Effect of an Ergonomic Ankle Support for Squatting Position on Labor progress and maternal outcome

Afaf Hassan Ahmed [1], Tahany Hassan Allam [2], Noha Mohamed Hassan [3]
(1) lecturer of Obstetrics and Gynecologic Nursing Faculty of Nursing, Alexandria University.
(2) lecturers of Obstetrics and Gynecologic Nursing Faculty of Nursing, Damanhour University.
(3) Assistance professor of Obstetrics and Gynecologic Nursing, Faculty of Nursing, Alexandria University. Egypt.
E-mail drnohahassan@gmail.com

Abstract

Introduction: Postural changes can be one of the simplest ways of promoting labor, as women can use them while remaining in bed, if medically indicated. **Aim of the study** to evaluate, the effect of an ergonomic ankle support for squatting position on progress of labor and maternal outcome among primiparae women. **Design**: A quasi-experimental research design was utilized. **Subjects:** A convenience study subject of (80) women were selected from EL-Shatby Maternity University Hospital. **Tools:** four tools were used by the researchers to collect the necessary data: Tool I: basic data structured interview schedule, Tool II: Partograph, Tool III: Maternal Outcome Observational Checklist and Tool IV: Cardiotocography (CTG). **Results**: There was highly a statistically significant differences between both groups (P=0.000) from the 1st to the 6th hour in relation to frequency, duration and intensity of uterine contraction. Mean cervical effacement demonstrated highly statistically significant difference (P=0.000) among the study and the control groups from the 1st to the 6th hours. Furthermore, highly a statistically significant difference was found between the study subjects' mean duration of the 1st stage of labor (P<0.000). **Conclusion**: it can be concluded that assuming squatting position with ergonomic ankle support for during the active phase of labor was more effective in accelerating progress of labor among the study group in terms of: stronger uterine contractions, faster cervical dilatation and effacement, faster fetal head descent and shorter duration of the three stages of labor. **Recommendations:** Squatting Position with ergonomic ankle support position should be advocated as one of the significant modalities to manage labor pains, Upright positions, especially Squatting Position with ergonomic ankle support position, during the first stage of labor need to be incorporated into antenatal care activities and Laboring women should be encouraged to assume upright (Squatting Position with ergonomic ankle support) position during the first stage of labor to control pain, facilitate labor as well as to promote self-control and attain more satisfactory birthing experience.

Keywords: first stage of labor, squatting position, the ankle supporter for squatting position, maternal outcome

Introduction

Position changes can be one of the techniques of promoting labor. Where western healthcare has not had much influence; the upright position is still very common. There is no right or wrong, best or worst position to give birth; it depends on where the parturient is most comfortable, with minimum complication. Woman's positions at during first stage of labor are classified into supine and vertical positions.(Barasinski, Debost-Legrand, Lemery, & Vendittelli, 2018; Gaffka, 2016)

Squatting position is categorized among common vertical positions during labour and delivery have benefits including better maternal and neonatal outcome, enhanced perineal integrity, decreased vulvar edema and labor augmentation. Turning to disadvantages it is very challenging to maintain a squatting posture during delivery even in minutes. Furthermore, keeping stabilized while squatting on a bed is difficult because of the soft surface of the mattress.(Ara, Ara, Kaker, & Aslam, 2015; Desseauve, Fradet, Lacouture, & Pierre, 2017)The different types of squatting position are depending on the extension of the

feet. It include two large families: squatting with the feet flat on the floor (this position was recently popularized under the name "Asian squat"), and squatting on tiptoe (sometimes called "western squat") as shown in Figure 1(Desseauve, Fradet, Lacouture, & Pierre, 2019) the use of ankles and calf muscles to shift the body's center of gravity is the main cause of leg discomfort during squatting. Directing the weight of the body onto the ball of the foot and arching the heel (about 22.5 off the ground) while squatting focuses this weight directly downward onto the ball and greatly reduces pressure on the calves and ankles, which helps to maintain the upper torso's perpendicular position with the floor and to improve squatting-related discomfort and soreness effectively.

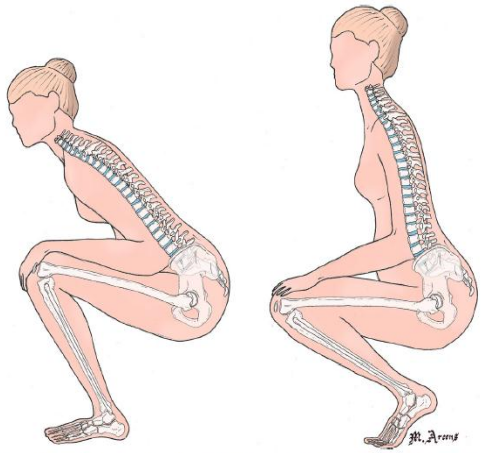


Fig. (2): Example of difference postures between different squatting birth positions according flexion of the feet

Maternity nurses' role should support as well as afford evidence-based care to both the mother and the fetus in addition to be knowledgeable about the advantages and hazards of labor positions that can enhance the birthing process**.** There is marginal evidence that adopts the upright positions including squatting position during labor since they promote vaginal delivery. These positions have been recommended by the world health organization (WHO)2014.(WHO, 2014)

In the Arab region, studies of normal delivery practices have an ethnographic orientation and have concentrated on home births and traditional practices. However, little is known about obstetric practices in facilities for normal labor and delivery, and of their relationship to evidence-based obstetrics. (Nieuwenhuijze, Korstjens, de Jonge, de Vries, & Lagro-Janssen, 2014)

Egypt is no exception, where 49% of maternal deaths occur within 24 hours of delivery due to provider malpractice. So; Squatting position one of position depends on where the women's are most comfortable, with minimum complication.(Lawrence, Lewis, Hofmeyr, & Styles, 2013Mahmoud & Omar, 2018)

Policy makers and health professionals are progressively utilizing the evidence-based rationale for guiding their decisions about maternal position during the first stage of labor; there is a long controversy idea regarding which maternal position is more appropriate during this stage. Therefore, this study was carried out to evaluate the effect of an ergonomic ankle support for squatting position on progress of labor and maternal outcome during the first stage among primiparae.The results of the current study may provide evidence depend on randomized controlled trial (RCT) that can aid in improving the body of knowledge and practices for the nursing field. It can also help policy makers to issue the right decisions which will eventually add to the optimum safety of women and their fetus.

