated cortisol levels in preterm infants following massage.⁴¹ Moreover, tactile stimulation-induced increase in ornithine decarboxylase, an important enzyme involved in protein synthesis, contributes to the weight gain.^{33,42,43} It is re-highlighted that improvements in weight gain are associated with improved metabolic efficiency leading to acquisition of body mass of all types-adipose, muscle and bone.³³ On the other hand, out of the analyzed studies, no significant effects of the massage on the weight gain have been observed. This is explained as fact that mothers could not use moderate pressure during massage implementations for their intense emotions about their small babies.⁴⁴

Whereas the weight gain was recorded at the end of massage therapy by mother, there was no weight gain in the report by Procianoy et al. (2010).^{30-31,38} Also, educating parents to massage their preterm infants with preterm infants may improve the physical well-being of the infants and increase parental satisfaction.²⁸ Practices made by mothers are supported by the literature proposing the mother's contribution on weight gain. We should moreover note that the difference among the studies might also attributed to preterms of less than 1000 g.³⁸

CURRENT STATUS AND FUTURE OUTLOOK

Massage therapy dates back to history of the human being from prehistoric times to modern history. Massage therapies have been used for different purposes and has been deemed as primary healing practices as of that time. In the Ayur-Veda (around B.C.800, India), it has been reported that massage therapies have been used for many conditions including mental diseases, stomach pain, dropsy, torpor etc. Also, in New Zeland, mothers used massage for shaping and improving their children' noses and strengthen their legs. In Cuba, a garlic and oil massage hav been used for alleviating pain. In Samoa, they use the mixture of coconut milk, flower and roots. Of the massage therapies, Swedish therapy is the most popular.⁴⁵

In the study by Yılmaz and Conk, massage therapies are also common in many parts of the world such as Nigeria, Uganda, Fiji, New Guinea, Venezuela. In Turkey, there are two types of the infant massages applies.⁴⁶ The first one is used for treatment of colic, abdomen and feet massage with some aromatic oils for the first months of the infants. The later one is the extension and flexion of the extremities of the infant.⁴⁶

We can deduce that masage therapies are not new, even old as human history but there is no a uniform method on the application. Of the analyzed studies along with the study, practitioners, duration, material as a massage agent and their content are different from each other. We can highlight that the mentioned variables induce and modulate the pathways of the efficiency of the metabolism and subsequently contribute to the weight gain. However, with the present results herein, we cannot conclude which treatments differing oil and their content- the efficacy of a biological material is well-known to be associated with their content- or standardize massage differing practitioners and duration are the optimum therapies albeit that the massage favors significantly weight gain. For the forthcoming studies, the optimal duration, method with optimal massage agent might be determined in comparison to the standardized massage.

TABLE 1: The details of the studies analyzed for the present review.

