

Association between Infant Carrying Methods, Duration, and Trunk Position Among Nursing Mothers of Lahore

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¹Substantial contributions to the conception or design of the work for the acquisition, analysis or interpretation of data for the work, ² Drafting the work or reviewing it critically for important intellectual content, ³ Final approval of the version to be published

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Introduction

Early childhood development must take into account newborn care, and nursing mothers are especially important in providing their infants care and nutrition.¹ One essential aspect of infant care is carrying the baby, which involves physically supporting and transporting the child.² Infant carrying, the act of carrying or holding an infant or child in arms on a baby carrier, enables a newborn to be physically near their mother or other caregiver. Infant carrying is often referred to as babywearing. Infants are frequently carried in arms, but babywearing allows a

A B S T R A C T

Background: Infant carrying, which involves holding an infant in arms or using a baby carrier, enables a newborn to remain physically close to their mother. However, the physical demands of caring for a newborn can make nursing mothers more prone to developing musculoskeletal disorders (MSDs).

Objective: To determine the association between infant carrying methods, duration, and trunk position among nursing mothers of Lahore.

Methodology: A descriptive cross-sectional study was conducted using a non-probability convenience sampling technique. The study included 176 female participants of childbearing age (18-35 years) with a body mass index (18.5-24.9 kg/m²) and infants aged 0-2 years. Data was collected from six immunization centers and four postnatal clinics in Lahore. A standardized questionnaire, consisting of three sections, was used. Section A focused on socio-demographic and infant-maternal characteristics, while sections B and C addressed various infant carrying methods (ICMs) and related musculoskeletal injuries. The test-retest reliability coefficients of this questionnaire were 0.80 and 0.79, respectively. Statistical analysis was performed using SPSS version 26.

Results: Out of 176 participants, 31.3% (n=55) commonly carry their infants in their arms, primarily adopting a forward trunk lean position (35.2%, n=62). Additionally, 76.1% (n=134) carry their infants for 1 to 6 hours daily. Musculoskeletal pain was predominantly reported in the upper limbs (65.4%, n=115) and upper back (68.2%, n=120). A significant association (p<0.05) was found between the infant carrying methods, trunk position, and time spent carrying an infant.

Conclusion: A greater number of participants used in-arms ICM for 1-6 hours daily, and reported forward lean trunk position, as well as upper limbs and upper back pain, suggesting an association between ICM duration and musculoskeletal discomfort.

Keywords: Body Mass Index, Caregivers, Infant, Musculoskeletal Pain.

mother or other caregiver to safely transport an infant while having both hands free.³

Infant carrying, has been a crucial component of raising children in many cultures for ages.⁴ Carrying methods have evolved over time, shifting from traditional practices to the use of modern tools like strollers, slings, and infant carriers. In an infant carrier, parents can keep their little one close while still having both hands free for other activities. Additional advantages of babywearing have been suggested, such as improved mother-infant bonding, prolonged breastfeeding, and decreased infant agitation.^{5,6} While these techniques are

practical and strengthen the bond between mother and child, they can also stress nursing mothers' musculoskeletal systems if not applied appropriately or ergonomically.^{7,8}

Musculoskeletal disorders (MSDs) encompass a range of conditions affecting the muscles, bones, tendons, ligaments, and other structures that support the body's movement. These conditions can be caused by strong exertions, uncomfortable postures, repetitive movements, and prolonged static positions.⁹ Due to the physical demands of caring for a newborn, including lifting, carrying, and breastfeeding, nursing mothers are more prone to MSDs. Hence, MSDs are one of the most prevalent issues for mothers who carry infants.¹⁰⁻¹²