Aim of the study: this study aims to evaluate, the effect of an ergonomic ankle support for squatting position on progress of labor and maternal outcome among primiparae women.

Research hypothesis:

H0: Laboring women who assume squatting position with ergonomic ankle support exhibit similar progress of labor as well as maternal outcome than those who don't assume such position**.**

H1: Laboring women who assume squatting position with ergonomic ankle support of labor exhibit faster progress of labor than those who don't assume such position**.**

H2: Laboring women who assume squatting position with ergonomic ankle support of labor exhibit better maternal outcome than those who don't assume such position**.**

Operational definitions:

- **Ergonomic Ankle Support for Squatting Position:** the ankle supporter device was used for squatting position.
- **Active phase of labor**: median duration of active phase with reference staring point (4cm) cervical dilation was between 3.7-5.9 hours.

Materials and Method

Research design:

This is A quasi-experimental research design was utilized, where the effect of an independent variable (ergonomic ankle support for squatting position during the active phase of 1st stage of labor) on a dependent variable (progress of labor) and (maternal outcome) were examined.

Setting:

This study was carried out at labor and delivery unit of El- Shatby Maternity University Hospital in Alexandria. This setting was particularly chosen because normal delivery turnover is satisfactory for the study in addition to the availability of Cardiotocography (CTG) machine which was used to assess the intensity of uterine contractions and fetal heart rate.

Subjects: A convenience sample of 80 women who attended labor unit was included in the study according to the following criteria:

- Primigravida.
- In active phase of 1st stage of labor (i.e., from 4 cm to 6 cm cervical dilation)
- Labor occurring between gestational weeks 37 and 41
- With a normal course of pregnancy
- A single viable fetus with occipto -anterior position.
- Free from any medical or obstetrical problems

Epi info 7 program was used to estimate the sample size using the following parameters:

- Population size is 600 over 3 months
- Expected frequency 50%
- Acceptable error 5%
- Confidence coefficient 95%
- Minimal sample size 80

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

Study group (Group 1) included 40 parturient, who assumed ergonomic ankle support for squatting position (research positioning) during the active phase of 1st stage of labor.

Control group (Group 2) involved 40 parturient, who followed the hospital routine positioning during the active phase of the 1st stage of labor (recumbent position).

Tools for data collection

Four tools were utilized for data collection as follows:

Tool one: socio-demographic and clinical data structured interview schedule:

It was developed and used by the researchers. It comprised three parts:

Part (I): Socio- demographic characteristics such as age, level of education, occupation, current residence and marital status.

Part (II): Reproductive (obstetric) history such as gravidity and number of abortion.

Part (III): History of current labor such as frequency, duration, interval and intensity of uterine contraction, cervical dilatation and fetal head decent.

Tool two: Partograph

It was adopted from the WHO version (1994) (Organization, 1994)and used by the researchers to plot:

- Progress of labor in terms of cervical effacement and dilatation as well as uterine contractions (frequency per 10 minutes, duration, interval & intensity) and descent of fetal head in fifths.
- Maternal condition such as vital signs and blood pressure as well as received drugs and IV infusions.
- Fetal condition such as fetal heart rate, condition of membranes and liquor as well as molding of fetal skull bones.

Tool three: Maternal Outcome Observational Checklist

This tool was involved: maternal distress (presence or absence of distress), mode of

rupture of membranes (spontaneous or artificial), duration of the three stages of labor, presence or absence of labor complications (genital injuries, or prolonged labor, bleeding, and retained placenta etc.),

Tool four: Cardiotocography (CTG)

Itis a technical means of recording (-graph), the fetal hearts (cardio-) and the uterine contractions (-toco-) through simultaneous recordings performed by two separate transducers, the first one detecting the fetal heart. The second one is for providing an estimate of the uterine contractions (intensity and frequency). It was invented by **Hammacher**et.al (1968) and used by the researchers for parturient upon their admission to labor unit. (Hammacher, Hüter, Bokelmann, & Werners, 1968)

Method

The study was executed according to the following steps:

Approval

1. Ethical consideration was maintained by obtaining the agreement of Ethic Research Committee of Alexandria Faculty of Nursing before conducting the research. The informed consent and assuring the participants that their decision to be included or not in the study will not affect their care in any means at that they are free to withdraw at any point of time in the study. Their privacy and confidentiality were maintained.
2. Written permissions to conduct the study were obtained from the medical director of El-Shatby Maternity University Hospital after explaining the purpose of the study.

Tool development

1. Tool one was developed by the researchers based on recent, current and relevant literature.
2. Tools were tested for content validity by a jury of five experts in the field of obstetric and gynecologic nursing. The recommended modifications were done and the final form was finalized after proving valid.
3. Tools reliability was tested by Cronbach's alpha test. The result was (0.84) which indicated an acceptable reliability for the tool.
4. The ankle supporter for squatting position was adapted and modified by the researchers based on previous study. It was constructed of plywood with a base measuring 60 cm x60 cm and two pairs of squat-support footboards angled at 22.5o(for normal-arch support) and 33o (for flat-arch support). The surfaces of the footboards were fitted with antislip pads. (fig 2)(Yu-Ching, Meei-Ling, Ghi-Hwei, & Hung-Chang, 2018)

Fig. (2): The Modified ankle supporter for squatting position

Pilot study

5. A pilot study was conducted on 8parturient women (out from the study subjects) from the previously mentioned settings.

