Short Communication

Impact of Structured Antenatal Education and Physical Activity Classes on Health-Related Quality of Life during Pregnancy: A Quasi-Experimental Study

Vian Najim Edeen Abdullah [1,*], Fattah Hama Rahim Fattah [1], Huda Muhaddein Muhammad [2]

[1] Department of Community Medicine, [2] Department of Obestetric and Gyenecology, College of Medicine, University of Sulaimani, Sulaymaniyah 460001 Kurdistan, Iraq.

[*] Corresponding author: Najimedeen.vian@gmail.com

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Abstract

Background Pregnancy affects multiple dimensions of women's well-being. **Objectives:** This study aimed to assess the impact of structured antenatal education and physical activity classes on health-related quality of life (HRQoL) among pregnant women in Sulaimani City, Kurdistan Region-Iraq. **Materials and Methods:** A quasi-experimental study was conducted at Qaiwan Primary Health Care Center from April 4, 2023, to August 22, 2024. A total of 292 pregnant women at 18–20 weeks' gestation were divided into three groups: Control (n=146) receiving routine antenatal care, Intervention 1 (n=80) receiving routine care and an educational brochure, and Intervention 2 (n=66) receiving routine care, brochure, and five structured antenatal education classes. HRQoL was measured using the SF-36 questionnaire at baseline and 36–37 weeks' gestation. **Results:** After intervention, Intervention 2 showed statistically significant improvements across multiple HRQoL domains compared to Control and Intervention 1. The physical domain improved from 71.5±16.5 to 72.7±16.1 ($p<0.001$), role-physical from 36.9±33.7 to 57.3±17.0 ($p<0.001$), role-emotional from 39.0±39.3 to 51.3±35.4 ($p<0.001$), and mental health from 61.2±10.3 to 61.3±8.9 ($p<0.001$). Mean difference comparisons showed significant benefits in Intervention 2 for physical (+1.15), role physical (+20.38), and role emotional (+12.31) domains. In contrast, Control and Intervention 1 groups showed significant declines. **Conclusion:** Structured antenatal education significantly enhances the physical, emotional, and functional well-being of pregnant women. Integrating comprehensive antenatal classes into routine care is essential to improve maternal HRQoL.

Keyword: Antenatal Care, Exercise, Health Education, Prenatal Care

Introduction

Pregnancy is a transformative period in a woman's life, marked not only by significant anatomical and physiological adaptations but also by complex emotional and psychological transitions. While pregnancy is biologically normal and often a source of personal and familial joy, it can also be a time of heightened vulnerability, resulting from the cumulative effect of physical discomforts, hormonal shifts, emotional fluctuations, and evolving social roles [1]. While pregnancy is biologically normal and often a source of personal and familial joy, it can also be a time of heightened vulnerability, resulting from the cumulative effect of physical discomforts, hormonal shifts, emotional fluctuations, and evolving social roles [2]. These changes influence maternal well-being in significant ways, and when inadequately addressed, they can negatively affect a woman's health-related quality of life (HRQoL), a multifaceted construct encompassing physical, emotional,

psychological, and social domains of health [3]. Even in low-risk pregnancies, expectant mothers may report feelings of fatigue, anxiety, low self-efficacy, and diminished social engagement, all of which contribute to a noticeable decline in perceived QoL as pregnancy progresses [4]. Globally, efforts to reduce maternal morbidity have traditionally centered on clinical outcomes, with less attention given to non-clinical indicators such as QoL, autonomy, and emotional resilience. This oversight is especially pronounced in low- and middle-income countries (LMICs), where maternal healthcare systems often prioritize survival over well-being [5]. Yet, as pregnancy extends beyond a mere clinical event and into the realm of holistic health, tools like QoL assessments provide a crucial window into the lived experiences of expectant mothers and their preparedness for childbirth [6]. To integrate well-being into maternal care effectively, structured interventions such as antenatal education and supervised physical activity are essential. These interventions have demonstrated potential in enhancing maternal self-efficacy, lowering anxiety levels, improving emotional regulation, and promoting healthier pregnancy outcomes [7, 8]. Despite robust evidence from high-income countries supporting the role of antenatal education and exercise in improving maternal health, few studies have conducted structured, comparative analyses of these interventions in LMICs, particularly in Iraq's unique sociocultural and healthcare context. Therefore, the main aim of this study was to assess the impact of structured antenatal education and physical activity classes on the health-related QoL of pregnant women in Sulaimani City.

