

# Effect of Diabetes Education Program on Gestational Diabetes Mellitus Knowledge Among Diabetic Pregnant Women: An Experimental Study

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## Research

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# Abstract

**Background:** Gestational diabetes mellitus (GDM) is a disease condition present during pregnancy and if not properly managed would have severe effect on the maternal and neonatal health. This research determined the effect of diabetes education program (DEP) on gestational diabetes mellitus knowledge (GDMK) among diabetic pregnant women (DPW) and significant differences within groups.

**Methods:** This study was based on a pretest – posttest measures of experimental research design involving experimental (n=110) and control (n=110) groups. A total of 220 DPW were purposively recruited from public hospitals in Nigeria between October and December 2019. The DEP was delivered to DPW in experimental group. The Gestational Diabetes Mellitus Knowledge Questionnaire (GDMKQ) of 0.774 was used for data collection. The statistical analysis was completed using IBM SPSS version 22.

**Results:** The results revealed that no statistically significant difference existed on GDM history ( $P=0.801>0.05$ ), smoking habit ( $P=0.0615>0.05$ ), parity status ( $P=0.503>0.05$ ), and level of education ( $P=0.720>0.05$ ), while difference was observed on alcohol status ( $P=0.011<0.05$ ), and age by birth ( $P=0.009<0.05$ ). Also, while no significant difference existed between the DPW in the treatment and control groups on GDMK pretest measures ( $P=0.901>0.05$ ), difference existed between the DPW in the intervention and control groups on GDMK posttest scores ( $P=0.026<0.05$ ). Also, the higher percentage score (78%) of DPW in the experimental group in the posttest GDMK measures which is higher than the score in the pretest measures (55%) of the same group were indications that DEP has significant effect on GDMK among DPW.

**Conclusion:** This demonstrates that reliable interventions are effective in combating pregnancy-related complications. This requires collaborative efforts by concerned bodies to combat notable complications during pregnancy using reliable intervention.

**Trial Registration:** In retrospect, the Pan African Clinical Trial Registry documented the study with registration trial code (Trial No.: PACTR201903003187005)

## Background

Gestational diabetes mellitus (GDM) is a disease condition present during pregnancy [1–4]. The impact of GDM is felt worldwide, and it has remained one of the greatest concerns of the global healthcare system. For instance, in United Kingdom, the prevalence of GDM was 5 per cent [2], and 4–14 per cent in United State of America [1]. In Southeast Asian regions, the prevalence rate was 18.3 per cent [5, 6], while in Nigeria, 2.98 per a thousand pregnancies was reported [7] and thus, positioning GDM as a worldwide issue in recent time. Contextually, GDM is the degree of intolerance of carbohydrate recognized during first time pregnancy [3]. This disease condition has adverse effects on maternal and neonatal health [1, 4]. Available researches confirmed GDM history, age of mother by birth, alcohol status, smoking habit, educational level, occupation and parity status as major correlates of GDM [8, 9].

Evidence of poor knowledge regarding GDM by pregnant women abounds. For instance, a comparative study of 143 women with diagnosed GDM revealed poor knowledge about GDM [10]. Also, a study of selected women receiving antenatal services in a primary health centre reported that 25.8% of the women had inadequate knowledge of GDM [11]. An age longed study involving 243 participants who received care from the traditional diabetic clinic reported poor knowledge about diabetes mellitus, its management and adverse complications [12]. These reports are indications that only few pregnant women possess adequate knowledge about GDM. The obvious implications are evidenced in increased records of poor maternal and neonatal health (1–9).

The prevailing reports on increased cases of GDM and established poor knowledge regarding GDM by the pregnant women call for a reliable educational intervention. This research therefore, validated diabetes education program -DEP and further established its effect on gestational diabetes mellitus knowledge (GDMK) in a sample of Nigerian diabetic pregnant women (DPW). Specifically, the DEP is designed to improve the quality of GDM knowledge and enhance both maternal and neonatal health. The program is a health education construct based on constructive principles and philosophies, meant to improve GDM knowledge. It is assumed that the DPW are eager to learn and understand the aetiology of GDM, be equipped with the relevant skills to cope effectively with the disease in their pregnancy condition. Similar programs have been successfully validated and confirmed to be significantly effective by various scholars [13–16].