There are several different infant carrying methods (ICMs) available to mothers depending on where they live, despite major cross-cultural differences. In most cases, carrying a baby involves close body contact while using a sling, wrap, or even no carrying equipment at all.³ The choice of ICM can significantly influence the physical strain experienced by nursing mothers. Traditional techniques, such as holding the infant in the arms or on the hip, have been used for a very long time and are firmly ingrained in many different cultures. However, these techniques have the potential to overstress the musculoskeletal system, resulting in pain and discomfort.^{13,14} Studies have shown that there is a link between infant carrying techniques and musculoskeletal disorders in nursing mothers. Thus, it has been reported that MSDs are quite common in different regions of the body, such as the neck, upper limbs, upper back, lower back, and lower limbs, depending on the ICM used.¹⁵

Currently, there are four main ways to carry a baby: front with support, front without support, in-arms, and side.¹⁶ These ICMs change the body's gravitational field in distinctive ways, loading the trunk in different directions. Trunk loading may add to the physical stress that frequently causes low back pain. Numerous studies have shown that carrying a newborn causes biomechanical change, including considerable decreases in pelvic axial rotation, hip and trunk angles, and postural modifications.^{17,18}

Modern baby carriers, strollers, and slings were created to support nursing women physically and reduce their workload. Slings and baby carriers are designed to evenly distribute the baby's weight around the caregiver's body, encouraging a more balanced load and minimizing stress on particular areas. Slings and carriers both allow for hands-free movement and a closer physical bond between mother and child. However, inadequate support, continuous use, or inappropriate adjustment can result in severe strain on the neck, shoulders, and lower back.¹⁹

To the best of the researcher's knowledge, this research helps improve understanding of the impact of infant carrying methods on the musculoskeletal system of mothers. Most mothers are unaware of how different ICMs can lead to musculoskeletal disorders. Hence, this study aims to increase understanding of the biomechanical effects of various infant carrying techniques, with the goal of raising awareness among nursing mothers and caregivers about safer carrying practices. By highlighting these effects, this research could guide future educational initiatives aimed at reducing musculoskeletal discomfort or injury. Therefore, this study aimed to determine the association between infant carrying methods, duration, and trunk position among nursing mothers of Lahore.

Methodology

The study was a cross-sectional investigation, carried out across six immunization centers and four postnatal clinics in Lahore from July 2022 to December 2022. Ethical approval was obtained from the Lahore College of Physical Therapy Ethical Board having a Ref. No. LCPT/DPT/16/57. Using the World Health Organization Sample Size Calculator, 176 female participants were recruited, with parameters set at a 95% confidence interval, an anticipated population proportion (p) of 0.66, and an absolute precision (d) of 0.03.²⁰

Eligible participants were women of childbearing age (18-35 years) with a body mass index (BMI) of 18.5-24.9 kg/m², along with their infants aged 0-2 years. Exclusion criteria included women who had been pregnant within the previous 9 months, nursing mothers with known neurological disorders, those who had received spinal injections during caesarean sections, and those with a history of chronic low back pain or other orthopaedic and musculoskeletal disorders.

Participants completed a standardized self-report questionnaire divided into three sections: A, B, and C. Section A gathered sociodemographic and infant-maternal information, while Sections B and C examined different infant carrying methods (ICMs) and related musculoskeletal issues. The questionnaire demonstrated test-retest reliability coefficients of 0.80 and 0.79.²⁰

The trunk positions of mothers while carrying infants were evaluated using observational analysis. Trained physiotherapist observed and recorded the trunk positions of participants as they carried their infants in various methods. The observed postures were categorized into four distinct positions: upright spine, backward trunk lean, forward trunk lean, and lateral trunk lean.

Participant anonymity was ensured, and data were analyzed using the Statistical Package for Social Sciences (SPSS) version 21, with results presented through frequency tables, pie charts, and bar charts for clarity.

Results

The result of the current study was described in tabulated and figure form. The study's demographic results, shown in Table I, indicated that most participants were aged 26-35 years (58.5%), had a normal BMI (81.3%), and delivered via caesarean (56.8%). A slight majority were primiparous (52.8%). Half of the infants weighed 6-10 kg, with 19.9% below 5 kg. Most mothers (76.1%) carried their infants for 1-6 hours daily, with fewer carrying them for longer periods.