Materials and Methods

Study design and setting

A quasi-experimental study was conducted from April 4, 2023, to August 22, 2024, at Qaiwan Primary Health Care (PHC) center in Sulaimani City, Kurdistan Region-Iraq. The study employed a three-group design comparing a control group receiving standard antenatal care (ANC) with two intervention groups.

Participants

Pregnant women attending Qaiwan PHC center were recruited through convenience sampling. Participants were divided into three groups: control group (n=146), intervention group 1 receiving brochure plus standard care (n=80), and intervention group 2 receiving brochure, structured classes, and standard care (n=66).

Inclusion criteria comprised all pregnant women with gestational age of 18-20 weeks attending the maternity department who wished to participate in the study.

Exclusion criteria included high-risk pregnancies with preexisting health conditions (hypertension, diabetes, depression, epilepsy, hepatitis, obesity, cancer, autoimmune diseases, infections), pregnancy-related complications (gestational diabetes, pregnancy-induced hypertension, preeclampsia, miscarriage, placenta previa, anemia, vaginal bleeding, amniotic fluid complications, fetal anomalies), lifestyle factors (smoking, drug addiction, alcohol abuse, toxin exposure), age extremes (under 18 or over 35 years), twin or multiple pregnancies, and illiteracy.

Sample Size: Sample size was calculated using the formula $n = (r + 1) * (Z\alpha + Z\beta)^2 * S^2 / r * (d)^2$, assuming alpha = 0.05 and power = 0.80. The calculated sample size was 61 per group.

Intervention

The control group received standard ANC provided at Qaiwan PHC center, which included

routine clinical assessments, anthropometric measurements, blood pressure monitoring, and basic laboratory investigations at scheduled visits. Intervention group 1 received standard ANC plus an educational brochure developed specifically for this study. The brochure was constructed based on the Guidelines for physical activity during pregnancy certified by the Australian Government Department of Health, with modifications to suit the local community context. It contained comprehensive information regarding pregnancy signs and symptoms, healthy diet recommendations and foods to avoid during pregnancy, appropriate weight gain guidelines, physical activity instructions including intensity and duration specifications, types of exercises (aerobic activities, muscle strengthening activities, and pelvic floor exercises), safety precautions, and warning signs to discontinue physical activity. Intervention group 2 received the most comprehensive intervention, combining standard ANC, the educational brochure, and structured antenatal classes. The antenatal classes followed a systematic schedule with five sessions conducted at specific gestational periods: weeks 18-23, 24-27, 28-31, 32-35, and 36-37 gestation. Each session lasted 90 minutes and comprised three distinct components delivered by certified healthcare professionals. The first component involved theoretical education using PowerPoint presentations prepared in three languages (English, Kurdish, and Arabic), covering anatomical and physiological changes during pregnancy, maternal and fetal health, nutrition guidance, exercise benefits, common pregnancy problems and solutions, and preparation for labor and delivery. Content was tailored according to gestational age, with the final session including detailed information about labor signs, delivery stages, breastfeeding advantages, and introduction to delivery room facilities and personnel. The second component provided individualized consultation sessions where participants could ask questions regarding pregnancy, delivery, lactation, or newborn care. The third component focused on practical neuromuscular exercises including gentle strengthening yoga, foot exercises to improve circulation and prevent swelling, Pilates for pelvic floor strengthening and balance improvement, and Kegel exercises particularly emphasized in later sessions to maintain muscle tone and prevent urinary incontinence.

Data collection

The data collection process involved multiple phases and instruments. Initially, pregnant women attending the maternity department underwent screening for eligibility criteria. After obtaining verbal and written informed consent, participants completed the first questionnaire encompassing demographic information (name, age, husband's name, contact numbers, date and age at marriage, residence, maternity file number), socioeconomic status assessment using the validated SES scale for health research in Egypt (total score 84 points across seven domains: educational and cultural, occupational, family possessions, family structure, home sanitation, economic resources, and healthcare access), and obstetrical history including gravidity, parity, abortion history, and reproductive health knowledge.