Adequate knowledge of GDM will translate into increased prevention, management and early diagnosis as well as allowing the patients to cope effectively with the disease [17–19]. Also, encouragements and supports from professionals are tools that inspired the patients to comply with diet, exercise, and blood glucose monitoring [20]. From the extensive literature reviewed and also to the researchers' best of knowledge, this study is the first DEP on GDMK to be conducted in Nigeria among DPW. This research therefore determined the effect of diabetes education program on gestational diabetes mellitus knowledge among diabetic pregnant women and significant differences within groups.

## **Methods**

### **Research Design**

This study was based on a pre-test – post test measures of experimental research design involving experimental and control groups.

### **Participants And Recruitment Procedures**

A total of 220 DPW were purposively sampled from recognized public hospitals in Nigeria between October and December 2019. These participants were selected from 1142 proposed sample size who were dully subjected to assessment for eligibility (see Fig. 1 for details of schematic procedure). The study was delimited to public hospitals in order to eliminate any form of bias regarding recruitment and

eligibility. All the sampled healthcare facilities received official notification and informed and written consent obtained with remarkable emphasis on the need to conduct the research. This procedure paved ways to the researchers for easy validation of the status and eligibility of the prospective DPW. Both inclusion and exclusion criteria were stipulated by the investigators and served as guide in the recruitment of the study participants. For the inclusion criteria: 1) the participant must be pregnant and within the age of 18 years and above, 2) she must have been diagnosed with GDM [9], 3) she must be willing to participate in the study from the beginning till end, 4) she must wilfully complete the informed consent form without any pressure. Those who were unable to meet these stipulated inclusion criteria were excluded from the study. The randomization of the eligible DPW into either experimental (N = 110) or control (N = 110) groups was done by the researchers based on expert suggestions [21]. Only the DPW in the experimental group received the DEP manual with two hours duration per group session, ones in a week for the period of 8weeks. This was completed successfully without obstructions or interruptions. Although, all the DPW in both intervention and non-treatment control groups fully participated in the pretest - posttest exercises. This facilitated the establishment of the effect of DEP on gestational diabetes mellitus knowledge. The DEP manual was compiled in English language for easy understanding. In a unanimous agreement and understanding of both the researchers and the participants, hospital facilities were chosen as the venue for implementation of the educational intervention. There was absolute carefulness of independent administration of both pretest and posttest assessments by the researchers at various time interval on the DPW in both groups. The essence was to control and eliminate allocation bias. Furthermore, the researchers blinded all the responses generated from the DPW until the completion of the whole statistical procedures. The completed outcome measures from both groups were returned at different times/ periods of pretest and post test.

## Questionnaire Instrument

The Gestational Diabetes Mellitus Knowledge Questionnaire – GDMKQ was used for data collection [22]. The validity of GDMKQ was established by team of experts including physicians, pharmacists, students and patients with very high internal consistency of Crobach's alpha 0.774 [9]. The GDMKQ consisted of fifteen items that explored questions regarding the basic knowledge of GDM, the notable risk factors, diet/food values, treatment options and management, as well as obvious complications. Out of 4 options in each question, one is correct with 1 point while the wrong answers have zero score. Scoring range for GDMKQ was minimum 0 to maximum 15 [9]. Therefore, any score below 60% was considered inadequate knowledge while score above 60% depicts adequate knowledge of GDM. In this study, the total knowledge score of GDM was obtained by summing up all the individual knowledge scores. The variables of interest were GDM history, age by birth, alcohol history, smoking habit, parity status, and level of education.

## Statistical Analysis

The statistical analysis was completed using IBM SPSS version 22 [23]. In this study, all the key statistical assumptions were met and no data was found missing. All the eligible DPW successfully

participated in the pretest and posttest exercises. Frequency, percentage, and ANCOVA statistics were employed in affirming the significant effect of DEP on GDMK among DPW. The results of this research were deemed statistically significant at  $P = 0.05$ .

## Ethics Approval

The study approval was granted by the Research and Ethics Committee of the Department of Human Kinetics and Health Education, Faculty of Education, University of Nigeria, Nsukka (REC/HKHE/19/00145). In retrospect, the Pan African Clinical Trial Registry documented the study with registration trial code (Trial No.: PACTR201903003187005).]

## Results

Table 1: Personal Profiles of the DPW (N = 220).