Table I: Demographic variables of Participants.		
Variables		N (%)
Maternal Age	18-25 years	103 (58.5%)
	26-35 years	73 (40.9%)
Occupation	Unemployed	131 (74.4%)
	Student	22 (12.5%)
	Public servant	21 (11.9%)
	Self employed	2 (1.1%)
	None	7 (4.0%)
Educational qualification	Primary	61 (34.7%)
	Secondary	48 (27.3%)
	Tertiary	41 (23.3%)
	Postgraduate	19 (10.8%)
	None	7 (4.0%)
Means of transportation	Personal car	75 (42.6%)
	Public transport	101 (57.4%)
Maternal body mass index	Normal	143 (81.3%)
	Overweight	31 (17.6%)
	Obese	2 (1.1%)
Mode of delivery	Vaginal	76 (43.2%)
	Caesarean	100 (56.8%)
Parity	Primiparous	93 (52.8%)
	Multiparous	83 (47.2%)
Weight of infant (kg)	Below 5	37 (21.0%)
	6-10	88 (50.0%)
	Above 10	51 (29.0%)
Age of infant (months)	Below 6	35 (19.9%)
	6-12	45 (25.6%)
	13-18	55 (31.3%)
	19-24	41 (23.3%)

The frequency of carrying an infant in different methods is as follows: front with support (11.4%, n=20), front without support (27.3%, n=48), side (30.1%, n=53), and in-arms (31.3%, n=55) as shown in Figure 1.

Out of 176 participants, the trunk position of mothers while carrying infants was assessed through observational analysis, revealing the following: upright spine (22.7%, n=40), backward

trunk lean (9.7%, n=17), forward trunk lean (35.2%, n=62), and lateral trunk lean (32.4%, n=57) as shown in Figure 2.

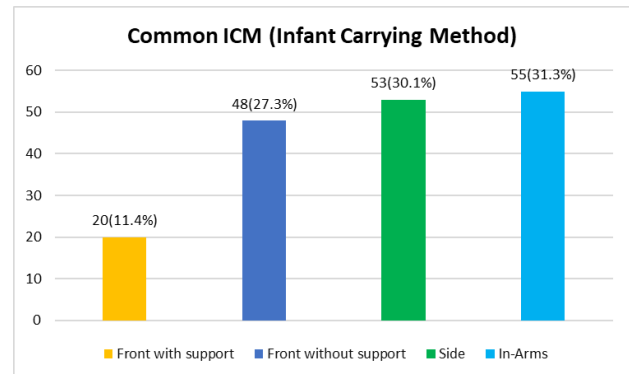


Figure 1. Bar chart of Common ICMs. (Infant carrying methods)

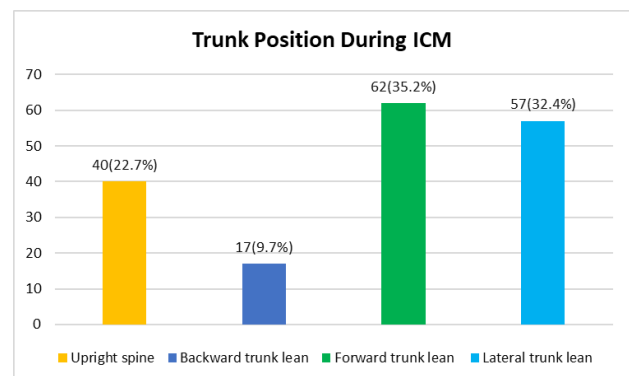


Figure 2. Bar chart of trunk position during ICM. (Infant carrying method)

The frequency of mother carrying infant 1 to 6 hours is 76.1% (n=134), 7 to 12 hours is 18.8% (n=33) and above 12 hours is 5.1% (n=9) as shown in table II.