Authors, Year, Country, Journal	Method	Sample	Implement	Evaluation	Conclusion
Rad et al. 2016. ²² IRAN Journal of Clinical Neonatology	Non-randomized blinded clinical trial	28-32 GW among 1000-1500 g During the last 20 days stabil. 20 trial, 20 control group (N=40)	It had been given 15 min massage therapy 3 times a day for one week.	Preterms weighted at 12 o'clock every day.	Two groups compared. Massage has significantly increased weight gain and shortened the length of stay in the hospital.
Singht 2017. ²⁴ SAUDI ARABIA International Journal of Innovative Research in Medical Science (IJIRMS)	Randomized Controlled trial	Among 2000-2500 g between 8-28 days. 30 trial, 30 control group (N=60)	It had been given 15 min massage with Coconut oil (20 ml) 2 times a day during five days.	Weight gain between the two groups was compared using an electronic scale.	Massage with coconut oil has been found to have a significantly effect on weight gain.
Saeidi et al. 2015. ²⁵ IRAN Acta Medica Iranica	Randomized Controlled trial	40 oil massage and 40 massage group (trial) 41 control group (N=121)	Randomly divided into 3 groups.	Three groups was compared about weight gain after the one week applied.	Massage with oil has been determined significantly effect on weight gain.
Bayomi and Nagger 2015. ²⁶ SAUDI ARABIA Journal of Nursing Education and Practice	Quasi-experimental trial	Two differents hospital NICU. Randomly chooses 64 preterms (N=64)	Massages were made for the babies taken to work after a shift change hours in the morning for a week.	Massage before and after evalua- tion with observer scale and NIPS.	At the end of the practice, there was a significant difference between preterms heart rate, apnea, temperature, weight gain and length of stay in the hospital.
Tekgündüz et al. 2014. ²⁷ TURKEY Italian Journal of Pediatrics	Pre-post test experimental trial	14 control and 13 trial groups (N=27)	It had been given 15 min massage 2 times a day.	Two groups compared to About delectation, weight gain, vomiting, abdominal circumference, gastric residue.	All parameters were significantly different in the trial group.
Rangey and Sheth 2014. ²⁸ INDIAN Hindawi Publishing Corporation International Journal of Pediatrics	Randomized Controlled trial	GW < 37 and weight <2500 g Stabil. without physical or genetic malformation. 15 trial group and 15 control group (N=30)	Massage and mother kangaroo care were applied to the trial group for 15 min. For 5 days.	Massage and Kangaroo care were compared to weight gain and stay hospital between two groups after intervention first day and fifth days.	Preterms who have massage and kangaroo care gained weight and length of stay in the hospital was short.
Kumar et al. 2013. ²⁹ INDIAN Indian J Pediatr	Randomized Controlled trial	Weight<1800 g and GW< 35 preterms 25 massage and 23 control group (N=48)	Massage group have standard care and oil massage, control group have standard care.	Serum triglyceride levels and anthro- pometric measurements were com- pared on days 7 th and 28 th of both groups.	It has been determined that oil massage increases weight gain and prevents weight loss within the first 7 days.
Smith et al. 2013B. ⁷ USA J Perinatal	Randomized longitudinally controlled	29-32 GW. 17 trial and 20 control group (N=37)	Massage was applied by therapist during the 2 times for 4 weeks	Two groups were evaluated about autonomic nervous system functions and cardiac rhythm.	There was no difference in weight gain between the two groups according to time. <i>continued...→</i>

TABLE 1: continued.