Parameter	Variables	Trt. Grp N(%)	Contrl. Grp N(%)	Stat.	Sig.
GDM history	GDM in previous pregnancies	83 (75%)	74 (67%)	1.090	0.801
	No GDM in previous pregnancies	27 (25%)	36 (33%)		
Alcohol Status	Non alcoholic	51 (46%)	62 (56%)	2.013	0.011
	Alcoholic	59 (54%)	48 (44%)		
Age by birth	18-25 years	49 (45%)	53 (48%)	0.004	0.009
	26-49 years	61 (55%)	57 (52%)		
Smoking Habit	Smoker	31 (28%)	28 (25%)	1.803	0.615
	Non smoker	79 (72%)	82 (75%)		
Parity status	0-3 children	88 (80%)	78 (71%)	1.490	0.503
	4 children and above	22 (20%)	32 (29%)		
Level of Edu.	Secondary Education	53 (48%)	64 (58%)	0.202	0.720
	Tertiary Education	57 (52%)	46 (42%)		

*Keys: N = sample size, %=percentage, () = bracket sign, Sig.=significance, stat. = statistics, GDM = gestational diabetes mellitus, Edu.= education, Trt.=treatment, Contrl.= Control, DPW = diabetic pregnant women, Grp. =group.*

A total of 220 DPW met the stipulated criteria and also participated in the study. There was 100% compliance to the educational intervention. There were 83(75%) DPW with GDM in previous pregnancies and 27(25%) DPW with no GDM in previous pregnancies in the treatment group; and 74 (67%) DPW with GDM in previous pregnancies and 36(33%) of them with no GDM in previous pregnancies in the control group, with no existing statistically significant difference ( $0.05 < 0.801$ ). A total of 51 (46%) DPW were non alcoholic and 59(54%) of them were alcoholic in the treatment group; and 62 (54%) DPW were non alcoholic and 48(44%) of them were alcoholic in the control group, with existing significant difference ( $0.05 > 0.011$ ). There were 49(45%) DPW between 18–25 years and 61 (55%) of them between 26–49 years in the treatment group; and 53(48%) DPW between 18–25 years and 57(52%) of them between 26–49 years in the control group, with existing statistically significant difference ( $0.05 > 0.009$ ). A total of 31 (28%) DPW were smokers and 79(72%) of them were non smokers in the treatment group; and 28 (25%) DPW were smokers and 82(75%) of them were non smokers in the control group, with no existing

significant difference ( $0.05 > 0.615$ ). There were 88(80%) DPW with 0–3 children and 22(20%) of them with 4 children and above in the experimental group; and 78(71%) DPW with 0–3 children and 32(29%) of them with 4 children and above in the control group, with existing statistically significant difference ( $0.05 > 0.503$ ). A total of 53 (48%) DPW had secondary education and 57(52%) of them had tertiary education in the treatment group; and 64(58%) DPW had secondary education and 46(42%) of them had tertiary education in the control group, with no existing significant difference ( $0.05 > 0.720$ ). This study did not report any form of risk or hazard (see Table 1 for details).

Table 2: Presenting Results of the Effect of DEP on GDMK among DPW (N = 220)

Instrument	Periods	Groups	Sample size	Percentage	P-Value	Remark
GDMK	Pretest	Experimental	110	55%	0.901	**
		Control	110	63%		
GDMK	Posttest	Experimental	110	78%	0.026	*
		Control	110	56%		

*GDMK = gestational diabetes mellitus knowledge, %= percentage, N = Sample Size, \*\* = no significant difference, \* = significant difference, DEP = diabetes education program.*

Data in Table 2 showed that statistically significant difference did not exist between the DPW in the treatment (55%) and control (63%) groups on GDMK pretest measures,  $P = 0.901 > 0.05$ . The Table further revealed that statistically significant difference existed between the DPW in the intervention (78%) and control (56%) groups on GDMK posttest scores,  $P = 0.026 < 0.05$ . Also, the Table indicated that the DPW in experimental group attained a higher percentage score (78%) in the posttest GDMK measures than the scores recorded in the pretest measures (55%) of the same group. Also, the post test percentage GDMK score of the DPW in experimental group (78%) was higher than the posttest percentage GDMK scores of the DPW in the non treatment group (56%). This implied that the DEP has significant effect on GDMK of the DPW (see Table 2 for details).

