Effect of Peanut Birth Ball on The Progress of Labor and Birth Outcome among Primigravidae

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Abstract:

***Background**: One of the World Health Organization's recommendations for preventing prolonged labor and averting cesarean sections is frequent position changes and movements during labor. However, some women may find themselves unable to get out of bed due to labor exhaustion, in addition to conventional procedures used in most hospitals such as labor induction, epidural anesthesia, and continuous fetal monitoring, create an environment in which women cannot move around freely or easily. To address these issues and implement World Health Organization's recommendations, the peanut birth ball may be a helpful tool for achieving frequent position changes without disrupting labor procedures. The current study **aimed** to evaluate the effect of the peanut birth ball on the progress of labor and birth outcome among primigravidae. **Methods**: A quasi-experimental research design was used. A convenient sample of 80 parturient was recruited from Damanhur national medical institute affiliated to the ministry of health. Three tools of data collection were used: (1) basic data-structured interview schedule (2) physical assessment sheet for progress of labor (3) An observational birth outcome checklist. **Results:** the current findings revealed that a statistically significant difference (P <**0.001**) was recognized between the two groups' frequency, duration and interval of uterine contractions as well as cervical dilation, and fetal descent after the intervention. In addition, a high significantly shorter duration of 1st and 2nd stages of labor among the study group than the control group (p **<0.001)** was observed. Almost the entire (92.5%) of the study group had normal vaginal delivery compared to 75% of the control group .No statistically significant difference was found between both groups concerning Apgar score and need for resuscitation. **Conclusion:** The peanut birth ball is thought to be an effective, affordable, reusable, innovative, non-pharmacological intervention that helps in the progress of labor and supports vaginal birth. **Recommendations**: utilization of peanut birth ball is recommended for laboring women, especially those who are confined to bed during childbirth*

Keywords: Peanut birth ball, Birth outcome, Progress of labor, Primigravidae

Introduction

Childbirth is a normal physiological process, but it is also a life-changing experience for many women. The care provided to women during labor has the potential to affect them both physically and emotionally. In addition, delivery management is one of the most frequent medical issues that healthcare providers deal with. When this significant event is handled improperly, labor dystocia or prolonged labor may occur. (Khresheh et al., 2019)

Prolonged labor is linked to an increase in maternal complications such as perineal lacerations, puerperal infection, and postpartum hemorrhage. In addition to perinatal problems like neonatal infection, lower Apgar scores, and admission to the neonatal intensive care unit. Cesarean deliveries are also frequently performed as a result of prolonged labor and failure to progress. Following a cesarean delivery, the mother may experience a more prolonged recovery time and an elevated risk of complications both during the postpartum period and in subsequent pregnancies. Therefore, efforts to shorten the length of labor as well as enhance mother and neonatal birth outcomes have received a lot of attention (Aquino et al., 2020; Grenvik et al., 2019; Riegel et al., 2018).

One of the World Health Organization's (WHO) recommendations for preventing prolonged labor and averting cesarean sections is frequent position changes and movements during labor. However, some women may find themselves unable to get out of bed due to exhaustion of labor, in addition to conventional procedures used in most hospitals such as labor induction, epidural anesthesia, and continuous fetal monitoring, create an environment in which women cannot move around freely or easily. To address these issues and implement WHO recommendations, the peanut birth ball may be a helpful tool for achieving frequent position changes without disrupting the labor procedures (Kamath et al., 2022; WHO 2018).

Using the birth ball during labor is a frequent practice in hospitals that value humanized delivery and women's empowerment. The peanut ball, a sizable plastic ball shaped like a peanut shell, is an alternative to the conventional birthing ball. It has a middle indentation that enables the mother to put the ball between her knees while lying in either the right or left lateral and semi-fowler position during labor. Most birthing balls can facilitate more natural labor progress for ambulatory women. However, when mother is immobile, due to specific circumstances, initiating the use of a peanut ball might shorten the labor process and promote positive labor outcomes (Tussey et al., 2015).