Table II: Time Carrying Infant (Hours)

Hours	Frequency	Percentage
1-6 hours	134	76.1%
7-12 hours	33	18.8%
Above 12 hours	9	5.1%

The frequency of participants experiencing musculoskeletal (MSK) pain was as follows: neck (33.5%, n=59), upper limb (65.4%, n=115), upper back (68.2%, n=120), and lower limb (7.4%, n=13) as shown in table III.

Table III: Musculoskeletal Pain.

Pain Region	f	%
Neck	59	33.5%
Upper Limb	115	65.4%
Upper Back	120	68.2%
Lower Limbs	13	7.4%

Table IV: Association between infant carrying methods and time carrying infant(hours).					
Infant Carrying Methods	Time Carrying Infant (hours)			Total	Chi-square p-value
	1-6	7-12	above 12		
Front with Support	12	7	1	20	16.433 ^a 0.012
Front without Support	41	7	0	48	
Side	46	5	2	53	
In-Arms	35	14	6	55	
Total	134	33	9	176	
<i>a.5 cells (41.7%) have expected count, less than 5. The minimum expected count is 1.02.</i>					

Table V: Association between infant carrying methods and trunk position during infant carrying.							
Infant Carrying Methods	Trunk position during Infant carrying				Total	Chi-square	p-value
	upright spine	backward trunk lean	forward trunk lean	lateral trunk lean			
Front with Support	6	2	11	1	20	113.967 ^a	0.000
Front without Support	8	2	36	2	48		
Side	7	1	3	42	53		
In-Arms	19	12	12	12	55		
Total	40	17	62	57	176		
^a 3 cells (18.8%) have expected count less than 5. The minimum expected count is 1.93.							

Significant associations were reported between infant carrying methods and time carrying infant (hours) as Chi-Square values is 16.433 (p = .012) as shown in table IV.

Significant associations was found between infant carrying methods and trunk position during infant carrying as Chi-Square values is 113.967 (p = .000) as shown in table V.

Discussion

Infant carrying methods are essential for nursing mothers, providing both transportation and facilitating mother-child bonding. However, incorrect use or poor ergonomic design of these methods can lead to musculoskeletal problems.²¹ This study examined the association between infant carrying methods and related musculoskeletal pain in nursing mothers of Lahore. Current study findings revealed that 31.3% of participants used in-arms carrying, while 30.1% used side carrying methods, with 76.1% of all participants carrying their infants for 1-6 hours daily, resulting in common pain areas such as the upper limbs and upper back.

Erin M. Mannen et al. in 2020 conducted an experimental study assessing the impact of baby carrying methods on postural sway and pain during prolonged standing. They compared in-arms and soft carrier techniques, finding that front carrying resulted in fewer musculoskeletal issues than back carrying, due to reduced biomechanical strain. These findings suggest that front carrying may be a biomechanically favourable approach for prolonged standing.³ In current study, we observed that 27.3% of participants used front carrying without support, and 11.4% used front carrying with support. The musculoskeletal pain reported among these participants

showed that front carrying without support was associated with higher upper back pain (28.3%) and upper limb pain (26.1%) compared to front carrying with support (upper back pain: 12.5%). This indicates that while front carrying is generally advantageous, the method of support is crucial, as improper support can lead to significant musculoskeletal discomfort. This emphasizing the need for proper support and ergonomic design in infant carriers.

In 2020, Park HK et al. conducted a cross-sectional study on baby carrier usage in healthy women, finding that slings were associated with musculoskeletal discomfort in the neck, shoulders, and lower back. They emphasized the importance of proper adjustment and support to minimize these risks.²² In current study, it was observed that 35.2% of participants carried infants with a forward trunk lean, 22.7% with an upright spine, 9.7% with a backward trunk lean, and 32.4% with a lateral trunk lean, indicating similar concerns about musculoskeletal strain. The forward and lateral trunk lean positions are particularly concerning, as they can exacerbate musculoskeletal discomfort, similar to the issues reported by Park HK et al.