The primary outcome measure, HRQoL, was assessed using the SF-36 Health Survey administered at baseline (18-20 weeks gestation) and post-intervention (36-37 weeks gestation). The SF-36 comprises 36 questions covering eight health domains: Physical Functioning (10 items), Role Physical (4 items), Bodily Pain (2 items), General Health (5 items), Vitality (4

items), Social Functioning (2 items), Role Emotional (3 items), and Mental Health (5 items). Scores were transformed to 0-100 scales using standardized formulas, with higher scores indicating better health states.

Ethical considerations

The study was approved by the ethics committee at the College of Medicine, University of Sulaimani, and conducted according to Helsinki Declaration principles ensuring confidentiality, anonymity, and voluntary participation. Permission was obtained from PHC center directors and written informed consent from all participants.

Statistical analysis

Data were analyzed using SPSS Version 26.0 software. Descriptive statistics included means and standard deviations for continuous variables and frequencies for categorical variables. Paired t-tests were used to compare pre- and post-intervention scores within groups, while ANOVA was employed to compare differences between groups. Statistical significance was set at $p < 0.05$.

Results

Table 1 presents the socio-demographic characteristics of 292 pregnant women, distributed across three study groups: Control (n = 146), Intervention 1(n = 80), and Intervention 2(n = 66). The overall mean age was 26.5 ± 4.5 years, with the majority aged 20–29 years 203 (69.5%), followed by 30–35 years 72(24.7%) and 18–19 years 17(5.8%). The mean age at marriage was 22.4 ± 3.6 years, with most participants marrying between 16–25 years 240(82.2%). Regarding educational attainment, 88(30.1%) of the women were university graduates and 74(25.3%) attended institutes; a smaller proportion had only primary 31 (10.6%) or preparatory 33 (11.3%) education. Among their husbands, 76 (26.0%) were university graduates and 69 (23.6%) had preparatory education, while a minority were illiterate 3 (1.0%). Most women identified as housewives 233 (79.8%), whereas husbands were more evenly distributed across skilled manual labor 84 (28.8%), semi-professional or clerical roles 84 (28.8%), and trades/business 74 (25.3%). A majority of the households 242 (82.9%) had a crowding index of ≤ 1 person per room.

Table 1: Socio-demographic characteristics of pregnant women across study groups.

Socio-demographic characteristics		Control	Intervention 1	Intervention 2	Total
Age	Mean ± SD	27.0 ± 5.0	25.9 ± 4.5	26.2 ± 3.2	26.5 ± 4.5
	18 - 19 Years	10 (6.8%)	6 (7.5%)	1 (1.5%)	17 (5.8%)
	20 – 29 Years	88(60.3%)	57 (71.3%)	58 (87.9%)	203(69.5%)
	30 – 35 Years	48 (32.9%)	17 (21.3%)	7 (10.6%)	72 (24.7%)
Age of marriage	Mean ± SD	22.3 ± 3.7	22.2 ± 4.0	22.9 ± 2.7	22.4 ± 3.6
	16 - 25 Years	119 (81.5%)	65 (81.3%)	56 (84.8%)	240(82.2%)
	26 - 36 Years	27 (18.5%)	15 (18.7%)	10 (15.2%)	52 (17.8%)
Education of wife	Read & write	6 (4.1%)	3 (3.8%)	0 (0%)	9 (3.1%)
	Primary	24 (16.4%)	6 (7.5%)	1 (1.5%)	31 (10.6%)
	Preparatory	19 (13.0%)	14 (17.5%)	0 (0%)	33 (11.3%)
	Secondary	28 (19.2%)	16 (20.0%)	10 (15.2%)	54 (18.5%)
	Institutes	33 (22.6%)	21 (26.3%)	20 (30.3%)	74 (25.3%)
	University graduate	35 (24.0%)	20 (25.0%)	33 (50.0&)	88 (30.1%)
	Postgraduate degree	1 (0.7%)	0 (0%)	2 (3.0%)	3 (1%)