The peanut ball is believed to improve the progress of labor by optimally positioning the fetus to the pelvis. Since pregnant women naturally develop a spinal lordosis, and the uterus' weight pulls the abdomen forward causing a spinal S curve, the parturient should be placed with her back curled forward, forming a C shape. The C curve improves the alignment of the uterus with the pelvis and the presenting portion of the infant with the pelvic inlet. When the laboring woman is in the C Curve position, the sacrum and coccyx are free to move back, expanding the pelvis' anterior-posterior diameter. This larger space makes it simpler for the infant to pass through the pelvis. To allow the C Curve in a side-lying position, the upper leg should be elevated as far away from the lower leg and this can be accomplished by using the peanut birth ball (Roth et al., 2016).

A key responsibility of healthcare professionals is to provide effective care and comfort to women during childbirth. Maternity nurses can reduce the need for medical procedures and their possible complications by supporting the natural birthing process with non-pharmacological methods. The peanut ball is a low cost, non-invasive method made of durable plastic that can be repeatedly used and sterilized. It can be used in a variety of postures during 1st and 2nd of labor to speed up the labor process (Ahmadpour et al., 2021; Johnson et al., 2017; Tussey et al., 2015).

Significance of the study

Up to 99% of maternal mortality in developing countries results from complications during labor and delivery**.** Prolonged labor is one factor that has been related to increased maternal and neonatal complications. Efforts to shorten labor have drawn a lot of interest. Peanut birth ball is a unique labor support tool that is thought to improve the progress of labor (Eprila et al, 2021). Although, the peanut ball is currently used in labor and birth units, there is a lack of evidence-based research on this new intervention. **So this study aimed** to evaluate the effect of peanut birth ball on the progress of labor and birth outcome.

Aim of the study:

This study aimed to evaluate the effect of peanut birth ball on the progress of labor and birth outcome among primigravidae.

Research hypothesis:

H1: Laboring women who use peanut birth ball exhibit faster progress of labor than those who don't use it.

H2: Laboring women who use peanut birth ball exhibit better birth outcome than those who don't use it

Operational definitions:

Birth outcome refers to the maternal and neonatal outcome

- The maternal outcome includes mode of delivery (normal or cesarean), incidence of complications as genital injuries
- The neonatal outcome includes Apgar score at 1st and 5th minutes and the need for resuscitation

Material and method

Research design:

A quasi-experimental research design was utilized in this study, where the effect of the peanut birth ball during active phase of 1st stage of labor (independent variable) on the progress of labor and birth outcome (dependent variables) was examined.

Setting:

This study was carried out at the labor and delivery unit of Damanhur national medical institute affiliated to the ministry of health. This hospital was chosen because normal delivery turnover is suitable for the study.

Subjects:

A convenient sample of 80 parturient who were available at the time of data collection was recruited from the aforementioned setting according to the following inclusion criteria:

- Primigravida
- Age between 20-35 years
- In the active phase of 1st stage of labor
- Full-term pregnancy (37–42 weeks of gestation)
- Singleton fetus in cephalic presentation
- With the normal course of pregnancy
- Women who are in bed due to exhaustion from labor.
- Willing to participate in the study

Epi-info version 7 statistical software was utilized to calculate the sample size according to the following parameters: total population over 3 months was 400 women, 50% expected frequency, 5% acceptable error, and 95% confidence coefficient. The estimated minimal sample size = is 78 women

The selected subjects were assigned to one of the following two groups:

Study group: included 40 parturient, who used peanut birth ball during the active phase of 1st stage of labor.

Control group: involved 40 parturient, who received routine hospital care during the active phase of the 1st stage of labor.

Tools for data collection

Three tools were utilized for data collection as follows:

Tool I: Basic data structured interview schedule

It was developed and used by the researchers to elicit socio-demographic characteristics such as age, level of education, occupation, and current residence.

Tool II: physical assessment sheet for progress of labor:

- This tool was developed by the researcher after review of literature (Bed well et al., 2017; Lavender et al., 2018). It included:
- Abdominal examination to assess uterine contractions (frequency per 10 minutes, duration and interval).
- Vaginal examination to assess cervical dilatation and descent of fetal head

- Assessment of duration of labor stages.

Tool III: An observational birth outcome checklist, including two parts

Part1: included assessment of maternal birth outcomes such as mode of delivery and incidence of complications.

Part 2: involved assessment of neonatal outcomes such as Apgar score at 1st and 5th minutes and need for resuscitation.

