

Effects of Antenatal Exercises on Clinical Outcomes in Pregnant Females with Gestational Diabetes Mellitus: A Randomized Controlled Trial

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Abstract

Background

Gestational diabetes mellitus is the most common complication that affects the health of the child and mother during pregnancy. The study was aimed to determine the effects of Antenatal exercises on glucose levels, mode of delivery and APGAR Score in females with gestational diabetes mellitus.

Methods

This Randomized controlled trial study was conducted on 72 pregnant females at department of Gynecology and Obstetrics, Mian Munshi DHQ Hospital, Lahore. The females in 20-35 years of age, at 20-24 weeks of gestation with diagnosed GDM were included to make sure that all the data could find out easily and genuinely. Group-A received Routine Physical Therapy with Insulin therapy and Group –B- received Antenatal exercises along with Insulin therapy. Total 3 sessions per week were given to the patients for 60 mins, from 20- 24 weeks of gestation, in which 1st six session given to the patient under supervision of therapist, remaining sessions was performed by the patients at home till the time of delivery. The outcome tools were APGAR scale for neonatal outcome and HbAc1 test % was measured for Glucose level. The data was entered and analyzed using SPSS Version 24. Nonparametric Mann Whitney u test was used to determine mean difference of glucose level and APGAR Scores between groups due to abnormal distribution of data. Chi square test was applied for mode of delivery among both groups. P-value ≤ 0.05 was considered statistically significant.

Results

Majority (69.4%) of the participants in experimental group had normal delivery, while 30.6% underwent C-section (P=0.00). The APGAR Score at 5 min was 8.86 ± 1.24 (P=0.035) in Group A and 9.38 ± 1.07 in Group B (P=0.030). The HbAc1 was 6.25 ± 0.98 in group A and in Group-B was 5.43 ± 1.14 (P=0.000).

Conclusion

Antenatal care is one of the essential components for pregnancy related outcomes. The antenatal exercise can decrease the chances of cesarean section, glucose level and APGAR score can be improved with use of antenatal exercise.

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'[ClinicalTrials.gov](https://clinicaltrials.gov) Protocol Registration and Results System (PRS).'

Background

Gestational diabetes mellitus (GDM) is defined as glucose intolerance resulting in hyperglycaemia of variable severity with onset during pregnancy. During pregnancy, GDM is the most common complication and it affects the health of the child and mother both. Studies have shown the effects of GDM on perinatal outcomes and can cause long term complication for both mothers and infants. It is observed that women with a history of GDM were at higher risk for DM type II (seven folds) compared to women without GDM. [1]

The GDM often does not present any specific sign and symptoms. Fortunately, by detecting GDM during pregnancy and timely action can cut down maternal hyperglycaemia and other complications.[2]

APGAR stands for "Appearance, Pulse, Grimace, Activity, and Respiration". In the test, five parameters are used to check a baby's health at 1st and 5 min after birth. Each is scored on a scale of 0 to 2, with 2 being the highest score. The APGAR score is measure for newborns shortly after their birth. It determines whether the baby needs additional medical treatment. [3]

Antenatal exercise refers to the exercise given to an expected mother from the time of conception until labor begins. The maternal benefit includes improved cardiovascular activity, decreased weight gain, decreased musculoskeletal damage and edema, psychological wellbeing, reduction in GDM and blood pressure and less complicated labor. The fetal benefit includes reduced body mass and increased maturation in neuronal behaviors. [4]

In developed countries, according to the American diabetes association, 14% of the pregnancies were complicated due to gestational diabetes mellitus. It stood to be a potential reason for the maternal mortality rate. In Pakistan, a study concluded on the prevalence of GDM, it was observed that more than one in every 10 pregnant mothers has gestational diabetes mellitus. [5]

The ACOG recommended 150 minutes/week exercise for post-partum and non-complicated pregnancies. This can reduce the risk of spasms, edema, and shortness of breath and back pain etc.[6]

A meta-analysis was conducted to examine the effect of antenatal exercise on the delivery process of stable pregnant women with light to moderate intensity physical activity. They determined in their study that regular antenatal exercise during pregnancy appears to increase the chance of normal delivery in healthy pregnant women.[7]

In a systematic review, study aim was to determine the glucose level and its effect on gestational level .The acute antenatal exercise can decrease the blood glucose level during the pregnancy.The sub group analysis shown that acute and chronic antenatal exercise reduced maternal circulating blood glucose level, with a greater effect in women with diabetes.[8]

This study aim was to investigate the effect of antenatal exercise in pregnant females with GDM. These exercise techniques have not been applied to special population during i-e GDM. The purpose of the study is to access the changes in glucose level, neonate health and delivery mode due to antenatal exercises. It

will be helpful in facilitating normal delivery, improve fetal health and decrease glucose level, decreasing the chances of emergency caesarean section and maternal mortality rate.