Previous research has consistently highlighted the relationship between infant carrying methods and musculoskeletal pain. Widyanti A et al. (2020) compared musculoskeletal symptoms in mothers using carriers versus traditional carrying methods, finding less shoulder pain and discomfort among carrier users. This suggests that carriers, when used correctly, can provide better support and weight distribution; hence, reducing the strain on specific body areas.²³ Similarly, Little EE et al. (2019) examined the impact of infant carriers on caregivers' musculoskeletal health, emphasizing the importance of maintaining a neutral posture, providing proper

support for the baby's spine and hips, adjusting equipment for optimal fit, and taking regular breaks to reduce physical strain.²⁴ They found that poor biomechanics in various infant carrying methods contributed to musculoskeletal pain in different regions.

Kim et al. in 2022 analyzed joint movement during different infant lifting motions using motion capture technology. They found that sling-based carrying techniques could lead to excessive lumbar hyperextension and paraspinal muscle hyperactivity, contributing to musculoskeletal problems. Additionally, carrying anterior weights increased trunk muscle activity, potentially causing issues among postpartum women with reduced muscular endurance.²⁵

In current study, musculoskeletal pain was reported in the neck, upper limbs, upper back, and lower limbs. Participants carrying infants in front with support experienced 12.5% upper back pain, while those carrying in front without support reported 28.3% upper back and 26.1% upper limb pain. Side carrying resulted in 33.9% upper limb and 31.7% upper back pain, and in-arms carrying led to 29.6% upper limb and 27.5% upper back pain. These findings indicate that the choice of carrying method significantly affects the distribution and intensity of musculoskeletal pain, reinforcing the conclusion that proper use of carriers can mitigate pain and emphasizing the need for proper ergonomic practices and support when using different ICMs.

Conclusion

The study revealed a predominant use of in-arms ICM for 1-6 hours daily, correlating with a forward lean trunk position and resulting in common musculoskeletal pain in the upper limbs and upper back. Significant associations were observed between infant carrying methods, trunk positions and duration of carrying.

References

1. Saleh A, Syahrul S, Hadju V, Andriani I, Restika I. Role of maternal in preventing stunting: a systematic review. *Gac Sanit*. 2021;35(Suppl 2):S576–82.
2. Barnett W, Hansen CL, Bailes LG, Humphreys KL. Caregiver–child proximity as a dimension of early experience. *Dev Psychopathol*. 2022;34(2):647–65.
3. Mannen EM, Havens KL, Kahney A, Nelson-Wong E. Baby-carrying method impacts caregiver postural sway and pain during prolonged standing. *J Women's Health Phys Ther*. 2020;44(2):47–53.
4. Berecz B, Cyrille M, Casselbrant U, Oleksak S, Norholt H. Carrying human infants—An evolutionary heritage. *Infant Behav Dev*. 2020;60:101460.