Method

Approvals

- Approval from Research Ethics Committee, Faculty of Nursing, Damanhur University was obtained.
- An Official letter from the Faculty of Nursing, Damanhur University was sent to the relevant authorities of the study setting to get their approval for data collection after explaining the study's goal.

Tools development

- Tools were developed by the researcher after reviewing the recent relevant literature.
- Tools' content validity was tested by a jury of 5 experts in the related field
- Tools II & III reliability was tested by Cronbach Alpha test to measure internal consistency and the result was satisfactory (80, 76) respectively.

Pilot study

A pilot study was carried out on 10 % of the study sample (8 women) to ensure the clarity and applicability of the tools, identify obstacles and problems that may be encountered as well as to estimate the time needed for data collection. Accordingly, the necessary modifications were made. Women participating in the pilot study were excluded from the main study sample.

- **Collection of data**

- Collection of data covered 3 months for 3 days/week
- The researchers approached the laboring women who fulfilled the inclusion criteria and provided them with a detailed description of the nature of the intervention. The recruited women were assigned randomly either to the study or the control group.
- During the active phase of the first stage:

- Data of tool one was collected from both groups through an interview that was conducted individually and in total privacy.
- **For the study group**, the peanut ball (which is a 45×80 cm) was placed between the legs of a woman at the early active phase of the first stage (starting from 4 cm cervical dilation) and they were assisted with turning or changing their position and adjusting the peanut ball every 1hours, the positions used were left lateral, right lateral or semi-fowler. It remained in place until the cervix was completely dilated, passive descent was complete, and the woman was ready to actively push. A cotton towel was tied around the ball to prevent discomfort from the plastic resting against the woman's legs. The balls were thoroughly cleaned using antiseptic techniques between each patient use.

- **For the control group**, women received routine hospital care during the active stage of labor which involved turning women from side to side or placing the woman in semi- or high-Fowler position every 1hours

- Data of tool II was collected from both groups two times: once before using the peanut ball at early active phase of 1st stage and the 2nd time at end of the active phase when cervix was completely dilated, through an abdominal and vaginal examination
- The duration of the first stage of labor was determined by the researcher from placement of the peanut ball at early active phase to 10 cm dilation, duration of the second and third stages of labor was also determined
- Tool III was used for both groups immediately following the second stage to assess maternal and neonatal birth outcome.
- The effect of the peanut birth ball on the progress of labor and birth outcome was determined by comparing the results of the two groups before and after the intervention.

Statistical analysis:

The Statistical Package for Social Sciences (SPSS) version 20.0 was utilized for data analysis. Descriptive statistics included numbers; percentages, means, and standard deviation were used. Chi-square-test, Fisher Exact test, and t-test were performed to determine the difference in the results at 0.05 (5%) level of significance.

Ethical considerations:

A written informed consent was obtained from the study participants after explaining the study’s aim. The researchers maintained the subject's privacy and data confidentiality, and the right of participants to withdraw at any time was considered.

Results

Table (1): Displays that the mean age was 20.37±3.516 & 21.37±3.444 among the study and control groups respectively. It was obvious that 50% &42.5% of both groups respectively had basic education. The table also shows that (70% & 75%) respectively of the study and control groups were housewife. In addition, 50% & 60% respectively were urban residents. No significant differences were observed between the study and control groups concerning all socio-demographic data

Table (2) illustrates the mean distribution of laboring women according to their progress of labor. A statistically significant difference (P= **<0.001**) was recognized between the two groups' frequency, duration and interval of uterine contractions as well as cervical dilation, and fetal descent at the end of the first stage of labor after the intervention, where the mean frequency. duration, interval of uterine contraction , cervical dilation and fetal descent was 5.321±0.248, 87.381± 2.061, 1.59±0.000 , 9.20±0.154 , 5.00 ± 0.000 for the study group , compared to 4.630±0.159, 81.250± 8.539, 2.22±0.423 , 9.05±0.221, 4.00 ± 0.001 for the control group respectively.

Table (3) shows that the mean duration of the 1st and 2nd stage of labor was 5.35±0.932 hours and 35.73±2.320 minutes respectively for the study group, compared to 6.15±1.122 hours and 57.75±3.248 minutes for the control group, with a statistically significant difference was found between two groups in favor to the study group where **p<0.001**. However, No statistically significant differences were found between the two groups 'mean duration of the 3rd stage of labor where the mean duration was 15.93±1.492 for the study group compared to 16.01±1.713 for the control group.