Methods

Aims, study design and settings

The aim of the study was to determine the effects of Antenatal exercises on glucose levels, mode of delivery and APGAR Score in females with gestational diabetes mellitus. This Randomized controlled trial study was conducted on 72 pregnant females at department of Gynecology and Obstetrics, Mian Munshi DHQ Hospital, Lahore after Ethical approval from Institutional Review Board of the University of Lahore.

Sample size collection

Sample size calculation formula was $N = (Z_{1-\beta} + Z_{1-\alpha/2})^2 (\delta_1^2 + \delta_2^2) / (\mu_1 - \mu_2)^2$, where desired $Z_{1-\alpha/2}$ Level of significance = 95%, μ_1 Expected mean change in APGAR scale in Control Group = 8.7, μ_2 Expected mean change in APGAR scale in Experimental Group = 8.03, δ_1 Expected standard deviation in Control group = 0.5, δ_2 Expected standard deviation in Experimental group = 1.2, $Z_{1-\beta}$ power of the study = 80%. [10] Sample size in each group was 36.

Sampling technique, Inclusion and exclusion criteria

Purposive sampling technique was used. Inclusion criteria was Panel patients, Booked cases, Participant's Borg scale score 6 to 14, Age 20-35 years, 20-24 weeks of gestation, Diagnosed case of GDM, Primigravida, BMI does not exceed 40 kg/m² to ensure that all data could collect easily and genuinely. Exclusion criteria was Females diagnosed with vascular complications, Uncontrolled diabetes mellitus Autonomic dysfunction, Nephropathy or retinopathy, Twins fetus Placenta Previa, Fetal anomalies, Female choice for caesarean section, Intrauterine growth retardation, Short cervix length, Antepartum hemorrhage. These patients were allotted in two groups, Group-A and Group-B via the concealed envelope method. Written Informed consent was obtained.

Data collection procedure

All the participants visited from the gynecology department after the diagnosis of GDM was considered after the initial screening test. Inclusion and exclusion criteria was followed before adding them to the study. These patients were allotted in two groups i.e., group A and group B via the lottery method. Informed consent was taken in written form showing that they were willing to participate in the study. The therapist had assessed the patients before the start of rehabilitation program:

Group A includes participants received the routine physical therapy only. Group B includes participants were given exercise program 20- 24 weeks of gestation to till the date of delivery, with addition of the routine physical therapy plan.

Group A: Routine Physical Therapy (RPT) + Insulin therapy

Group A- (n=36) participants received only routine treatment for gestational diabetes mellitus which includes insulin therapy and diet control programs guided by a gynecologist and routine physical therapy which includes walk for 1 hr which includes proper warm up and cool down periods, three times in a week 20-24 weeks of gestation to till delivery.

Group –B-Antenatal + RPT + Insulin therapy+ Exercise

Group B- (n=36) participants completed routine therapy and antenatal exercises which includes Aerobic and strengthening Exercises with workout 3 days a week, for 2 weeks (6 sessions under the supervision of physiotherapist and remaining was performed at home along with routine treatment for gestational diabetes mellitus which includes insulin therapy and diet control program as guided by gynecologist. The exercise program was started with quarter-hour moderate-intensity aerobic activity and slowly rising the duration to a maximum of half-hour each exercise session. A 10–15-minute warm-up physical exercise, and a 10–15-minute cool-down period was included. The duration of the exercise was assessed the Borg scale (rate of perceived exertion) .American College of Obstetricians and Gynecologists Guideline corresponded to exercise of moderate-intensity were followed. Aerobic exercise includes a brisk walk to train the main muscle groups which includes, chest muscles, deltoid, quadriceps, and calf muscles were targeted the main muscle groups. In sitting position, strengthening exercise were performed in which one end of the Thera band (Elastic band) was placed under the foot, hold for 5 seconds then released along with 10 repetitions. The movements were involvement of wall push-ups, shoulder flexion, shoulder abduction, knee extension and ankle plantar flexion. It was guided that pregnant women avoid exercise promptly if they experience any signs such as dizziness, dyspnea, amniotic fluid leaking or vaginal bleeding. Besides, group participant was wear loose-fitting clothing and keep hydrated while exercising in an environment with adequate temperature and moisture. All sessions of the exercise under supervision were fully documented on successful completion.