## Discussion

This experimental-based research established the effect of diabetes education program on gestational diabetes mellitus knowledge among diabetic pregnant women. The outcomes of the research are quite encouraging and reflect notable implications to health, research, education and policy. It shows that the health knowledge regarding complications can be improved through educational intervention. Secondly, the gap between existing literature and the present study has been covered. Finally, the educational interventions are dependable tools that can significantly impact on the health policies. This study reveals significant effect of DEP on GDMK among DPW during pregnancy. The DEP has significant effect on the quality of GDMK among DPW in the experimental group than their counterparts in the control group in the posttest measures. Also, the treatment given was found to be more effective on GDMK when percentage scores of pretest and posttest measures of the DPW in the experimental group are compared. The

changes in the pretest and posttest scores are attributed to the intervention received by DPW in the experimental group. This study therefore, affirms that DEP is an effective health promoting mechanism with significant impact in improving the quality of knowledge regarding health complications among the most vulnerable groups in the population. It equally suggests that successful implementation of DEP can be instrumental in combating other pregnancy-related complications such as malaria, anaemia, and hypertension. Available research indicated that the management of GDM largely depends on DPW's thoughts, perception, knowledge and understanding of the disease [9].

From the literature reviewed, similar programs were found to be significantly effective in accomplishing various research goals. For instance, a randomized controlled trial of a culturally tailored diabetes education and management program led by a community health worker, reported significant effect of Community Diabetes Education (CoDE) for uninsured Mexican Americans [13]. An international perspective study involving pre- and post-test educational intervention program of 215 patients reported a high mean score of knowledge increase from  $60.6 \pm 20.65$  to  $78.1 \pm 13.4$  after a diabetes education program for people with type 2 diabetes [14]. Also, a community-based quasi-experimental study involving 103 participants reported significant effect of diabetes education program on physical exercise among participants with type 2 diabetes [15]. Also, Arash et al. [24] reported the effectiveness of educational intervention based on psychological factors on achieving health outcomes in patients with type 2 diabetes. Patricia et al. [16] reported that Diabetes Self-Management Education and Medical Nutrition Therapy have significant effect on Registered Dietician Nutritionist Interventions in the Management of Glycemic Control and Diabetic Dyslipidemia.

The outcome of our study has availed quality data to the existing literature on educational intervention studies. However, poor management of GDM can result in many harmful effects on the DPW and the foetus. Available literature reported some notable severe outcomes of poor management and uncontrolled GDM on maternal and neonatal health [1, 4]. Specifically, Ferrara et al. [1] summarized the adverse GDM outcomes on maternal health to include miscarriages, caesarean section, increase in weight, and increased risk of type 2 diabetes mellitus in future. The neonatal severe outcomes include macrosomia, neonatal hypoglycaemia, respiratory disorders, elevated number of red blood cells, lower levels of calcium in neonate, jaundice, still birth, and even neonatal death [4]. These unwholesome conditions draw the attention of experts and professionals (i.e. gynecologists, obstetrician, counsellors, educators, physicians and psychologists) in sourcing for reliable approaches to remedy the situation. The researchers therefore, recommend the adoption of the outcome of this research by concerned individuals, bodies and organizations in rendering dignified care and services to DPW. In addition, it is hoped that this finding would aid the development of a functional diabetes knowledge-based intervention system necessary in helping DPW to maintain optimum wellbeing during pregnancy and after delivery.

Although, the strength of this experimental study lies in its methodology and design, yet, there are notable limitations. Firstly, data collection process relied primarily on GDMK questionnaire. There is need to adopt other methods of data collection such as qualitative approach including interview, and focus group discussion. These approaches would avail the participants the ample opportunity to express their views

and experiences regarding the study phenomenon. Also, further studies are needed to follow-up the post intervention effects using the same study population. This is important because the present study is restricted to pretest and post test measures only. Also, this study investigated only the DPW who were recruited from hospital facilities. There is need to conduct further studies to explore the effect of DEP on GDMK among DPW at community level.

## Conclusion

The DEP has significant effect on the GDMK among diabetic pregnant women. This signifies that valid educational interventions are veritable tools in combating and curtailing common health complications prevailing as threat to maternal and neonatal health during pregnancy. Also, the study can serve as a positive step towards designing gestational diabetes mellitus programme for public enlightenment and knowledge empowerment. There is need for collaborative efforts by individuals, organizations and Nigerian government to tackle preventable and manageable complications that act as threat to pregnancy condition using educational intervention. This is necessary since poor knowledge of health complications during pregnancy can have detrimental and adverse effects on the mother and unborn child.