Table (4) clarifies that most (92.5%) of laboring women in the study group had normal vaginal delivery compared to (75%) of the control group. In addition, the majority (94.6%) of the study group had no complication during labor compared to (76.7%) of the control group. Genital injuries were observed among only (5.4%)

of the study group compared to 23.3% of the control group. A statistically significant difference was found between two groups in relation to mode of delivery and complications during labor where $p<0.05$.

Table (5) shows that fetal Apgar score at 1st minute was found to be normal among most of the study group (95 %), compared to (77.5%) of the control group. Meanwhile, mild asphyxia was found among only 5 % of the former, compared to 17.5 % of the latter. In addition, fetal Apgar score at 5 minutes was normal among most of the study group (97.5%), compared to 82.5 % of the control group. Mild asphyxia was observed among only 2.5% of the study group, compared to 15% of the control group. In addition, the need for resuscitation was not needed for most newborns in the study group (95 %), while they were needed for (17.5 %) of the control. No statistically significant difference was found between the study and control group concerning Apgar score at 1st, 5th minutes and need for resuscitation.

Discussion

Position changes during the first and second stages of labor may help the women in several ways, such as reducing pain, enhancing maternal-fetal circulation, enhancing the quality of uterine contractions, shortening the duration of labor, facilitating fetal descent, and improving maternal satisfaction with their birthing experience. On the other hand, lack of movement during labor has been linked with longer 1st and 2nd stages of labor. When laboring women are immobile, the fetus's capacity to flex, engage in the pelvis, rotate into position, and descend is reduced. Therefore, even if a woman is confined to bed during childbirth, maternal positions that increase pelvic mobility and improve labor progress should be encouraged (Payton, 2015).

Expanding women's access to non-medical interventions during labor is advised by the American Congress of Obstetricians and Gynecologists 2014. The use of a birth ball is one of the non-pharmacological strategies of improving labor progress. An alternative to the traditional birthing ball is the peanut ball that is positioned between a woman’s legs when she is lying in the lateral recumbent position during labor. This position is assumed to mimic the upright position and facilitate the widening of the pelvis and fetal descent. However, there is little information available about its effectiveness as a tool for labor (Grenvik et al., 2019).

The study achieved its proposition by illustrating that the peanut birth ball is an effective method for improving progress of labor and birth outcome. On evaluating the effect of peanut birth ball on the progress of labor, the results of the present study revealed a significant increase in the number of uterine contractions /10 minutes, increased duration as well as decreased interval of uterine contractions among the study group than the control group. As a result of the impact of effective uterine contraction, there was a significant increase in fetal head descent and cervical dilatation. Researches indicate that the peanut ball simulates a sitting or squatting position during labor to increase the width of the pelvic diameters. By maximizing the diameters of the pelvis, the fetus has the greatest ability to descend in the pelvis. As the head is applied directly on the cervix, uterine contractions increase in intensity, regularity, and frequency. This effectiveness of uterine contractions promotes cervical dilation and faster labor progress. (Payton, 2015)

The current finding is compatible with the study of **Tussey et al. (2015)** who concluded that the peanut birthing ball is an effective nursing intervention to improve the progress of labor.

It also relatively agrees with **Sheishaa,et al 2019),** who observed that the average total bishop score (including dilation, effacement etc.) was significantly higher in the intervention group than in the control group. They reported the significant impact of birthing ball exercises during pregnancy on the first stage progress of labor.

On the contrary, the current finding is not in accordance with the study of **Mercier and Kwan (2018)** who stated that the use of the birthing ball does not significantly increase uterine contractions or cervical dilatation.

On assessing the **duration of labor stages**, the results of the present study elucidated a high significantly shorter duration of 1st and 2nd stages of labor among the study group than the control group. This can be interpreted in the light that using the peanut ball promotes spinal flexion, thus increasing the utero-spinal angle .This widening of the pelvic diameter subsequently assists in facilitating occiput posterior rotation to a more favorable position for delivery (Tussey et al. 2015)

The current finding is in agreement with the previously mentioned studies by**Tussey et al. (2015),** who found a significant reduction in the length of both the first and the second stages of labor among parturient who were in the peanut birth ball group. Furthermore, **Sheishaa et al. (2019)** reported that women in the intervention group had reduced length of labor compared to the control group.