Confidentiality of all the details was ensured. A blind study (to remove chance of bias), in which random allocation of women between two categories, via the concealed envelope was executed.

Follow Ups

Total 3 sessions per week were given to the patients for 60 min., from 20- 24 weeks of gestation to till the time of delivery. Home plan was given to the participants and follow up was done whenever participants came to gynecology department.

Assessment readings were taken at baseline and after the treatment at the time of delivery. All exercise sessions were conducted by the same physiotherapist. The exercise program parameters were in concordance with the FITT principle. (Frequency, Intensity, Time, and Type) ⁽⁸³⁾

Outcome variables:

1. Glucose level

2. Mode of delivery

3. APGAR Score

Data analysis

The data was entered and analyzed using SPSS Version 24. Categorical Data like the type of delivery was presented in the form of in frequency (Percentage) tables. All numerical data was expressed as mean±standard deviation (SD).After checking normality of data, non-parametric Mann Whitney u test was used to determine mean difference of glucose level and APGAR Scores between group A and B. P-value ≤ 0.05 was considered statistically significant.

Results

There were 72 participants, 36 in each group. Mean APGAR score at 1st min was improved (6.94 ± 1.94) in Group-B as compared to Group-A (7.88 ± 1.75). Mean APGAR score at 5 min was reduced in Group-A (8.86 ± 1.24) as compared to Group-B (9.38 ± 1.07). Similarly HbAc1 level was good in experimental (5.43 ± 1.14) as compared to other (6.25 ± 0.98) (table no 1).

In Group-A there were 15 normal vaginal deliveries (41.7%), while in experimental Group-B there were 25 (69.4%) normal deliveries. In group B C-sections (30.6%) were significantly lower than in group A (58.3%). Results showed antenatal exercise increases the chances of vaginal delivery. There was considerably higher association, between normal vaginal delivery and experimental group. P –value had shown significant results in experimental group with P =0.03 (Table 2)

There is a significantly higher association for normal vaginal delivery in experimental group as compared to other group. P –value had shown significant results in experimental group with P .000 (Table 3)

Mann Whitney test was use due to abnormal distribution of data. APGAR score at 1st min in Group-A and Group-B has significant difference (P=0.03). APGAR Score at 5 min, had also considerable difference in Group A and B (P 0.03). Regarding HbAc1 test, result indicated significant lower glucose level in the experimental group (P=0.00) .(Table 4)

Discussion

The results of present study were in support that physical exercise plan during pregnancy. In current study one group had received routine intervention, resulting normal vaginal deliveries were 15 after the exercise sessions, while in experimental group 25 out of 36 participants were able to deliver their babies normally after the antenatal exercise plan given from 20-24 week of gestation till the time of delivery. These results also showed that exercise had reduced the risk of C-section.

A study concluded that improvement in spontaneous vaginal delivery and APGAR score at 5 minutes was highest in the exercise group. Water based antenatal exercise helped in weight reduction, facilitate natural birth rate without instrumental support. Improved was also observed on APGAR scores. [9]

Awad E et al (2019) performed a controlled trial in which 60 pregnant females with GDM were included. It was concluded that antenatal exercises can be considered effective in decreasing labor complications and shifting the mode of delivery towards normal, complication-free delivery in females with GDM and ensure the well-being of their offspring. The result of the study was in our support. [10]

Gehan et al checked the efficacy of antenatal exercises on the mode of delivery and APGAR score in primigravida. They concluded that there was no relation between antenatal exercises and mode of delivery in primigravida. APGAR score was higher in exercise Group-As compared to other group. [11]

The results stated that exercise had beneficial effects on decreasing the blood glucose level and on delivery method. Control group was given sports activities and experimental was given antenatal exercise (30 min/day) till the delivery. There was significant decrease in glucose level and rate of C-section was also decreased after 1 month sessions. [12]

A contrast was found in a systemic review performed by Emily Bian in which result stated that there was no significant difference in exercise group as compared to non-exercise group regarding GDM risk factors and cesarean section. Both groups have no difference in results. [13]

A research was performed on GDM showed that structured exercise improve the liver and renal functions and help to improve glucose level in the body. [14]