Data collocation

6. Collection of data covered a period of 3 months. Data was collected from one parturient/day for 2 days/week considering days, where cases were not available or excluded.
7. Each parturient who fulfilled the inclusion criteria and available at the time of data collection was assigned either to the control or the study group.
8. The control group was started with and completed before the study group to avoid contamination of the sample.
9. Data of tool one (part I, II and III) was collected from both groups during the latent phase of the 1st stage of labor, through an interview which was conducted individually and in a total privacy.
10. On admission to labor unit, data of tool two was collected from both groups through an abdominal examination to

assess uterine contractions (frequency, interval, duration & intensity); FHR; and descent of fetal head in fifths. Vaginal examination was also performed to assess cervical effacement and dilatation as well as condition of membranes. Then the data was plotted on the partograph in addition to maternal vital signs.

11. Then each parturient of both groups was assessed for FHR and uterine contractions, using tool four (CTG). The researchers applied and secured CTG sensors on the mother's abdomen for 10 minutes; one sensor was placed over the fundus of the uterus to record the uterine contractions and the other one was placed over the location of the strongest fetal heart

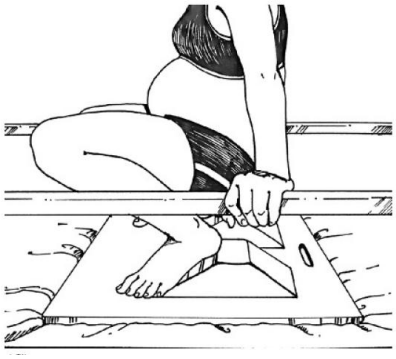
For control group

12. Each woman of the control group followed the hospital routine of a recumbent position during the first stage of labor, in addition to the researchers' physical presence.

For study group

13. Each woman in the study group was separately met in the latent phase, meanwhile, an elaboration of the importance of changing their position to squatting.

14. At the starting active phase of labor each woman of the study group was assisted onto the ankle support, which was set on the hospital bed mattress. Meanwhile if in not available it is put on the floor of room after putting a protective cover under the support. Participants were encouraged to hold onto the bed rails, both to maintain balance and to facilitate the labor progress. Assuming such position for the 15-20 minutes every one hour according to each mother comfort and in between women was permitted to lie down on the bed for 10-15 minutes and advise her to repeat squatting position up to full cervical dilatation.



15. The researchers accompanied each participant through the entire delivery process and collected outcome data.

Evaluation

16. The researchers evaluated progress of labor and maternal outcome, through assessing cervical dilatation, uterine contraction, fetal condition as well as maternal distress.

The following statistical tests were used:

17. Descriptive statistics were applied (e.g., mean, standard deviation, frequency and percentages). Test of significance (chi square and paired *t* test One – Way ANOVA test & Fisher Exact tests were applied to test the study hypothesis. A statistically significant difference was considered at $p \leq 0.05$, and a highly statistically significant difference was considered at $p \leq 0.00$.

Ethical considerations:

18. Consent from ethical committee of faculty of nursing Alexandria University. For each recruited subject the following issues was considered: securing the subject's informed written consent after explanation of research purpose, keeping her privacy, anonymity and right to withdraw at any time as well as assuring confidentiality of her data.

Results

According to table (1), both groups were younger, where slightly less than three quarter of them (70%) was 20 -<25 years. The study and the control groups were also less educated, where 42.5% & 47.5% of them respectively

were illiterate or just read and write and 50% & 42.5% respectively had basic level. The table also manifests that 55%&75% the study and the control groups respectively were working; 47.5% & 62.5% of both groups respectively had nuclear families; 50% & 57.5% respectively had enough family income/ month and 60% of were urban dwellers. However, socio-demographic characteristics of both groups were without any statistically significant differences.

Table (1): Number and percent distribution of the study subjects according to their socio-demographic characteristic

Socio-demographic characteristics	Study Group (40)		Control Group (40)		F / χ^2 (P)
	N	%	N	%	
Age (years):					
20 -	28	70.00	28	70.00	4.444 (0.108)
25 -	10	25.00	5	12.50	
30 - < 35	2	05.00	7	17.50	
Level of education:					
- Illiterate/ read and write	17	42.50	19	47.50	2.021 (0.568)
- Primary & Preparatory	20	50.00	17	42.50	
- Secondary or its equivalent	2	05.00	4	10.00	
- University	1	02.50	0	00.00	
Occupation:					
- Working	22	55.00	30	75.00	3.516
- Not working	18	45.00	10	25.00	(0.061)
Original Residence:					
- Rural	16	40.00	16	40.00	0.000
- Urban	24	60.00	24	60.00	(1.000)
Family type:					
- Nuclear	19	47.50	25	62.50	1.818
- Extended	21	52.50	15	37.50	(0.178)
Family income/month:					
- Enough	20	50.00	23	57.50	0.453
- Not enough	20	50.00	17	42.50	(0.501)

F (P): Fisher Exact Test & P for FET-Test χ^2 (P): Chi-Square Test & P for χ^2 Test

*: Significant at $P \leq 0.05$

Table (2) displays mean frequency of uterine contraction /10 minutes revealed highly statistically significant difference (P=0.000) among the study and the control groups from the 1st to the 6th hour. The relationship was statistically significant between the two groups during the 2nd hour (P=0.003), where the mean frequency was 3.87 ± 0.704 contractions for the study group, compared to 3.36 ± 0.778 contractions for the control group. It was also highly statistically significant between them during the 4th hour (P=<0.0001), where the mean frequency was 4.88 ± 0.326 contractions for the study group, compared to 4.37 ± 0.490 contractions for the control group. Mean duration of uterine contractions illustrated highly statistically significant difference (P=0.000) among the study and the control groups from the 1stto the 6th hour. Highly statistically significant difference was found between the two groups during the 2nd, 3rd , 4th hour (P=0.001), where the mean duration was 55.08 ± 2.655,57.26 ± 1.615 and 58.63 ± 1.497 seconds for the study group compared to 52.00 ± 3.671, 54.70 ± 1.854 and 55.73 ± 2.504 seconds for the control group, respectively.