Eprila et al. (2021) Observed similar findings in their study of the ''effectiveness of using peanut ball on the progress of 1st stage of childbirth in BMP Palembang city ''the results of this study indicate that the average length of labor was 3.00 hours in the study group compared to 4.60 hours in the control group. Additionally, **Farrag and Omar (2018)** reported that the mean duration of the first stage of labor in the study group was significantly less than the control group.

The shorter duration of labor among the study group in the present study matches the study of **Roth et al. (2016)** titled ''randomized controlled trial of the use of the peanut ball during labor" they reported that the total length of labor was 79 min shorter in the peanut ball group compared to the control group. Again, the current finding partially agrees with the study of **Fournier et al,.2017** who found that shorter labor duration was strongly associated with more birth ball training time. Also, it is partially congruent with the study of **Delgado et al.** (2022) who concluded that using peanut birth ball after receiving epidural analgesia shortens the first stage of labor by 87minutes.

On the other hand, the study by **Hickey and Savage (2019)** demonstrated that using a peanut birth ball alone does not shorten labor time. It is also not in a line with a study of Payton (2015) who reported that there was no decrease in the length of the first stage of labor in addition, the second stage of labor was significantly longer in the intervention group (75.63 min) than the control group (57.84 min).

Although a necessary and occasionally life-saving intervention, CS is associated with more than double the rate of severe maternal morbidity and maternal mortality when compared to vaginal birth. The challenge is to keep the CS that are necessary to save lives and reduce morbidity while eliminating the CS that are not. In this respect, the results of the present study revealed that normal vaginal delivery was significantly higher among the study group than the control group as well as a significant reduction in labor complications such as the incidence of genital injury.

This finding is consistent with that of **Evans and Cremering (2016)** who concluded that the use of a peanut ball can improve maternal outcomes by reducing the rates of cesarean birth, operative birth, and third- and fourth-degree lacerations. Also, **Tussey et al. (2015)** in their previously mentioned study found that using a peanut birth ball is successful in lowering the rate of cesarean sections, as well as the rate of instrumental births, and the incidence of third- and fourth-degree perineal lacerations during vaginal deliveries.

In addition, the current finding matches with previously mentioned studies, by **Farrag and Omar (2018)** who revealed a highly statistically significant difference between the control group and the study group using the birthing ball in relation to the mode of delivery in favor of the study group. Also**, Hickey and Savage (2019)** reported that cesarean births were 50% less common among the peanut birth ball group's participants.

Moreover, the studies of Honaker (2021) **and Grenvik et al. (2019)** revealed that women used peanut ball have lower rate of cesarean birth.

On contrary, the current finding isn't in line with the systematic review and meta-analysis of **Ahmadpour et al. (2021)** about the use of the peanut ball during labor which indicated that there was no statistically significant difference in the rate of caesarean section in women who used peanut balls during labor.

On assessing fetal outcome, the results of the present study displayed that the Apgar score at 1st and 5th minutes were higher among the study group than the control group. In addition to the need for resuscitation was lower among the study group than in the control group. However the difference between both groups was not statistically significant. This is in harmony with that of **Grenvik et al. 2019** who found no significant difference between both groups in relation to neonatal outcome.

In conclusion the peanut birth ball appears to have a significant effect on the progress of labor and maternal outcome as well as improving neonatal outcome and it is considered to be an effective, inexpensive, reusable, innovative non-pharmacological and noninvasive intervention for managing laboring women, especially those with limited movement during labor.

Recommendations:

Based on the findings of the current study the following recommendations are suggested:

1. Maternity nurses should use the peanut birth ball as an innovative non-pharmacological technique in their nursing care of laboring mothers.
2. Training programs for nurses in labor and delivery units about the utilization of non-pharmacological interventions especially peanut ball are recommended.

