ORIGINAL ARTICLE

PREVALENCE OF LOWER LIMB EDEMA IN NATAL AND POST-NATAL PERIOD

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ABSTRACT

Objective: The objective of this study was to determine the occurrence of edema in the natal and post-natal period, risk factors, and their association with edema.

Material and Methods: An observational study was conducted at Cantonment Hospital and Benazir Bhutto Hospital, Rawalpindi, Pakistan from August 2018 to January 2019. Out of 405 females, 18-35 years of age and 3rd trimester of gestation or post-natal period and women with previous venous diseases or high-risk gestations were included. In contrast, women with edema in other body parts and those after puerperium were excluded. The data was collected by self-structured questionnaire, edema grading scale, and limb measurement. Data was analyzed by SPSS 23.

Results: The frequency of leg edema was 65.9% and higher in the third trimester, especially during the eighth and nine months of pregnancy. It could lead to several other symptoms like pain and cramps that could be intensified by prolonged standing and comforted through rest. At the same time, a few other factors that affect edema include less water intake and lack of exercise. There is a significant association between edema and its related risk factors including months of pregnancy, exercises during pregnancy, and activity level ($p < 0.001$).

Conclusion: Lower limb edema is prevalent in late pregnancy, especially during the 8th - 9th month. There is a significant association between edema and its related risk factors including months of pregnancy, exercises during pregnancy, and activity level.

Keywords: Edema, lower limb, pregnancy, prevalence.

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INTRODUCTION

Gestation is linked with variations in the larger portion of the physiological outlines of the body. Leg edema is ace of cutaneous appearances of gestation. [1] Gestation-provoked leg edema is linked with gestation consequences and is almost observed as typical. [2] Edema of the lower limb area is remarkably elementary in normal gestation and it is very difficult to say at what time this has conceded as far as possible, the hydration of gestation might in some cases, become shown as edema without being physiological. [3] Through usual gestation whole body water increases through 6-8 liters, 4-6 liters of which are extracellular, and no less than 2-3 liters are interstitial. At some stage in gestation 8, out of 10 women have self-evident clinical edema. During gestation, nearby is a modest decrease in interstitial liquid colloid osmotic pressure and an upsurge in capillary hydrostatic pressure. [4] Water absorption for 20 minutes is an effective technique for waning peripheral edema throughout gestation. [5] External pneumatic pressure reduces lower limb swelling and pressure stocking moreover reduces leg signs. [6] For occurrence, if only one out of ten pregnant females developed leg edema, it would be acceptable to contemplate herself as abnormal but if eight out of every ten pregnant females developed leg edema, they are more likely to consider leg edema a normal sign of gestation. [7] Similarly, if a female who had pregnancy-related leg edema in earlier gestations might associate the condition with precise hostile gestation events, the concern about leg edema during pregnancy would be well respected. While a number of physical and pharmacological procedures have been tried to relieve leg edema throughout gestation, nobody has been constantly created to discuss benefits superior to non-treatment, and some are possibly destructive. [8-10] The presence of sedentary, prolonged standing, wearisome fitted stockings, and being obese are a few of the risk factors that contribute to

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lower limb edema. By altering these factors, the quality of life could be enhanced. [11] The frequently happening kinds of edema are pitting and non-pitting. Pitting edema reacts to every type of compression whereas non-pitting edema does not. If the skin with a finger/object and a ditch-like spot appears, it shows pitting edema whereas non-pitting edema does not react to compression or lead to any kind of pit. Individuals suffering from edema may be observed with distended and constricted veins and shiny skin. Puffiness on the eyes, face, and ankle swelling were similarly detected. Pain in several parts of the body and joint stiffness are also common in affected females. [12]

The primary purpose of the study is to find out the occurrence of lower limb edema in natal and post-natal periods and the secondary objective is to find out major associated risk factors. This research offers useful knowledge on pregnancy-induced leg edema with related risk factors. Information on the occurrence and clinical significance are important for treatment preparation and cure plans in hospitals as well as in local societies whereas information on risk factors is important for prevention.

MATERIALS AND METHODS

The observational study was conducted on the pregnant and postpartum females in the gynecological ward and OPD at Cantonment Hospital and Benazir Bhutto Hospital, Rawalpindi, Pakistan for a duration of 6 months from August 2018 to January 2019. The sample size of 405 was calculated through the pool in this study. Females 18-35 years of age and in 3rd trimester of the pregnancy or post-natal phase and women with previous venous diseases or high-risk pregnancies were included. Whereas women with edema in other body parts sparing lower extremities and those after the puerperium were excluded.