Mean interval of uterine contractions exhibited highly statistically significant difference (P=0.000) among the study and the control groups from the 1st to the 6th hour. The relationship was statistically significant between the two groups during the 2nd hour (P=0.004), where the mean

interval was 2.21 ± 0.409 minutes for the study group, compared to 2.62 ± 0.747 minutes for the control group. In addition, there was highly statistically significant (P=0.000) between them during the 3rd hour, where the mean interval was 2.00 ± 0.000 minutes for the study group, compared to 2.30 ± 0.463 minutes for the control group. It was also statistically significant between them during the 4th hour (P= 0.003), where the mean interval was 2.00 ± 0.000 minutes for the former group, compared to 2.28 ± 0.457 minutes for the latter group.

Table (2): Mean distribution of the study subjects according to characteristics of their uterine contractions using CTG

Characteristics of uterine contractions	**Study Group**		**Control Group**		**T- test (P)**
	N	**Mean & SD**	**N**	**Mean & SD**	
Frequency of contraction / 10 minutes:					
1st hour	40	2.95 ± 0.749	40	3.05 ± 0.749	0.597 (0.552)
2nd hour	38	3.87 ± 0.704	39	3.36 ± 0.778	3.014 (0.003)*
3rd hour	35	4.49 ± 0.507	39	4.14 ± 0.585	2.706 (0.008)
4th hour	27	4.88 ± 0.326	29	4.37 ± 0.490	4.510 (<0.0001)**
5th hour	0	-	23	5.00 ± 0.000	-
6th hour	0	-	5	5.00 ± 0.000	-
F (P)	37.934 (0.000)**		27.096 (0.000)**		
Duration of contraction (seconds):					
1st hour	40	48.60 ± 4.125	40	48.37 ± 4.093	0.250 (0.8030
2nd hour	38	55.08 ± 2.655	39	52.00 ± 3.671	4.209 (<0.0001)**
3rd hour	35	57.26 ± 1.615	39	54.70 ± 1.854	6.232 (<0.0001)**
4th hour	27	58.63 ± 1.497	29	55.73 ± 2.504	5.232 (<0.0001)**
5th hour	0	-	23	56.95 ± 1.253	-
6th hour	0	-	5	56.50 ± 0.707	-
F (P)	48.781 (0.000)**		27.522(0.000)**		
Interval of contractions (minutes):					
1st hour	40	3.60 ± 0.928	40	3.42 ± 0.958	0.854 (0.396)
2nd hour	38	2.21 ± 0.409	39	2.62 ± 0.747	3.007 (0.004) *
3rd hour	35	2.00 ± 0.000	39	2.30 ± 0.463	3.887 (0.000) **
4th hour	27	2.00 ± 0.000	29	2.28 ± 0.457	3.057 (0.003) *
5th hour	0	-	23	2.00 ± 0.000	-
6th hour	0	-	5	2.00 ± 0.000	-
F (P)	26.605 (0.000) **		13.909 (0.000) **		

F (P): F for One – Way ANOVA test & (P) for F testT (P): T for t test & P for T-Test*: Significant at P ≤ 0.05**: Highly Significant at P ≤ 0.05

Table (3) displays highly statistically significant differences (P=0.000) among the study and the control groups from the 1st to the 6th hour. They were revealed during the 2ndhour, strong uterine contraction was as much as 50% among study group compared to only 12.82% among the control group. On the 3rd hour, where strong uterine contraction was 85.70%, compared to 30.77% among the study and control group, respectively; and during the 4th hour, where strong uterine contraction was 92.59% among the study group compared to 48.28% among the control group.

Table (3): Number and percent distribution of the study subjects according to their strength of uterine contraction using CTG

Intensity of labor pain	Study Group (40)		Control Group (40)		F / χ^2 (P)
	No	%	No	%	
1st hour:					
- Mild	27	67.50	26	65.00	0.162 (0.922)
- Moderate	10	25.00	10	25.00	
- Strong	3	07.50	4	10.00	
2nd hour:	**(n=38)**		**(n=39)**		
- Mild	1	02.63	13	33.33	18.673 (0.000)**
- Moderate	18	47.37	21	53.85	
- Strong	19	50.00	5	12.82	
3rd hour:	**(n=35)**		**(n=39)**		
- Moderate	5	14.30	27	69.23	23.354 (0.000)**
- Strong	30	85.70	12	30.77	
4th hour:	**(n=27)**		**(n=29)**		
- Moderate	2	07.41	15	51.72	12.317 (0.000)**
- Strong	25	92.59	14	48.28	
5th hour:	**(n=0)**		**(n=23)**		-
- Strong	٠	00.00	23	100.0	
6th hour:	**(n=0)**		**(n=5)**		-
- Strong	٠	00.00	5	100.0	
F / χ^2 (P)	175.618 (0.000)**		158.344 (0.000)**		

F (P): Fisher Exact Test & P for FET-Test χ^2 (P): Chi-Square Test &P for χ^2 Test
*: Significant at P ≤ 0.05 **: Highly Significant at P ≤ 0.05