Authors, Year, Country, Journal	Method	Sample	Implement	Evaluation	Conclusion
Abdallah et al. 2013. ³⁰ USA Infant Behavior & Development	Quasi-experimental trial	Two university hospitals similar characteristic 66 preterms, 32 massage and 34 control group. (N=66)	Massage was applied by mother.	Data were collected by the investigators and evaluated for discharge weight, PIPP, stay hospital, neurodevelopmental status (Bayley score) and breastfeeding status up to 12 months.	Preterms had weight gain. Also, PIPP scores were significantly low. There was no difference between two groups the length of stay in the hospital, breast-feeding and motor functions.
Karbasi et al. 2013. ³¹ IRAN Iran J Reprod Med	Randomized Controlled trial	33-37 GW among 1500-1999 g. Stabli 20 trial, 20 control group. (N=40)	First day mothers was trained on massage practice. It was applied to the trial group for 10 min. Prone and spine position three times a day during 14 days.	Two groups were evaluated weigh, tall stature and head circumference at the first and fifth months	While the massage group was found to gain more weight and the difference was significant, there was no difference in height and head circumference measurements.
Ang et al. 2012. ³² USA Pediatrics	Randomized placebo controlled	58 massage and 62 control group. (N=120)	Massage applied 5 days until to discharge 4 weeks.	Immunology, complete NK, T and B cell samples, NK ciotoxin, weight, infection and hospital stay were assessed.	While weight gain was detected in the massage group, there was no significant difference in the other parameters between the two groups.
Massaro et al. 2009. ³³ USA Journal of Perinatology	Randomized Controlled trial	GW<32or<1500 g preterms. 20 tactile massage group, 20 massage/Kinaesthetic stimulation group, 20 control group. (N=60)	Stabil Preterms was applied to massage or Kinaesthetic stimulation. The intervention was done two times per day for 15 min at a time from the time of study entry until discharge.	Primary outcomes of average daily weight gain during the study period and length of stay were assessed at discharge.	Although there was weight gain in the trial group, it was determined that it did not shorten the length of stay in the hospital.
Aliabadi and Askary 2013. ³⁷ IRAN Iran J Pediatr	Randomized Controlled trial	28-32 GW, 1000-1500 g. during the last 20 days stabli. 20 trial, 20 control group. (N=40)	Kinaesthetic stimulation was applied to the trial group for 15 min. Prone and spine position three times a day for 10 days.	Data were evaluated by same person with ± 5 gr Philips electronic scale device and Brazelton newborn behavior assesment scale.	Although there was a tendency to increase daily weight gain, there was no statistical significance. Significant results were determined in "motor" functions in the trial group at the Brazelton scale.
Procianny et al. 2010. ³⁸ BRAZIL Early Human Development	Randomized Controlled trial	GW<32 among 750-1500 g 35 massage and 38 control group. (N=73)	Preterms was applied to massage by mother and skin to skin contact (trial group), only skin to skin contact (control group)	Preterms were evaluated growing and neurodevelopmental follow-up for 2 years.	There was no difference in weight, height and head circumference measurements between the two groups. Psychomotor development index scores of massage group were significantly high.
Field et al. 2008. ⁴⁰ USA J Dev Behav Pediatr	Randomized Controlled trial	≤ 34 GW preterms 21 trial, 21 control group. (N=42)	Massage group implemented touch and passive extremity practise 15 min. 5 days a week. Control group applied standard nursing care.	On the first and fifth days, insulin and insulin growth factor-1 (IGF-1), weight gain, calorie consumption in the blood serum were evaluated.	Although similar formula was taken, the preterms that were massaged showed very good results at the five-day period. Especially 1) weight gain 2) insulin serum level 3) insulin growth factor (IGF-1) <i>continued...→</i>

TABLE 1: continued.

Authors, Year, Country, Journal	Method	Sample	Implement	Evaluation	Conclusion
Mohamadzadeh et al. 2005. ³⁴ IRAN Medical Journal of the Islamic Republic of Iran	Randomized Controlled trial	28-32 GW among 1000-1500 g. Stabil. 12 trial, 11 control group. (N=23)	Kinaesthetic stimulation was applied massage three times a day 15 min. during 10 days.	The weight gain of two groups was compared after 10 days.	The trial group was determined to have a significantly weight gain according to the control group.
Sankaranarayanan et al. ³⁵ INDIAN Indian Pediatrics	Randomized Controlled trial	Preterm infants among 1500-2000 g. Trial group 38 (coconut oil) and 7 mineral oil, 37 placebo group. (N=112)	Massage training was given fort he next two days after birth and was implemented four times Daily until discharge.	Preterms were evaluated about anthropometric measurements and Brazelton neuro-behavioral scale on 7 th and 31 th days.	It was determined that the massage group with coconut oil have weight gain and tall stature. Neuro-behavioral differences were not found among the three groups.
Dieter et al. 2003. ³⁶ USA Journal of Pediatric Psychology	Randomized Controlled trial	25-34 GW among 750-1600 g. 16 trial and 16 control group. (N=32)	Three times a day 15 min. during 10 days.	It was compared to weight gain, defecation, feeding, cal. sleep/non- sleep behavior.	The massage group was found to have an average weight gain of 53% more than the control group.

CONCLUSION

The evidences suggest that massage therapy improve and promote the growth and development in preterm infants and subsequently weight gain, which is coupled and shunted with improved metabolic efficiency and attenuated stress behaviors. Regardless of the different physiological, sociological and cultural characteristics of the preterms all, massage therapy is deemed and suggested as an effective method for weight gain through modulating metabolic efficiency of preterm infants.

Acknowledgement

We would like to the anonymous referees for their valuable comments and contributions on the earlier draft of this review study.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

All authors contributed equally while this study preparing.

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