The results of current research in which APGAR Score at 1 min and 5 min recorded, p-value had shown significant difference in Group-A and B. The studies of Kokic et al in 2018, in women with gestational diabetes where the one group received antenatal care and regular exercises with 30 mins of brisk walk, but other group was given only antenatal care. All participants followed exercise plan for 2 times/week lasting about an hour. Pregnancy was ended with lower level of glucose in experimental Group-But difference of APGAR scores was not reported. [15]

In contrast to Murtezani found that exercise had not improved outcomes significantly in exercise group compared to the control group. The results were in contrast to our study regarding other outcomes except than that of APGAR score 1 min and 5 min showing significant effects between the groups. [16]

The contrast was found in a systematic review by Gema Sanabria-Martinez on labor outcomes based on exercises as intervention to improve birth outcomes. After combination of flexibility, strength and aerobic exercises, APGAR score at 1 min was less. There was no difference seen APGAR score 5 min between groups. [17]

Another study was performed on pregnant GDM females to check the effect of physical therapy on various clinical outcomes. It was concluded that moderate intensity of about 20 minutes per day plus low caloric diet decreases the complications related to GDM during pregnancy. [18] This study support the antenatal exercise plan for pregnant females to decreases complications.

This study was limited to single setting, the study has not evaluated effects of Obesity and other risk factors, smaller sample size, and age group cannot be generalized in elder population.

Conclusion

Exercise can be a new way to promote normal delivery and decrease fetal health complications. The study concluded that antenatal care is one of the essential components for pregnancy related outcomes. The routine care and combination of exercise are effective in decreasing risk of C- section, decreasing glucose level and improvement of APGAR score, but the additive effects of exercise were more effective for pregnant women with Gestational Diabetes Mellitus by reducing complication due to GDM.

This study will be helpful in facilitating normal delivery, improve fetal health and glucose level, decreasing the chances of emergency caesarean section, maternal mortality rate. This study will guide the clinical practitioner and pregnant females about importance of antenatal exercises.

List Of Abbreviations

Abbreviations	Full form
APGAR	Appearance, Pulse, Grimace, Activity and Respiration
ACOBG	American College of Obstetrics and Gynecology
GDM	Gestational diabetes mellitus
C-section	Cesarean section
DHQ	District head quarter
NVD	Normal Vaginal Delivery
BMI	Body Mass Index
RPT	Routine Physical therapy

Declarations

Ethics approval and consent to participate

Ethical approval was taken from Institutional Review board committee of the University of Lahore with a valid reference number (IRB-UOL-FAHS/600-1/2020). It is confirm that all research was performed in accordance with relevant guidelines /regulations and include in their manuscript. It was performed in accordance with the Declaration of Helsinki. Informed consent was taken in written form showing that participants were willing to participate in the study.

Consent for publication

Not Applicable.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available because all the data generated is not completely used in this research article. Only some datasheets and files are used. but data are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interest.

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Authors' contributions

All authors reviewed and approved the manuscript.

AS: Conception and design of research, Collection and assembly of data, literature writing, Drafting of the article, responsible and accountable for the accuracy.

FT: Proof reading of article and literature search and editing of study.

AA: Critical revision of the article for important intellectual content.

AG: Idea for questionnaire design

AH: Analysis and interpretation of the data and Statistical expertise.

RK: Data collection.

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Tables

Table-1: APGAR scores and HbAc1 between groups

Group	APGAR Score 1 min		APGAR Score 5 min		HbAc1 test %	
	Mean	Std.	Mean	Std.	Mean	Std.
Group-A	6.94	1.94	8.86	1.24	6.25	.98
Group-B	7.88	1.753	9.38	1.07	5.43	1.14

Table-2: Frequency of Modes of Delivery

Method of Delivery	Group-A	Group-B	% age
NVD	15	25	55.6%
C-Section	21	11	44.4%
Total	36	36	100%

Table-3: Chi Square Test Statistics for mode of delivery Assessment

Chi-Square Tests					
Tests	Value	Df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.625 ^a	1	.018		
Continuity Correction ^b	4.556	1	.033		
Likelihood Ratio	5.705	1	.017		
Fisher's Exact Test				.032	.016
Linear-by-Linear Association	5.547	1	.190		
N of Valid Cases	72				

Table-4: Mann-Whitney u Test Comparison of APGAR scores between groups.