Table (4) portrays highly statistically significant difference (P=0.000) among the study and the control groups from the 1st to the 6th hours in relation to mean of their cervical effacement. Statistically significant differences (P=0.005) were noticed between the two groups during the 2nd hour, where the mean effacement was 82.63 ± 7.60% for the study group, compared to 76.67 ± 10.087 % for the control group, and during the 3rd hour (P=0.002), where it was 91.14 ± 5.827% for the former group, compared to 85.41 ± 8.691% for the latter group. In addition, a highly statistically significant difference (P=<0.0001) was observed between the both groups during the 4th hour, where the mean effacement was 98.52 ± 3.620% for the study group, compared to 91.72 ± 5.391% for the control group. Mean cervical dilatation elucidated highly statistically significant difference (P=0.000) among the study and the control groups from the 1st to the 6th hour. The relationship was statistically significant between the two groups during the 3rd hour (P=0.044), where the mean dilatation was 8.54 ± 0.980 cm for the study group, compared to 8.03 ± 1.108 cm for the control group. It was also highly statistically significant between them and during the 4th hour (P= 0.0001), where the mean dilatation was 9.77 ± 0.652cm for the former group, compared to 8.79 ± 0.902 cm for the latter group. Regarding fetal condition; mean FHR revealed highly statistically significant difference (P=0.000) among the study and the control groups from the 1st to the 6th hour. The relationship was statistically significant between the study and the control groups during the 2nd hour (P=<0.0001) 127.47 ± 1.006 B/M, compared to 132.72 ± 4.039 B/M; during the 3rd hour (P=<0.0001) 128.31 ± 0. 932 B/M compared to 136.17 ± 4.379 B/M; during the 4th hour (P=<0.0001) 129.67 ± 1.074 B/M compared to 140.34 ± 5.499 B/M.Mean fetal descent/fifths also clarified highly statistically significant difference (P=0.000) among the study and the control groups during the 1st, the 3rd and the 6th hours. However, a statistically significant difference was found

between both groups during the 3rd hour (P=0.042), where the mean descent was 3.68 ± 0.989 for the study group, while it was 3.21 ± 1.005 for the control group.

Table (4): Mean distribution of the study subjects according to their cervical and fetal condition

Cervical effacement and dilatation	Study Group		Control Group		T- test (P)
	N	Mean & SD	N	Mean & SD	
Cervical effacement (%):					
1st hour	40	51.75 ± 11.297	40	52.25 ± 11.206	0.199 (0.843)
2nd hour	38	82.63 ± 7.600	39	76.67 ± 10.087	2.923 (0.005) *
3rd hour	35	91.14 ± 5.827	39	85.41 ± 8.691	3.267 (0.002) *
4th hour	27	98.52 ± 3.620	29	91.72 ± 5.391	5.499 (<0001)**
5th hour	0	-	23	99.09 ± 2.942	-
6th hour	0	-	5	100.0 ± 0.000	-
F (P)	124.817 (0.000)**		93.568 (0.000)**		
Cervical dilation (cm):					
1st hour	40	4.18 ± 1.152	40	4.23 ± 1.121	0.197 (0.845)
2nd hour	38	7.61 ± 1.079	39	7.18 ± 1.315	1.566 (0.122)
3rd hour	35	8.54 ± 0.980	39	8.03 ± 1.108	2.052 (0.044)*
4th hour	27	9.77 ± 0.652	29	8.79 ± 0.902	4.570 (<0.0001) **
5th hour	0	-	23	9.05 ± 0.785	-
6th hour	0	-	5	10.0 ± 0.000	-
F (P)	111.702 (0.000) **		76.872 (0.000) **		
Fetal heart rate (B/M):					
1st hour	40	123.10 ± 1.598	40	123.30 ± 2.233	0.461 (0.646)
2nd hour	38	127.47 ± 1.006	39	132.72 ± 4.039	7.780 (<0.0001)**
3rd hour	35	128.31 ± 0. 932	39	136.17 ± 4.379	10.391(<0.0001)**
4th hour	27	129.67 ± 1.074	29	140.34 ± 5.499	9.902 (<0.0001)**
5th hour	0	-	23	143.52 ± 5.080	-
6th hour	0	-	5	143.50 ± 3.536	-
F(P)	124.707 (0.000)**		99.859 (0.000)**		
Fetal decent in fifth:					
1st hour	40	1.8٣ ± 0.747	40	2.15 ± 1.001	1.620 (0.109)
3rd hour	35	3.68 ± 0.989	39	3.٢١ ± ١.٠٠٥	2.068 (0.042) *
6th hour	٠	-	٥	5.00 ± 0.000	-
F (P)	87.464 (0.000)**		16.488 (0.000)**		

F (P): F for One – Way ANOVA test & (P) for F testT (P): T for t test & P for T-Test
**: Highly Significant at P ≤ 0.05 *: Significant at P ≤ 0.05

Table (5) describes statistically significant differences (P=0.000) among the study and the control groups regarding the rupture of membrane. They were revealed spontaneous rupture of membrane was among the entire study group compared to 70% among the control group. There was also significant statistically difference between both group regarding to occurrence of signs of maternal distress, rupture of membrane, presence of labor complications where p= (0.027, 0.006, 0.027), respectively . Highly a statistically significant difference was found between the study subjects' mean duration of the 1st stage of labor (P<0.000), where it was 3.28 ± 0. 847hrs for the study group, compared to 5.55 ± 0. 932 hrs for the control group. Again Highly statistically significant differences were discovered between the two groups' mean during of the 2nd & the 3rd stage of labor (P<0.0001), where they were 22.73 ± 2.320 min & 12.93 ± 1.492 min respectively for the former group, compared to 26.75 ± 3.248 min &16.80 ±1.713 min respectively for the latter group.