Education of Husband	Illiterate	2 (1.4%)	1 (1.3%)	0 (0%)	3 (1%)
	Read & write	8 (5.5%)	2 (2.5%)	0 (0%)	10 (3.4%)
	Primary	34 (23.3%)	13 (16.3%)	2 (3.0%)	49 (16.8%)
	Preparatory	39 (26.7%)	23 (28.8%)	7 (10.6%)	69 (23.6%)
	Secondary	18 (12.3%)	15 (18.8%)	8 (12.1%)	41 (14.0%)
	Institutes	19 (13.0%)	8 (10.0%)	14 (21.2%)	41 (14.0%)
	University graduate	26 (17.8%)	16 (20.0%)	34 (51.5%)	76 (26.0%)
Occupation of wife	House wife	125(85.6%)	69 (86.3%)	39 (59.1%)	233(79.8%)
	Skilled manual worker/farmer	1 (0.7%)	1 (1.3%)	6 (9.1%)	8 (2.7%)
	Trades/business	0 (0%)	1 (1.3%)	4 (6.1%)	5 (1.7%)
	Semi-professional/ clerk	11 (7.5%)	5 (6.3%)	12 (18.2%)	28 (9.6%)
	Professional	9 (6.2%)	4 (5.0%)	5 (7.6%)	18 (6.2%)
Occupation of husband	Non-working	1 (0.7%)	0 (0%)	0 (0%)	1 (0.3%)
	Unskilled manual worker	6 (4.1%)	2 (2.5%)	14 (21.2%)	22 (7.5%)
	Skilled manual worker/farmer	47 (32.2%)	30 (37.5%)	7 (10.6%)	84 (28.8%)
	Trades/business	45 (30.8%)	18 (22.5%)	11 (16.7%)	74 (25.3%)
	Semi-professional/ clerk	37 (25.3%)	19 (23.8%)	28 (42.4%)	84 (28.8%)
	Professional	10 (6.8%)	11 (13.8%)	6 (9.1%)	27 (9.2%)
Crowding Index	≤ one person/ room	116(79.5%)	68 (85.0%)	58 (87.9%)	242(82.9%)
	> one person/ room	30 (20.5%)	12 (15.0%)	8 (12.1%)	50 (17.1%)
Total		146 (100%)	80 (100%)	66 (100%)	292 (100%)

Table 2 displays the baseline mean scores and standard deviations of various HRQoL domains among the three study groups at 18–20 weeks' gestation. In the physical domain, Intervention 2 reported the highest mean score of 71.5 ± 16.5, followed by Intervention 1 at 61.2 ± 22.8 and the Control group at 58.7 ± 20.6, with a statistically significant difference ($p < 0.001$). The role physical domain also showed a significant difference ($p = 0.03$), with means of 36.9 ± 33.7 in Intervention 2, 28.6 ± 25.1 in Intervention 1, and 23.9 ± 27.3 in the Control group. The role emotional domain showed no statistically significant difference ($p = 0.294$), with scores ranging from 32.1 ± 32.5 to 39.0 ± 39.3. In the vitality domain, scores were relatively close across groups and no significant difference was observed ($p = 0.118$). The mental health domain showed a significant difference ($p = 0.001$); the Intervention 2 group had the highest score at 61.2 ± 10.3, compared to 55.5 ± 11.7 in Intervention 1 and 54.6 ± 13.3 in the Control group. No significant difference was observed in the social functioning domain ($p = 0.27$). However, a significant difference was noted in bodily pain scores ($p = 0.019$), with the lowest score reported in Intervention 2 (39.4 ± 20.1). No significant differences were found in the general health domain ($p = 0.84$).

Table 2: Baseline Mean Scores and Standard Deviations of HRQoL Domains among Study Groups before the Intervention at 18- 20 Weeks' Gestation.