5. Whittle R. Baby on board: the impact of sling use on experiences of family mobility with babies and young children. *Mobilities*. 2019;14(2):137–57.
6. Grisham LM, Rankin L, Maurer JA, Gephart SM, Bell AF. Scoping review of biological and behavioral effects of babywearing on mothers and infants. *J Obstet Gynecol Neonatal Nurs*. 2023;52(3):191–201.
7. George SA, Abraham AT, Kumar A. A case study on risk of musculoskeletal disorder due to poor ergonomics in first-time lactating mother with recurrent myofascial trigger. *Int J Health Sci Pharm*. 2022;6(1):2581–6411.
8. Miller RR, Bedwell S, Laubach LL, Tow J. What is the experience of babywearing a NICU graduate? *Nurs Women's Health*. 2020;24(3):175–84.
9. Scopa P, Pasqua di Bisceglie A, De Lotto F, Alfano A, Faiferri S, Regazzo A. Musculoskeletal disorders and work-related musculoskeletal diseases among nursery school teachers: analysis in a sample in the city of Venice. *G Ital Med Lav Ergon*. 2020;42(2):82–6.
10. Okuyucu K, Hignett S, Gyi D, Doshani A. Midwives' thoughts about musculoskeletal disorders with an evaluation of working tasks. *Appl Ergon*. 2021;90:103263.
11. Bianchi T, Belingheri M, Nespoli A, De Vito G, Riva MA. Occupational risks in midwifery: From Bernardino Ramazzini to modern times. *Saf Health Work*. 2019;10(2):245–7.
12. Khattak HG, Arshad H, Anwar K, Hanif S, Kiani N, Sultana B. Prevalence of musculoskeletal disorders among pregnant women: cross-sectional study. *Pak J Med Health Sci*. 2022;16(5):48.
13. Havens KL, Severin AC, Bumpass DB, Mannen EM. Infant carrying method impacts caregiver posture and loading during gait and item retrieval. *Gait Posture*. 2020;80:117–23.
14. Mbada CE, Adebayo OS, Olaogun MO, Johnson OE, Ogundele AO, Ojukwu CP, et al. Infant-carrying techniques: Which is a preferred mother-friendly method? *Health Care Women Int*. 2022;43(6):535–48.
15. Williams L, Standifird T, Madsen M. Effects of infant transportation on lower extremity joint moments: Baby carrier versus carrying in-arms. *Gait Posture*. 2019;70:168–74.
16. Wu CY, Huang HR, Wang MJ. Baby carriers: a comparison of traditional sling and front-worn, rear-facing harness carriers. *Ergonomics*. 2017;60(1):111–7.
17. Ojukwu CP, Fab-Agbo C, Ikele CN, Onuchukwu CL, Anekwu EM. Infant carrying-related low back pain: prevalence and correlates among nursing mothers in Enugu, Nigeria. *Int J Med Biomed Res*. 2017;6(3):125–35.
18. Williams LR. The impact of infant carrying on adolescent mother–infant interactions during the still-face task. *Infant Child Dev*. 2020;29(3):e2169.
19. Havens KL, Johnson EV, Day EN, Holdener CJ, Starnes CP. Infant carrying in the United States: a survey of current practices, physical and mental health benefits, and challenges of babywearing. *J Women's Health Phys Ther*. 2022;46(1):25–34.
20. Ojukwu CP, Anyanwu GE, Anekwu EM, Chukwu SC, Fab-Agbo C. Infant carrying methods: correlates and associated

- musculoskeletal disorders among nursing mothers in Nigeria. *J Obstet Gynaecol.* 2017;37(7):855–60.
21. Ojukwu CP, Okafor CJ, Chukwu SC, Anekwu EM, Okemuo AJ. Evaluation of selected cardiopulmonary and perceived exertion responses to four infant carrying methods utilised by African mothers. *J Obstet Gynaecol.* 2019;39(8):1098–103.
 22. Park HK, Shin HK, Nam KS. Investigation of wearing methods of a baby carrier on muscle activation during trunk flexion-extension in healthy women. *Phys Ther Rehabil Sci.* 2020;9(1):36–42.
 23. Widyanti A, Ramadhiar A, Fista B, Rahmawati N. The ergonomics of mothering and child care activities (ErgoMOMics) in Indonesia: individual and social factors influencing musculoskeletal symptoms. *Work.* 2020;65(3):625–33.
 24. Little EE, Legare CH, Carver LJ. Culture, carrying, and communication: beliefs and behavior associated with babywearing. *Infant Behav Dev.* 2019;57:101320.
 25. Ojukwu CP, Okafor CJ, Chukwu SC, Anekwu EM, Okemuo AJ. Evaluation of selected cardiopulmonary and perceived exertion responses to four infant carrying methods utilised by African mothers. *J Obstet Gynaecol.* 2019;39(8):1098–103.

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