Table (5): Number and percent distribution of the study subjects according to maternal outcome

Maternal outcome	Study Group (40)		Control Group (40)		F / χ^2 (P)
	N	%	N	%	
Maternal distress					
- yes	0.0	-	5	12.5	5.333
- no	40.0		35	87.5	(0.027)*
Presence of labor complication					
- **Yes**	0.0	-	5	12.5	5.333
- **No**	40		35	87.5	(0.027)*
Presence of labor complication					
- Prolonged labor	0.0		3	60	
- Genital injury	0.0	-	1	20	-
- Hemorrhage	0.0		1	20	
Duration of labor	**Mean &SD**		**M &SD**		**T- test (P)**
• Duration of the 1st stage (hrs)	3.28 ± 0. 847		5.55 ± 0. 932		171.795 (0.000)**
• Duration of the 2nd stage (min)	22.73 ± 2.320		26.75 ± 3.248		6.370 (<0 .0001)**
• Duration of the 3rd stage (min)	12.93 ± 1.492		16.80 ±1.713		10.775 (<0 .0001)**

F (P): Fisher Exact Test & P for FET-Test X^2(P): Chi-Square Test & P for Test
**: Highly Significant at P ≤ 0.05 *: Significant at P ≤ 0.05

Discussion

Maternal position is one of the obstetric care in the labour wards. Consideration of maternal position in the labour wards is indicative of a supportive environment. In the squatting position, a woman's weight rests mainly on her feet, but her knees are obviously bent and lean or pull on some support. World health organization (WHO) recommended that application of upright positions during the first stage of labor reduce its duration, intervention as well as enhance mothers and fetus wellbeing.(Organization, 2018; Zileni et al., 2017)Therefore, this study has shed some lights on the effect of an ergonomic ankle support for squatting position on progress of labor and maternal outcome among primiparae women

The results of this study will be discussed in frame of previously mentioned research hypothesis. *On evaluating uterine contraction;* the present study reveals highly statistically significant difference among the study and the control groups from the 1st to the 6th hour in relation to intensity, frequency, duration and interval of uterine contractions (table 2).From the results of the present study, it can be observed that, the study group was significantly better than control group after intervention. This result was obviously showed remarkable increased of strong uterine contraction and decreased mild and moderate contraction among study group than control group. This result suggests that the ankle support aids in squatting position helping women for strengthens the uterine contractions by using gravity which potentially prevent aortocaval compression, resulting in more uterine perfusion, that strengthened uterine contraction. Moreover it increase the size of pelvic diameter by approximately 20% thereby enabling faster labor progress , as well as maternal expulsive forces facilitated by the force of gravity , improved alignment of the fetus for passage through the pelvis.(Zwelling, 2010)

This result is relatively coincides with the study of Emam A, Eidah Al-Zahrani (2018)(Emam & Al-Zahrani, 2018)who showed that decrease interval and increases duration, frequency and intensity of uterine contraction were found among squatting group compared to of the recumbent group. Furthermore the result is in harmony with Gizzo SS et.al.(2014)(Gizzo et al., 2014)who reported that alternative maternal positioning as squatting position may positively strengthening uterine contraction. It also agreed with Kumud et al.(2013)(Kumud &

Chopra, 2013)who observed that assuming upright positions such as squatting position had increase strength of uterine contractions than supine position.

On evaluating cervical dilation and effacement the present study shows the mean cervical effacement and dilatation elucidated highly statistically significant difference (P=0.000) among the study and the control groups from the 1st to the 6th hour (table 3).This may be probably justified by the fact that the study group had better progress of labor than the control group due to that the fact that radiological evidence has shown that the squatting position widens the dimensions of the pelvic outlet. Moreover during the first stage of labor squatting position allow the relaxation of abdominal muscles that result in the falling down of uterus. This directs the fetal head into the pelvic inlet and applies direct pressure to the cervix which stimulates cervical dilatation. This result is in line Ibrahim H (2020)(Ibrahim et al., 2020) who found with significant differences ($P < 0.05$) were observed between the study and control groups in relation to cervical dilation .

On evaluating fetal condition; fetal heart rate, fetal decent and molding, the present study revealed that mean FHR is highly statistically significant difference (P=0.000) among the study and the control groups from the 1st to the 6th hour in favorite to former group (Table 2). This is could be contributed to the fact that intra-abdominal vessels may be compressed in assuming lithotomy or supine positions during labor; accordingly, leading to decline uteroplacental perfusion; thus, more fetal heart rate abnormalities occurred. Conversely, squatting position may avoid compression of intra-abdominal vessels, especially the inferior vena cava thereby fewer fetal heart rate patterns are found in this position. This results is relatively agrees with the Systematic Review of Gupta.J et.al (2017)(Gupta, Sood, Hofmeyr, & Vogel, 2017)who showed that fewer abnormal fetal heart rate patterns were recorded in the upright squatting position (RR 0.46, 95% CI 0.22e0.93). In addition , it is also in line with the systematic review of Kemp .E et.al (2013)(Kemp, Kingswood, Kibuka, & Thornton, 2013)who stated that decreased abnormal FHR pattern have been pointed out as the advantage of squatting position. On other hand the present study is not in line with Mirzakhani K et.al (2020)(Mirzakhani, Karimi, Mohamadzadeh Vatanchi, & Feroz Zaidi, 2020) who found that different maternal positions during the first- and second-stage of labor did not affect maternal, fetal, and neonatal outcomes.