Groups	Control	Intervention 1	Intervention 2	P- value
Baseline data at 18-20 weeks Gestation	Mean±SD	Mean±SD	Mean±SD	
Physical domain	58.7±20.6	61.2±22.8	71.5±16.5	< 0.001
Role Physical Domain	23.9±27.3	28.6±25.1	36.9±33.7	0.03
Role emotional domain	32.1±32.5	32.5±32.6	39.0±39.3	0.294
Vitality domain	53.1±12.1	53.9±10.3	56.0±8.7	0.118
Mental health Domain	54.6±13.3	55.5±11.7	61.2±10.3	0.001
Social functioning domain	43.9±13.5	41.6±13.0	44.0±13.3	0.27
Bodily pain domain	47.9±20.1	42.1±21.9	39.4±20.1	0.019
General health domain	48.1±14.6	45.9±15.2	47.9±9.8	0.84

Table 3 summarizes post-intervention mean scores and standard deviations of HRQoL domains at 36–37 weeks' gestation across the study groups. Intervention 2 showed substantial improvements in multiple domains. In the physical domain, Intervention 2 had the highest score of 72.7 ± 16.1, compared to 49.3 ± 17.3 in Intervention 1 and 43.1 ± 19.6 in the Control group ($p < 0.001$). The role physical domain also indicated a marked increase in Intervention 2 (57.3 ± 17.0), while lower scores were seen in Intervention 1 (21.4 ± 19.9) and the Control group (14.4 ± 20.7), with a significant difference ($p < 0.001$). Similarly, the role emotional domain was considerably higher in Intervention 2 (51.3 ± 35.4) compared to Intervention 1 (20.2 ± 27.3) and the Control group (18.9 ± 26.1), also reaching statistical significance ($p < 0.001$). The vitality domain followed the same pattern, with Intervention 2 scoring 57.2 ± 10.3, higher than both Intervention 1 (50.9 ± 10.9) and the Control group (51.6 ± 10.8) ($p < 0.001$). Mental health scores were significantly greater in Intervention 2 (61.3 ± 8.9), followed by Intervention 1 (55.3 ± 10.1) and the Control group (53.0 ± 10.3) ($p < 0.001$). Interestingly, the bodily pain domain showed significant differences ($p < 0.001$), but the Control group reported the highest score (52.1 ± 16.2), followed by Intervention 1 (46.7 ± 20.3) and Intervention 2 (44.3 ± 17.5). No significant differences were observed in the social functioning domain ($p = 0.55$) and general health domain ($p = 0.82$).

Table 3: Post-Intervention Mean Scores and Standard Deviations of HRQoL Domains among Study Groups at 36–37 Weeks' Gestation.

Groups	Control	Intervention 1	Intervention 2	P- value
Data at 36-37 weeks gestation	Mean±SD	Mean±SD	Mean±SD	
Physical domain	43.1±19.6	49.3±17.3	72.7±16.1	< 0.001
Role Physical domain	14.4±20.7	21.4±19.9	57.3±17.0	< 0.001
Role emotional domain	18.9±26.1	20.2±27.3	51.3±35.4	< 0.001
Vitality domain	51.6±10.8	50.9±10.9	57.2±10.3	< 0.001
Mental health domain	53.0±10.3	55.3±10.1	61.3±8.9	< 0.001
Social functioning domain	45.4±12.6	44.2±13.0	46.5±11.2	0.55
Bodily pain domain	52.1±16.2	46.7±20.3	44.3±17.5	< 0.001
General health domain	49.2±11.8	48.1±17.8	48.3±10.1	0.82

Table 4 presents a comparison of Health-Related QoL domain scores before and after ANC classes across the control and intervention groups. In the control group, most domains showed a significant decline post-intervention, including the physical domain (58.7 ± 20.6 to 43.1 ± 19.6; $p = 0.009$), role physical (23.9 ± 27.3 to 14.4 ± 20.7; $p < 0.001$), and role emotional (32.1 ± 32.5 to 18.9 ± 26.1; $p < 0.001$). In contrast, the bodily pain domain improved from 47.9 ± 20.1 to 52.1 ± 16.2 ($p < 0.001$), and general health showed a slight increase (48.1 ± 14.6 to 49.2 ± 11.8; $p < 0.001$). Intervention 1 also exhibited statistically significant declines in most domains, such as physical (61.2 ± 22.8 to 49.3 ± 17.3; $p = 0.002$) and vitality (53.9 ± 10.3 to 50.9 ± 10.9; $p < 0.001$), while modest improvements were noted in social functioning (41.6 ± 13.0 to 44.2 ± 13.0; $p = 0.149$, not significant) and bodily pain (42.1 ± 21.9 to 46.7 ± 20.3; $p < 0.001$). In contrast, Intervention 2 consistently demonstrated significant improvements across almost all domains, especially in role physical (36.9 ± 33.7 to 57.3 ± 17.0; $p < 0.001$), role emotional (39.0 ± 39.3 to 51.3 ± 35.4; $p < 0.001$), and vitality (56.0 ± 8.7 to 57.2 ± 10.3; $p < 0.001$). Bodily pain scores also improved significantly (39.4 ± 20.1

to 44.3 ± 17.5; p = 0.008), and general health increased slightly from 47.9 ± 9.8 to 48.3 ± 10.1 (p = 0.002).