The data was collected by self-structured questionnaire, edema grading scale, and limb measurement was done through measuring tape. Primary, examining and palpating the limbs whether edema was prevalent or non-prevalent, whether it was unilateral or bilateral, and whether it was pitting or non-pitting. While examining the leg edema, apply pressure through the thumb/index finger on the leg behind the ankle, on the midfoot, and on the shin bone for at least 5 seconds.

After pressure application, a clear pit was observed, documented as pitting edema, whereas no pit on the area where pressure was applied, was documented as non-pitting edema. Moreover, the grading of pitting edema, no noticeable change or pit, depth less than 6mm, and pit extinct quickly, it is edema grade 1.

When the pit was approximately 6 – 12mm and was extinct within 10 – 15 seconds, it was grade 2. When the pitting was deep, the limb swelled, and the depth of pitting was 1 – 2.5 cm, and the length of the pit extinct was 1 – 2 minutes, it was grade 3, and when the limb swelled, out of shape, pitting depth was greater than 2.5 cm, and length of pit extinct was 2 – 5 minutes, it was grade 4 edema. Limb circumference measurement was done through measuring tape at three different areas that are; instep (5 cm from the big toe), at the ankle (4 cm from the heel), and at the calf (11 cm from the heel). A greater than half-inch difference in circumference values of both limbs indicated edema.

The study has been approved by Riphah Ethical Committee, Riphah College of Rehabilitation Sciences, Riphah International University, Islamabad, ref no: Riphah/RCRS/REC/00482, whereas informed consent was taken from all patients through a printed form in the local language.

RESULTS

Out of 405 females with a mean age of 26.8 ± 4.3 years were included in the study. The majority of females were housewives 394 (97.3%) while 11 (2.7%) were serving and 349 (86.2%) belonged to urban areas while 56 (13.8%) were from rural areas. Most of the females were graduates 123 (30.4%), 111 (27.4%) were matric, 75 (18.5%) had the degree of intermediate, 63 (15.6%) were under matric and 33 (8.1%) females did not go any school. Among these females, 170 (42%) were in their 9th month, 113 (27.9%) were in their 8th month, 79 (19.5%) were in the 7th month and 43 (10.6%) were in the puerperium period.

Most (86.1%) didn't have any menstrual irregularities, (94.4%) had not used any contraceptive measures and had not worn tight clothes or shoes, (77.5%) had no bowel and bladder difficulties, (97.8%) had no smoking history, and (95.5%) had not used any medicines. Regarding the prevalence of edema, prevalent in 267 (65.9%) and non-prevalent in 138 (34.1%). Most of the women had bilateral edema 238 (58.8 %). Non-pitting edema was more experiential 162 (40%) and pitting edema 105 (25.9%). Grade-1 pitting edema was mostly noticed at 77 (19%) (Table 1).

Most women's limb perimeter had between 8 to 9 inches at the right instep 210 (51.9%) and likewise at the left instep 201 (49.6%), between 8 to 9 inches at the right ankle 179 (44.2%) and left ankle 174 (43%) and between 12 to 13 inches at right calf 112 (27.7%) and left calf 112 (27.7%) respectively (Table 2).

Regarding the risk factors of edema, most of the females 166 (62.3%) had a normal body type, 202 (75.7%) female's daily routine throughout pregnancy was prolonged standing 202 (75.7%), most of the females presented a lack of activity level i.e., did not do any exercise before pregnancy 239 (89.5%) or during pregnancy 245 (91.8%) whereas most women's sleep duration was about 7 to 9 hours 137 (51.3%). In terms of diet, the majority

included dairy products 215 (80.5%), meats 229 (85.8%), vegetables 263 (98.5%), fruits 264 (98.9%) whereas very limited had a high sodium 41 (15.4%), and high caffeine consumption 26 (9.7%). Women experienced different symptoms in lower limbs like pain 213 (79.8%), redness 233 (87.3%), cramps 175 (65.5%), fatigue 229 (85.5%), heaviness 208 (77.9%), numbness 174 (65.2%) and paresthesia 131 (49.1%).

Regarding the aggravating factor, most females had a history of prolonged standing 182 (68.2%) whereas the rest was the most dominant relieving factor 100 (37.5%). Most edema-prevalent women had a family history of hypertension adding diabetes mellitus (16.9%) and (89.9%) had no considerable significance past medical history and complications in current gestation; many females were seen with anemia 56 (21%), and 25 (9.4%) reported preeclampsia (Table 3).