## Abbreviations

GDM

Gestational Diabetes Mellitus

GDMK

Gestational Diabetes Mellitus Knowledge

DPW

Diabetic Pregnant Women

DEP

Diabetes Education Program

## Declarations

**Acknowledgement:** Not applicable

**Funding:** No source of funding

**Availability of data and material:** The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Authors' contribution:** UCU conceived the work and reviewed relevant literature. All the authors acquired, analysed and interpreted the data. OCE drafted the work and revised it critically for important intellectual content. All authors approved the version to be published and equally agreed to be accountable for all parts of the work.

**Ethics approval:** The study approval was granted by the Research and Ethics Committee of the Department of Human Kinetics and Health Education, Faculty of Education, University of Nigeria, Nsukka (REC/HKHE/19/00145). In retrospect, the Pan African Clinical Trial Registry documented the study with registration trial code (Trial No.: PACTR201903003187005).

**Consent to participate:** The diabetic pregnant women who participated in the study gave informed consent in written before the commencement of the intervention programme.

**Consent for publication:** There is no any individual person's data in any form as contained in the manuscript.

**Competing Interests Statement:** None to declare.

**Code availability:** Not applicable

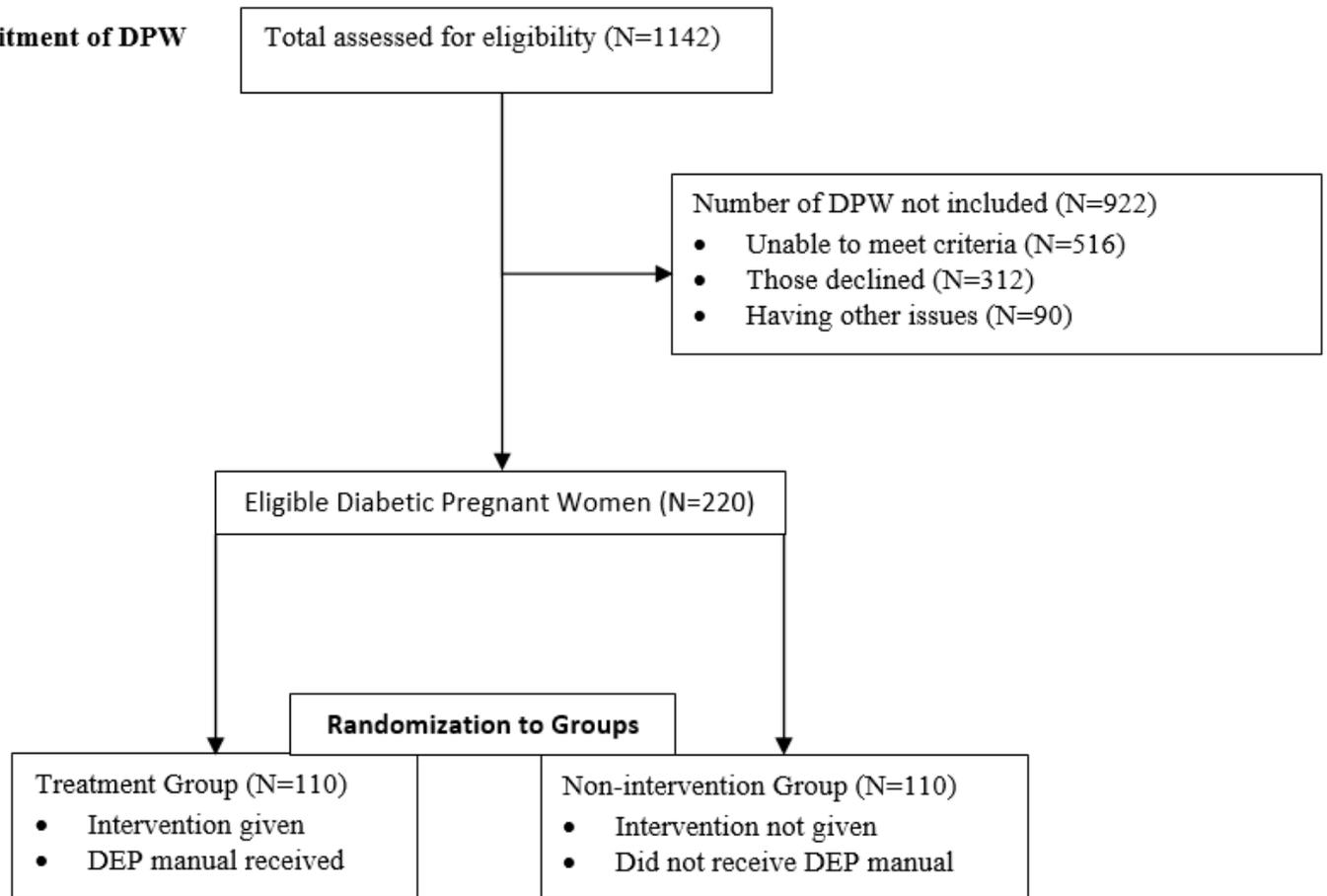
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## Figures