The current study showed a highly statistically significant difference (P=0.000) among the study and the control groups during the 1st, the 3rd and the 6th hours in relation to fetal decent. This could be justified by the efficacy of ankle support in giving more room to the baby for rotation by enlarging the pelvic inlet and outlet, and letting the pelvic angle be maintained at an angle of 90 degrees to 120 degrees.(Desseauve et al., 2017; Emam & Al-Zahrani, 2018; Simkin, Ancheta, & ICCE, 2011; Storton, 2013)The current study is compatible with Taiwanese study done by Yu-Ching**et.al (2018)**(Yu-Ching et al., 2018)who detected significant differences among squatting without support and semi recumbent pushing and squatting with the aid of ergonomically designed ankle supports groups in relation to mean times between the start of +1 station and the start of head crowning (p >.001).This finding is also in the same line with previously mentioned study done by Emam and Eidah Al-Zahrani (2018)(Emam & Al-Zahrani, 2018)who observed that increases fetal head descent/fifth among the study group. Furthermore, the current study is in conformity with studies conducted by Desseauve et.al (2017) (Desseauve et al., 2017),Simkin et .al (2011)(Simkin et al., 2011)and Storton (2013)(Storton, 2013)who found that in the squatting position; pushing efforts act on a downward direction as well as gravity, so the descent of fetal head will be easier among parturient.

On investigating maternal outcome,the present study showed statistically significant differences (P=0.000) among the study and the control groups regarding their maternal outcome (table 5).This is in harmony with Awad, M.A (2019) (Mohamed A Awad, 2019) concluded that upright positions had favorable impact on labor progression through decreasing length of labor course and labour

pain and consequently better neonatal outcomes. On the other hand Türkeli, G (2016)(Turkeli, Öz, Kuscu, & Ugur, 2016) found that there was no difference in obstetric outcomes between the groups. The result of the current study reveals that intervention group was significantly better than the control group after intervention in relation to their mean duration of the first, second and third stage of labor. In this context the previously mentioned study done by Awad, M.A (2019)(Mohamed A Awad, 2019) who observed that duration of 1st, 2nd and 3rd stage of labour, pain and fetal heart rate decreased significantly in upright group than recumbent group. Moreover, Berta et.al (2019)(Berta, Lindgren, Christensson, Mekonnen, & Adefris, 2019)found that a remarkable reduction in duration (19.8 min) of the second stage of labor among squatting group than supine group. The study is also relatively in conformity with the study of Kao Getal (2018)(Kao, Hwang, Lin, & Lin, 2018)who reported that using the assistive device in squatting group had decreased in duration of second stage of labor compared to semi-recumbent group. It is also in accordance with the previously mentioned one done by Emam and Eidah Al-Zahrani (2018)(Emam & Al-Zahrani, 2018) who revealed that high statistical significant difference between the squatting and recumbent groups in term of decreases duration of the three stages of labor among the upright group. In addition, it is relatively congruent with Moralogluetal (2017)(Moraloglu et al., 2017)who revealed that women experienced a significant reduction in the duration of the second stage of labor with the mean length of the second-stage of labor shorter in the squatting group than in the supine group. Carquillaetal (2016)(Carquillat, Boulvain, & Guittier, 2016)who reported that squatting position can reduce the duration of the second stage of labor as compared with supine position. The relative agreement between the present study and previously mentioned studies could bring to light upon the efficacy of squatting position on increased mobility, and increased diameter of the pelvic outlet and in inducing a flexible sacrum birthing position. On the contrary, the current finding contradicts a systematic review carried out by Mirzakhanietal (2019)(Mirzakhani et al., 2020)who reported that different maternal positions including squatting during the first- and second-stage of labor did not affect maternal, fetal, and neonatal outcomes. Moreover, the current study is not in accordance with the study of Guittieretal (2016)(Guittier, Othenin-Girard, De Gasquet, Irion, & Boulvain, 2016)who reported that maternal position had no effect on delivery duration.

Conclusion

Based on the findings of the present study, it can be concluded that:

The application of squatting position with ergonomic ankle support for during the 1st stage of labor was more effective in accelerating progress progress of labor among the study group in terms of: stronger uterine contractions, faster cervical dilatation and effacement, faster fetal head descent and shorter duration of the three stages of labor.

Recommendations:

Based on the findings of the present study, the following recommendations are suggested:

1. Squatting Position with ergonomic ankle support position should be advocated as one of the significant modalities to manage labor pains.
2. Upright positions, especially Squatting Position with ergonomic ankle support position, during the first stage of labor need to be incorporated into antenatal care activities.
3. Laboring women should be encouraged to assume upright (Squatting Position with ergonomic ankle support) position during the first stage of labor to control pain, facilitate labor as well as to promote self-control and attain more satisfactory birthing experience.

References

Ara, F., Ara, B., Kaker, P., & Aslam, M. (2015). CHILD BIRTH; COMPARISON OF COMPLICATIONS BETWEEN LITHOTOMY POSITION AND

SQUATTING POSITION DURING. *Professional Medical Journal, 22*(4).

Barasinski, C., Debost-Legrand, A., Lemery, D., & Vendittelli, F. (2018). Positions during the first stage and the passive second stage of labor: A survey of French midwives. *Midwifery, 56*, 79-85.

Berta, M., Lindgren, H., Christensson, K., Mekonnen, S., & Adefris, M. (2019). Effect of maternal birth positions on duration of second stage of labor: systematic review and meta-analysis. *BMC pregnancy and childbirth, 19*(1), 1-8.

Carquillat, P., Boulvain, M., & Guittier, M.-J. (2016). How does delivery method influence factors that contribute to women's childbirth experiences? *Midwifery, 43*, 21-28.

Desseauve, D., Fradet, L., Lacouture, P., & Pierre, F. (2017). Position for labor and birth: State of knowledge and biomechanical perspectives. *European Journal of Obstetrics & Gynecology and Reproductive Biology, 208*, 46-54.

Desseauve, D., Fradet, L., Lacouture, P., & Pierre, F. (2019). Is there an impact of feet position on squatting birth position? An innovative biomechanical pilot study. *BMC pregnancy and childbirth, 19*(1), 251.

Emam, A. M. M., & Al-Zahrani, A. E. (2018). Upright versus recumbent position during first stage of labor among primipara women on labor outcomes. *Journal of Nursing Education and Practice, 8*(7).

Gaffka, K. (2016). The Effect of Alternative Labor Positions Versus the Lithotomy Position on Birthing Outcomes: An Integrative Literature Review.