Table 4 reveals that the chi-square test of independence showed a significant association between edema and risk factors of edema including months of pregnancy with X2 = 17.90, p = 0.000, exercises during pregnancy with X2 = 400.58, p = 0.000, and activity level with X2 = 396.2, p = 0.000. the findings showed that pregnancy at the 9th month, sedentary females, and female activity level of prolonged standing exhibited higher frequency.

Table 1: Circumference Assessment of Edema Limb

AT INSTEP		
Circumference in Inches	Right Instep N (%)	Left Instep N (%)
7" to 8"	18 (4.4%)	22 (5.4%)
8" to 9"	210 (51.9%)	201 (49.6%)
9" to 10"	162 (40%)	159 (39.3%)
10" to 11"	15 (3.7%)	22 (5.4%)
AT ANKLE		
	Right Ankle N (%)	Left Ankle N (%)
6" to 7"	25 (6.2%)	24 (5.9%)
7" to 8"	125 (30.9%)	129 (31.9%)
8" to 9"	179 (44.2%)	174 (43.0%)
9" to 10"	63 (15.6%)	66 (16.3%)
10" to 11"	9 (2.2%)	8 (2.0%)
11" to 12"	4 (1.0%)	4 (1.0%)
AT CALF		
	Right Calf N (%)	Left Calf N (%)
8" to 9"	1 (2%)	0 (0%)
9" to 10"	13 (3.2%)	12 (3%)
10" to 11"	21 (5.2%)	24 (5.9%)
11" to 12"	65 (16%)	64 (15.8%)
12" to 13"	112 (27.7%)	112 (27.7%)
13" to 14"	94 (23.2%)	96 (23.7%)
14" to 15"	58 (14.3%)	58 (14.3%)
15" to 16"	24 (5.9%)	23 (5.7%)
16" to 17"	11 (2.7%)	11 (2.7%)
17" to 18"	6 (1.4%)	5 (1.2%)

DISCUSSION

Gestation is interrelated with variations in the utmost of physiological systems of the body and edema is a very common problem during gestation. The conclusions of the current study kindle discussion as to what is a main

Table 2: Risk Factors of Edema

	Risk Factors	No. of Cases N (%)
Routine Throughout Pregnancy	Prolong Standing	202 (75.7%)
	Prolong Sitting	29 (10.9%)
Activity Level During Pregnancy	Regular exercise	12 (4.5%)
	Exercise sometimes	10 (3.7%)
	No Exercise	245 (91.8%)
Sleep Duration	≤ 6 hours	80 (30.0%)
	7 to 9 hours	137 (51.3%)
	≥ 10 hours	50 (18.7%)
Symptoms experienced in lower limbs	Pain	213 (79.8%)
	Redness	233 (87.3%)
	Cramps	175 (65.5%)
	Fatigue	229 (85.8%)
	Heaviness	208 (77.9%)
	Numbness	174 (65.2%)
	Paresthesia	131 (49.1%)
Aggravating Factors	Rest	31 (11.6%)
	Walking/Prolonged Standing	182 (68.2%)
	Changing the position of a limb	13 (4.9%)
	Nothing	40 (15%)
Present Pregnancy Complications	Preeclampsia	25 (9.4%)
	GDM	13 (4.9%)
	Anemia	56 (21%)
	Placenta Previa	4 (1.5%)
	Preeclampsia + GDM	3 (1.1%)
	Preeclampsia + Anemia	11 (4.1%)
	GDM + Anemia	1 (0.4%)
	Placenta Previa + Anemia	2 (0.7%)
	Placenta Previa + GDM	1 (0.4%)
	Preeclampsia + GDM + Anemia	1 (0.4%)
*GDM, gestational diabetes mellitus		

Table 3: Chi-Square Between Edema and Risk Factors

Risk Factors				X2	df	p-value
		Prevalent n	Non- Prevalent n			
Months of Pregnancy	7th	44	35	17.90	3	0.000***
	8th	79	34			
	9th	125	45			
	Puerperium	19	24			
Exercise during Pregnancy	Regular	13	139	400.58	4	0.000***
	Sometimes	11	0			
	No Exercise	242	0			
Activity Level	Prolong Standing	201	138	396.2	3	0.000***
	Prolong Sitting	30	0			
	Bed Rest	36	0			