3. The current study should be replicated with a larger population size and different settings for better generalization and validation of results

Table (1): Socio- demographic characteristics of the studied women

Socio-demographic characteristics	Study group (n=40)		Control group (n=40)		X^2 (P)
	No.	%	No.	%	
Age (years):					
<20	22	55.0	15	37.5	2.540 P= 0.281
20-30	13	32.5	19	47.5	
>30	5	12.5	6	15.0	
Mean ±SD	20.37±3.516		21.37±3.444		
level of education					
Illiterate, read & write	5	12.5	7	17.5	0.719 (0.868)
Basic	20	50.0	17	42.5	
Secondary/its equivalent	12	30.0	12	30.0	
University	3	7.5	4	10.0	
Occupation					
Housewife	28	70.00	30	75.0	0.626 P= 0.428
Working	22	30.00	10	25.0	
Place of residence					
Urban	20	50.0	24	60.0	0.808 P= 0.369
Rural	20	50.0	16	40.0	

X^2= Chi-Square test *: Significant p at ≤0.05

Table (2): Mean distribution of the studied women according to their progress of labor

progress of labor	Before intervention		After intervention	
	Study group (n=40)	Control group (n=40)	Study group (n=40)	Control group (n=40)
	Mean & SD	Mean & SD	Mean & SD	Mean & SD
Frequency of uterine contraction/ 10 minutes	2.10±0.329	2.050±0.349	**5.321±0.248**	4.630±0.159
T (p)	**0.659 (0.512)**		**14.835 (<0.001*)**	
Duration of uterine contraction (sec)	56.400±10.275	57.300±7.832	**87.381±2.061**	81.250±8.539
T (p)	**0.441(0.661)**		**4.414 (<0.001*)**	
Interval of uterine contraction	3.60±0.928	3.42±0.958	**1.59±0.000**	2.22±0.423
T (p)	**0.928 (0.928)**		**9.420 (<0.001*)**	
Cervical dilatation	4.18±1.152	4.23±1.121	9.20±0.154	9.05±0.221
T (p)	**0.197 (0.8445)**		**3.522(<0.001** *)	
Fetal descent (station)	1.90 ± 1.001	1.83 ± 0.947	5.00 ± 0.000	4.00 ± 0.001
T (p)	**1.620(0.109)**		629.317*(<0.001*)	

T (P): T for t-test & P for T-Test *: Significant p at ≤0.05

Table (3): Mean distribution of the studied women according to the duration of labor stages

Duration of labor stages	Study group (n=40)	Control group (n=40)	T (P)
	Mean& SD	Mean& SD	
• **The first stage (hrs.)(active phase)**	5.35±0.932	6.15±1.122	**3.469 (<0.001*)**
• **The second stage (min)**	35.73±2.320	57.75±3.248	**34.891 (<0.001*)**
• **Third stage (min)**	15.93±1.492	16.01±1.713	**0.223 (0.824)**

T (P): T for t-test & P for T-Test *: Significant at P ≤ 0.05

Table (4): Mean distribution of studied women according to maternal outcome

Maternal outcomes	Study group (n=40)		Control group (n=40)		F/X^2 (P)
• **Mode of delivery**					
Vaginal (NVD)	37	92.5	30	75.0	4.500 (0.033*)
C.S	3	7.5	10	25.0	
• **Complications during labor**	n=37		n=30		
- No	35	94.6	23	76.7	4.579 (0.032*)
- Genital injury	2	5.4	7	23.3	

F (P): Fisher Exact Test & P for FET-Test (P): Chi-Square Test &P for Test *: Significant at P ≤ 0.05

Table (5): Number and percent distribution of the studied women according to neonatal outcome

Neonatal outcomes	Groups				F/ X^2 (P)
	Study group (n=40)		Control group (n=40)		
	No	%	No	%	
• Apgar score at 1st minute					5.487
Normal		95.00			P= 0.064
Mid	38	5.00	31	77.5	
Severe	2	0.00	7	17.5	
	0		2	5.00	
• Apgar score at 5th minute				82.5	
Normal	39	97.5	33	15.00	5.0714
Mid	1	2.5	6	2.50	P= 0.079
Severe	0	0.00	1		
• Need for resuscitation:					3.130
Yes	2	5.00	7	17.5	P= 0.0769
No	38	95.00	33	82.5	

F (P): Fisher Exact Test & P for FET-Test (P): Chi-Square Test &P for Test *: Significant at P ≤ 0.05

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