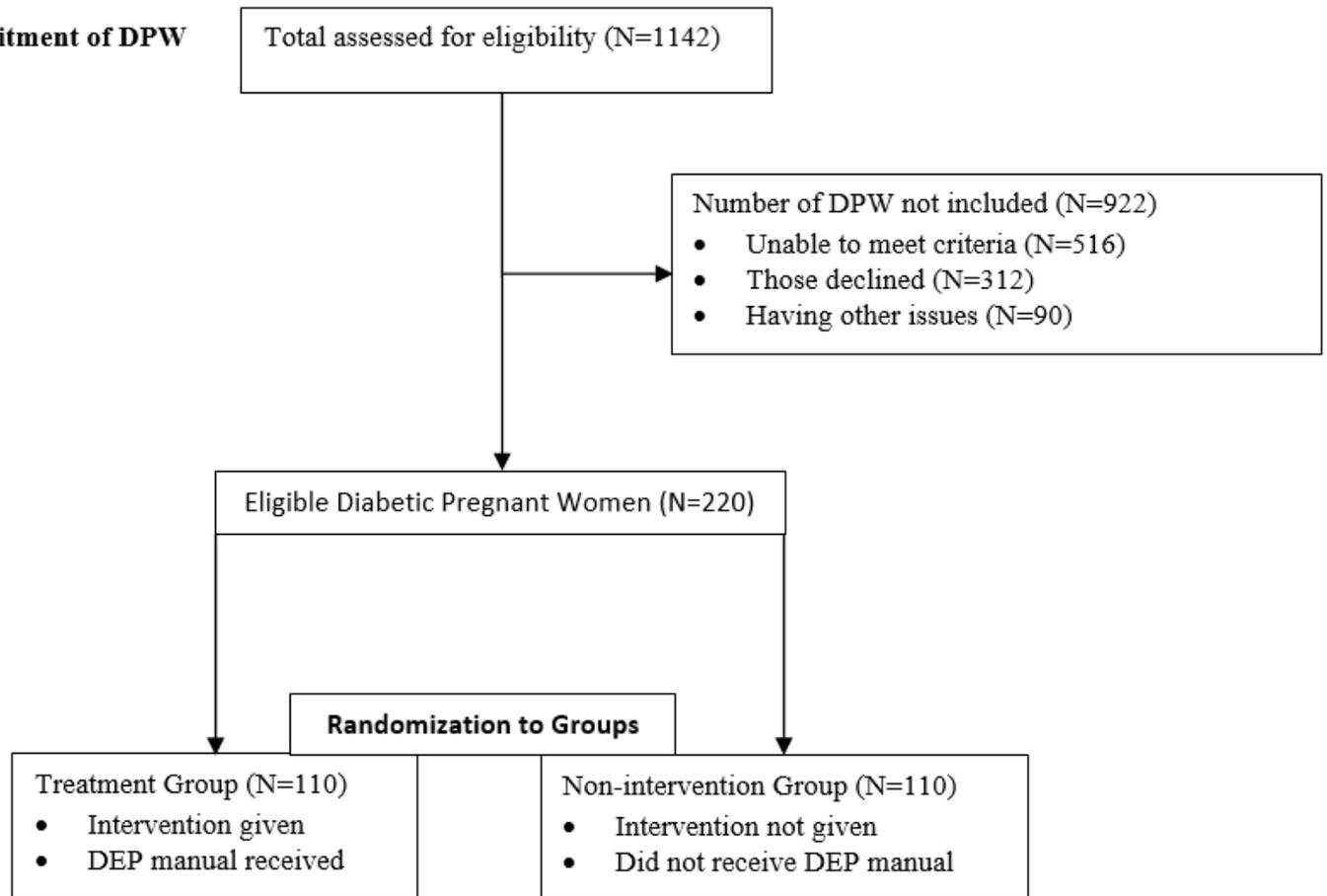
**Recruitment of DPW**



**Figure 1**

Schema representing participants' recruitment procedure (source: authors)

**Recruitment of DPW**



**Figure 1**

Schema representing participants' recruitment procedure (source: authors)