Table 4: Comparison of QoL Domain's Scores Before and After ANC Classes across Control and Intervention Groups.

Groups	Control			Intervention 1			Intervention 2		
Domains	Mean ±SD		P- value	Mean ±SD		P- value	Mean±SD		P- value
	Before	After		Before	After		Before	After	
Physical	58.7±20.6	43.1±19.6	0.009	61.2±22.8	49.3±17.3	0.002	71.5±16.5	72.7 ± 16.1	< 0.001
Role Physical	23.9 ±27.3	14.4±20.7	< 0.001	28.6±25.1	21.4±19.9	< 0.001	36.9 ±33.7	57.3±17.0	< 0.001
Role Emotional	32.1±32.5	18.9±26.1	< 0.001	32.5±32.6	20.2±27.3	< 0.001	39.0±39.3	51.3±35.4	< 0.001
Vitality	53.1±12.1	51.6±10.8	< 0.001	53.9±10.3	50.9±10.9	< 0.001	56.0±8.7	57.2 ± 10.3	< 0.001
Mental Health	54.6 ±13.3	53.0±10.3	< 0.001	55.5±11.7	55.3±10.1	< 0.001	61.2±10.3	61.3±8.9	< 0.001
Social Functioning	43.9±13.5	45.4±12.6	< 0.001	41.6±13.0	44.2± 13.0	0.149	44.0±13.3	46.5±11.2	0.06
Bodily Pain	47.9±20.1	52.1±16.2	< 0.001	42.1±21.9	46.7±20.3	< 0.001	39.4±20.1	44.3±17.5	0.008
General Health	48.1±14.6	49.2±11.8	< 0.001	45.9±15.2	48.1±17.8	< 0.001	47.9 ± 9.8	48.3±10.1	0.002

Table 5 presents the mean differences in QoL domain scores following ANC interventions among the study groups. Statistically significant changes were observed in several domains. The physical domain showed a deterioration in both the control group (-15.57 ± 25.00) and Intervention 1 (-11.91 ± 23.24), while Intervention 2 demonstrated a slight improvement (1.15 ± 16.15), with the difference being statistically significant (p < 0.001). In the role physical domain, Intervention 2 exhibited a notable improvement (20.38 ± 29.61) compared to declines in the control (-9.47 ± 28.23) and Intervention 1 (-7.24 ± 24.43) groups (p < 0.001). Similarly, the role emotional domain improved significantly in Intervention 2 (12.31 ± 31.50), while both the control group (-13.13 ± 33.14) and Intervention 1 (-12.28 ± 24.25) experienced declines (p < 0.001). The bodily pain domain also yielded statistically significant improvements across all groups, with mean differences of 4.20 ± 12.44 (control), 4.61 ± 11.94 (Intervention 1), and 4.92 ± 21.95 (Intervention 2) (p < 0.001). Other domains, including vitality, mental health, social functioning, and general health, did not show statistically significant differences between groups (p > 0.05).

Table 5: Mean Differences in QoL Domain Scores after ANC Interventions among Study Groups.

Groups	Control	Intervention 1	Intervention 2	p- value
Domains difference (mean score after intervention mean score before intervention)	Mean±SD	Mean±SD	Mean±SD	
Physical domain mean difference	-15.57±25.00	-11.91±23.24	1.15±16.15	< 0.001

	General health domain mean difference	Pain domain mean difference	Social functioning domain mean difference	Mental health domain mean difference	Vitality domain mean difference	Role emotional domain mean difference	Role Physical domain mean difference
	1.14±11.93	4.20±12.44	1.42±14.54	-1.58±12.82	-1.59±13.07	-13.13±33.14	-9.47±28.23
	2.24±18.15	4.61 11.94	2.63±16.75	-0.21±8.64	-2.96±10.49	-12.28±24.25	-7.24±24.43
	0.38±11.12	4.92±21.95	2.50±15.18	0.12±9.62	1.23±10.46	12.31±31.50	20.38±29.61
	0.721	< 0.001	0.824	0.518	0.104	< 0.001	< 0.001