Outcomes	Group	N	Mean Rank	Sum of Ranks	P-Value
APGAR.1min	Group-A	36	31.38	1129.50	.035
	Group-B	36	41.63	1498.50	
APGAR.5min	Group-A	36	31.63	1138.50	.030
	Group-B	36	41.38	1489.50	
HbAc1 test %	Group-A	36	44.81	1613.00	.00
	Group-B	36	28.19	1015.00	

Group-A (RPT+ Insulin Therapy)

Group-B (RPT+ Antenatal exercises+ Insulin therapy)

Figures

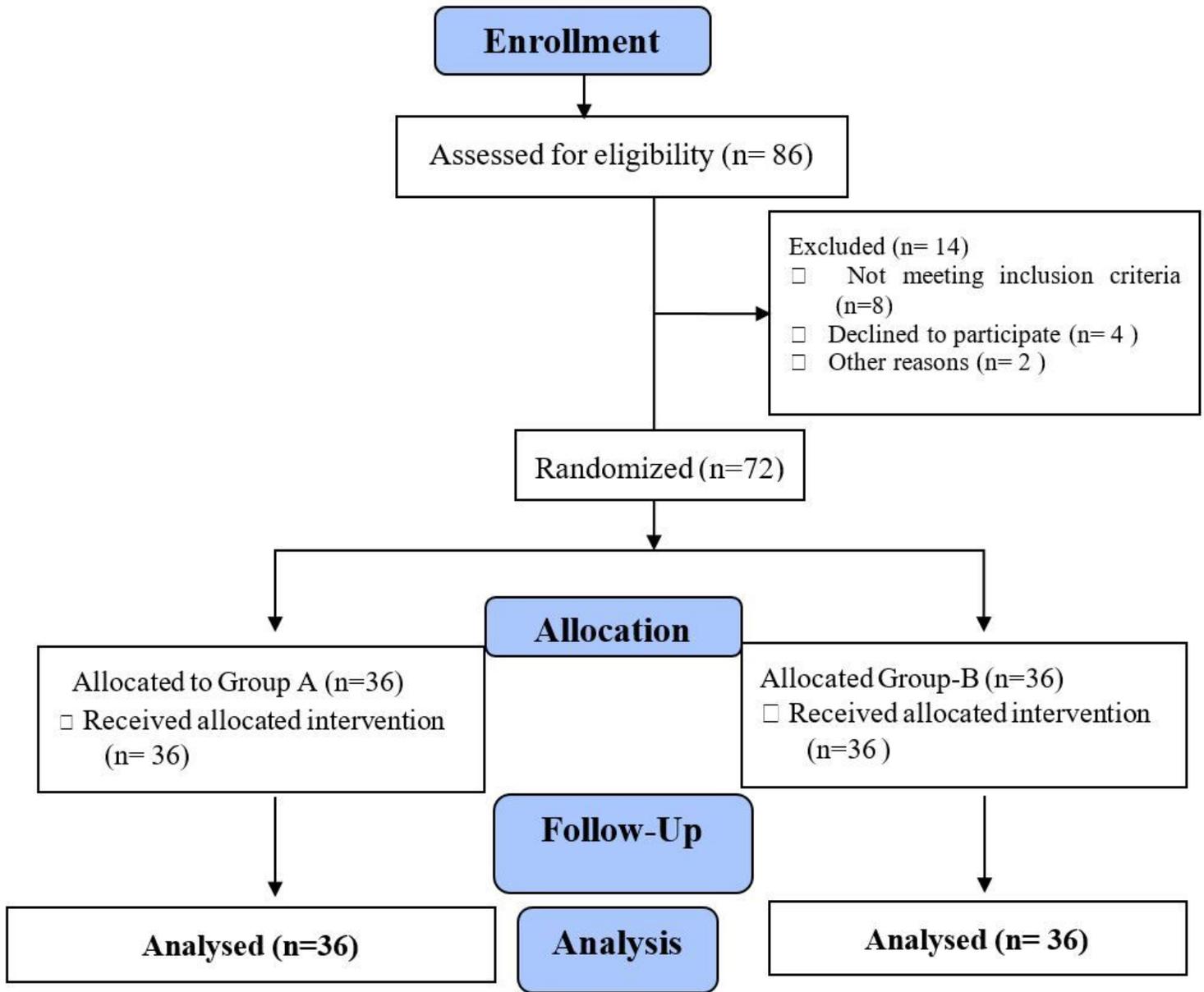


Figure 1

CONSORT Flow Diagram