***p < 0.001.

part in the improvement of the lifestyle of females affected by leg edema and how to alter the risk factors that contribute to leg edema. Very limited research has been directed to assess leg edema and related risk factors, the current study revealed that the occurrence of leg edema is higher in late pregnancy and is mostly associated with prolonged standing and sedentary females. Tanveer F. et al. directed an observational study to rule out the incidence of lower limb edema throughout 3rd trimester of gestation and observed the frequency of leg edema. It is concluded that most women suffered from lower limb edema throughout gestation, particularly in 3rd trimester. [13] Pregnancy induces many changes in the female body including hormone-induced sodium and water retention, increased levels of hormones, and changes in vascular permeability. All these changes lead to edema formation. Other factors can aggravate edema like prolonged static posture, excess salt intake, warm atmosphere, etc. [14] In the present study, the frequency of pregnancy-induced lower limb edema was higher in the third trimester, especially during the eighth and nine months of pregnancy. This edema mainly was associated with activities in prolonged standing and females with a sedentary lifestyle. Limb circumference measurement increased to 8 – 9 inches to the right and left instep, 8 – 9 inches to the right and left ankle, and 12 – 13 inches to the right and left calf regions.

Cross-sectional research on reliability and feasibility approaches to quantitatively evaluate peripheral edema. 20 individuals with diabetes type II and a variety of edema severity, comprising individuals with no edema, eight approaches of edema evaluation were estimated. The research determined that out of 8 approaches, water displacement and ankle circumference presented greater reliability; though, water displacement is time-consuming and may be challenging in clinical setups. Patient-reported level and occurrence of edema, based on an unvalidated questionnaire, were usually well associated with physical evaluation of edema severity and might be evidence to be an alternative reliable and precise technique of evaluating edema.[14] One more retrospective research by Katarzyna O et al was directed to find out the interrelated risk factors of limb edema, compression, and physical activity throughout gestation. Research revealed that out of 54 expecting women 42 were observed with bilateral lower limb swelling, majority in areas of feet and lower legs, and less often on entire legs. Edema was collected complaint by particular symptoms, such as sensation of limb heaviness, pain, and a bursting sensation in limbs (40%). The research determined that compression therapy in combination with appropriate exercises looks to be an effective method to prevent and treat venous thrombosis and lower limb edema in expecting females. [15] While the current study highlights that out of 405, 238 females observed with bilateral leg edema, most of them were non-pitting edema, and in grade 1. Out of those females experienced symptoms like feelings of pain, heaviness, and paresthesias-like sensations.

Another study was conducted on leg edema during gestation amongst Nigerian females: perceptions, prevalence, prognosis, and treatment-seeking behaviors. Results showed that the general frequency of leg edema throughout gestation was 8.5%. The initial gestational age at which edema first appeared throughout gestation was 24 weeks, and 100% of cases were extinct within one week of delivery. Anemia, malnourishment, unnecessary body water, kidney and liver diseases, and hypertension/pre-eclampsia were the assumed reasons for leg edema throughout gestation.[16] On the other hand, in the current study, the prevalence rate of leg edema was 65.9% and first appeared during the third trimester. Prolonged standing, no exercise during pregnancy, a sedentary lifestyle of females, anemia, low water intake, and hypertension with diabetes are the expected risk factors for pregnancy-induced leg edema. There is a significant association between edema and its related risk factors including months of pregnancy, exercises during pregnancy, and activity

level ($p < 0.001$). Females in the 9th month pregnant, sedentary females, and females' activity level of prolonged standing showed a higher frequency of developed edema.

CONCLUSION

The study showed that lower limb edema is prevalent in 3rd trimester of pregnancy, especially during the 9th month. Edema is one of the numerous changes that happen in a woman during pregnancy, could be caused and affected by several factors like prolonged standing, and a sedentary lifestyle. It could lead to various warning signs such as pain, cramps, and further distress that could be aggravated by continued standing and relieved by rest. Other factors that affect edema include reduced water consumption and lack of exercise.

This study included an assessment of risk factors only from subjects who had been prevalent with edema. In future studies, the assessment of risk factors can be spread to even cases without having edema and a comparison of both groups can be brought to light.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

Rafique A:	Data analysis and interpretation
Rafique N:	Critical revision of the articleFinal approval of the article
Afzal K:	Writing the article
Khan HA:	Research concept and design
Ashfaq N:	Collection and/or assembly of data
Rubab A:	Collection and/or assembly of data

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.