Discussion

Health-related quality of life (HRQoL) is a multidimensional construct that encompasses physical, emotional, and social well-being, particularly crucial during pregnancy, a period marked by profound physiological and psychological change [9]. ANC traditionally focuses on medical monitoring; however, structured antenatal education and physical activity programs have been proposed as valuable adjuncts to improve maternal outcomes beyond the biomedical model [10]. In this quasi-experimental study, we assessed the impact of structured antenatal classes (including health education, exercise routines, and lifestyle counseling) on the HRQoL of pregnant women. The findings revealed that pregnant women who participated in comprehensive antenatal classes (Intervention Group 2) experienced notable improvements in several domains of HRQoL in contrast to women receiving standard care or educational brochures alone. The control group in this study, which received only routine ANC, followed the expected deteriorative trajectory, with decreases observed across most QoL domains. These findings are consistent with those from Amini Hospital in Iran, where control groups did not show any meaningful improvement in QoL by the third trimester [11]. Similarly, a study conducted in Karoon City reported that women receiving only routine care experienced declines in physical function, emotional well-being, and pain levels [12]. Comparable results were also noted in Goran and Zanjan cities, where QoL either remained unchanged or declined in control groups, reinforcing the limitations of routine care in addressing the complex psychosocial and physical needs of pregnant women [13, 14]. The first intervention group, which received only an educational brochure, showed slight improvements in most domains, particularly in emotional and physical role limitations. However, the effects were modest and less significant compared to the second intervention group.

Social functioning and overall vitality changed minimally. This indicates that while providing educational materials can have a positive influence, particularly on increasing awareness and encouraging some behavioral changes, such passive interventions alone may not be sufficient in addressing broader psychosocial or physical challenges during pregnancy. A similar trend was noted in previous research conducted in Sina Hospital, where educational interventions improved certain domains but did not consistently affect social or overall health experiences of pregnant women [12]. In contrast, the second intervention group, which participated in structured antenatal classes, demonstrated the most substantial improvements across nearly all QoL domains. Physical and emotional functioning, in particular, showed marked gains, while even domains such as social functioning and vitality exhibited positive upward trends. These findings mirror those from several Iranian studies. In Amini Hospital, for example, antenatal education significantly improved mental health, vitality, and emotional well-being [11]. Research from Goran City further confirmed that women who attended such classes experienced notable enhancements in mental health, general health perceptions, and pain management [13]. Similarly, the Zanjan City study found improvements in vitality, mental health, and social functioning following structured class participation [14]. The strong alignment between the present findings and those from previous studies reinforces the value of interactive and multifaceted antenatal education in enhancing the overall well-being of pregnant women. The findings revealed that, without targeted intervention, pregnant women in the control group experienced significant declines in physical function, role physical, and role emotional domains over the course of gestation. In contrast, women receiving both education and physical activity (Intervention 2) exhibited maintained or improved scores in these domains, highlighting the synergistic effect of combining educational and exercise components. These results align with Budler et al., who reported that moderate-intensity exercise throughout pregnancy reduces musculoskeletal discomfort and enhances overall maternal well-being. The present study extends these findings by showing that when exercise is embedded within a structured educational program, benefits are even more pronounced [15]. The mental health domain in our study also benefited significantly from the integrated intervention, mirroring findings from a socio-ecological systematic review by Junjiang et al., which identified that multi-level interventions (combining individual education with community support) yield greater reductions in prenatal stress and depressive symptoms than single-component programs [16]. Intervention 2's group-based classes likely fostered peer support and accountability, addressing social determinants of health that pure educational materials cannot. However, the bodily pain domain exhibited a unique pattern: although all groups reported some improvements, the control group paradoxically had the highest post-intervention score. This may reflect natural adaptation to pregnancy or regression to the mean in pain reporting. Similar observations were made by Li et al., in a Chinese cohort, where most pain relief was attributed to endogenous hormonal changes rather than structured exercise, underscoring that physical activity's analgesic effects may be secondary to broader biochemical adaptations during late pregnancy [17]. The study's strengths include its quasi-experimental design with two intervention intensities, allowing for dose-response insights. Limitations involve reliance on self-reported

QoL measures and potential selection bias due to voluntary participation. Future research should incorporate objective physical performance metrics and explore histopathological correlates to elucidate biological mechanisms underlying observed functional improvements.