Gizzo, S., Di Gangi, S., Noventa, M., Bacile, V., Zambon, A., & Nardelli, G. B. (2014). Women's choice of positions during labour: return to the past or a modern way to give birth? A cohort study in Italy. *BioMed Research International, 2014*.

Guittier, M., Othenin-Girard, V., De Gasquet, B., Irion, O., & Boulvain, M. (2016). Maternal positioning to correct occiput posterior fetal position during the first stage of labour: a randomised controlled trial. *BJOG: An International Journal of Obstetrics & Gynaecology, 123*(13), 2199-2207.

Gupta, J. K., Sood, A., Hofmeyr, G. J., & Vogel, J. P. (2017). Position in the second stage of labour for women without epidural anaesthesia. *Cochrane Database of Systematic Reviews*(5).

Hammacher, K., Hüter, K., Bokelmann, J., & Werners, P. (1968). Foetal heart frequency and perinatal condition of the foetus and newborn. *Gynecologic and Obstetric Investigation, 166*(4), 349-360.

Ibrahim, H. A.-F., , H. I. I. S., Obstetrics and Gynecologic Nursing department, D. U., Damanhour, 22511, Egypt, articles:, S. f. o., Scholar, d. c., & Elgzar, a. W. T. I. (2020). Effect of upright and ambulant positions versus lying down during the active first stage of labor on birth outcomes among nulliparous women: randomized controlled clinical trial *Frontiers of Nursing, 7*(3), 239. doi:https://doi.org/10.2478/fon-2020-0035.

Kao, G.-H., Hwang, T. P., Lin, Y., & Lin, Y.-C. (2018). *Squatting Support Device for Labor.* Paper presented at the International Conference on Applied Human Factors and Ergonomics.

Kemp, E., Kingswood, C. J., Kibuka, M., & Thornton, J. G. (2013). Position in the second stage of labour for women with epidural anaesthesia. *Cochrane Database of Systematic Reviews*(1).

Kumud, R. A., & Chopra, S. (2013). Effect of upright positions on the duration of first stage of labor among nulliparous mothers. *Nurs Midwifery Res J, 9*(1), 10-20.

Lawrence, A., Lewis, L., Hofmeyr, G. J., & Styles, C. (2013). Maternal positions and mobility during first stage labour.

Cochrane Database of Systematic Reviews(8).

Mahmoud, G. A., & Omar, A. M. (2018). Women's awareness and perceptions about maternal mortality in rural communities in Assiut and Fayoum Governorates, Egypt. *Egyptian Nursing Journal, 15*(1), 21.

Mirzakhani, K., Karimi, F. Z., Mohamadzadeh Vatanchi, A., & Feroz Zaidi, F. (2020). The Effect of Maternal Position on Maternal, Fetal and Neonatal Outcomes: A Systematic Review. *Journal of Midwifery and Reproductive Health, 8*(1), 1988-2004.

Mohamed A Awad, W. M. K., Emad Salah. (2019). Effect of Upright versus Recumbent Positions on Labour Outcomes. *Kwartalnik Fizjoterapia Polska / Quarterly: Polish Journal of Physiotherapy, 19*(3), 174.

Moraloglu, O., Kansu-Celik, H., Tasci, Y., Karakaya, B. K., Yilmaz, Y., Cakir, E., & Yakut, H. I. (2017). The influence of different maternal pushing positions on birth outcomes at the second stage of labor in nulliparous women. *The Journal of Maternal-Fetal & Neonatal Medicine, 30*(2), 245-249.

Nieuwenhuijze, M. J., Korstjens, I., de Jonge, A., de Vries, R., & Lagro-Janssen, A. (2014). On speaking terms: a Delphi study on shared decision-making in maternity care. *BMC pregnancy and childbirth, 14*(1), 223.

Organization, W. H. (1994). *The Partograph: the application of the WHO partograph in the management of labour, report of a WHO multicentre study, 1990-1991*. Retrieved from

Organization, W. H. (2018). *WHO recommendations on intrapartum care for a positive childbirth experience*: World Health Organization.

Simkin, P., Ancheta, R., & ICCE, C. D. (2011). The Labor Progress Toolkit: Part 1. Maternal Positions and Movements. *The Labor Progress Handbook: Early Interventions to Prevent and Treat Dystocia*, 277.

Storton, S. (2013). Step 4: Provides the Birthing Woman With Freedom of Movement to Walk, Move, Assume Positions of Her Choice. *Perinatal Education®, 16*(1), 25.

Turkeli, G., Öz, M., Kuscu, E., & Ugur, M. (2016). The Effects of Maternal Position on Labour and Obstetric Outcomes, A Prospective, Randomized Trial. *Turkiye Klinikleri Jinekoloji Obstetrik, 26*(1). doi:DOI: 10.5336/gynobstet.2015-45849

WHO, U. (2014). UNFPA, the World Bank, and the United Nations Population Division. Trends in Maternal Mortality: 1990 to 2013. *World Health Organization, 201456*.

Yu-Ching, L., Meei-Ling, G., Ghi-Hwei, K., & Hung-Chang, L. (2018). Efficacy of an ergonomic ankle support aid for squatting position in improving pushing skills and birth outcomes during the second stage of labor: a randomized controlled trial. *journal of nursing research, 26*(6), 376-384.

Zileni, B. D., Glover, P., Jones, M., Teoh, K.-K., Zileni, C. W., & Muller, A. (2017). Malawi women's knowledge and use of labour and birthing positions: a cross-sectional descriptive survey. *Women and Birth, 30*(1), e1-e8.

Zwelling, E. (2010). Overcoming the challenges: maternal movement and positioning to facilitate labor progress. *MCN: The American Journal of Maternal/Child Nursing, 35*(2), 72-78.