Conclusion

In conclusion, this study demonstrates that structured antenatal classes are significantly more effective than routine ANC or brochure-based education in enhancing the QoL of pregnant women, particularly in physical, emotional, and functional domains. While brochure interventions offer limited benefits, mainly in physical and emotional role functioning, they fall short in addressing broader psychosocial needs. The consistent decline observed in the control group emphasizes the inadequacy of routine care alone in maintaining maternal well-being during pregnancy. These findings underscore the importance of integrating structured, interactive antenatal education programs into prenatal care services to promote better health outcomes, emotional resilience, and overall QoL for expectant mothers.

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References

[1] Bjelica A, Cetkovic N, Trninić-Pjević A, Mladenovic Segedi L. The phenomenon of pregnancy - A psychological view. *Ginekologia Polska*. 2018;89(2):102–106.

[2] Davis EP, Narayan AJ. Pregnancy as a period of risk, adaptation, and resilience for mothers and infants. *Development and Psychopathology*. 2020;32(5):1625–1639.

[3] El Emrani L, Senhaji M, Bendriss A. Measuring health-related quality of life in the population of Tetouan, Morocco, by the SF-36: normative data and the influence of gender and age/Mesure de la qualite de vie en relation avec la sante chez la population de Tetouan (Maroc) a l'aide du SF-36: donnees normatives et influence du sexe et de l'age. *Eastern Mediterranean Health Journal*. 2016;22(2):133–142.

[4] Estebsari F, Kandi ZRK, Bahabadi FJ, Filabadi ZR, Estebsari K, Mostafaei D. Health-related quality of life and related factors among pregnant women. *Journal of Education and Health Promotion*. 2020;9:299.

[5] World Health Organization (WHO). Maternal mortality 2023.

[6] Mazuchová L, Murínová M, Kelčíková S, Maskálová E, Malinovská N. Predictors related to quality of life in pregnant women. *Iranian Journal of Public Health*. 2023;52(10):2109–2116.

[7] Mohammed HH, Hamed A, Afefy NAE, Sherif NA, Ibrahim SM. The effectiveness of nurse-led antenatal education on maternal self-efficacy: an evidence-based approach. *BMC Nursing*. 2025;24(1):895.

[8] Prihadianto D, Sari I. The effectiveness of prenatal education interventions on maternal anxiety and birth outcomes: a systematic

review. *Journal of Health Research and Technology*. 2025;3(2):247–259.

[9] Boutib A, Chergaoui S, Marfak A, Hilali A, Youlyouz-Marfak I. Quality of life during pregnancy from 2011 to 2021: systematic review. *International Journal of Women's Health*. 2022;14:975–1005.

[10] Zanetti MRD, Sosa C, Foster T, Rossello JL, Serruya S, De Múcio B. What are the benefits of antenatal education as a maternal health promotion tool? A systematic review with meta-analysis. *ABCS Health Sciences*. 2024;49:e024305.

[11] Hajipour L, Mohtasham Amiri Z, Montazeri A, Torkan B, Hosseini Tabaghdehi M. The effects of prenatal classes on the quality of life in pregnant women. *Journal of Holistic Nursing and Midwifery*. 2017;27(1):45–51.

[12] Soleymani S, Makvandi S. Effect of childbirth preparation classes on quality of life in pregnant women. *Specialty Journal of Medical Research and Health Science*. 2018;3(2):16–21.

[13] Ziaei T, Gholipour S, Danesh A. The effect of group counseling based on communication skills on the quality of life of pregnant women. *Journal of Research Development in Nursing and Midwifery*. 2021;18(1):49–52.

[14] Dinmohammadi S, Dadashi M, Ahmadnia E, Janani L, Kharaghani R. The effect of solution-focused counseling on violence rate and quality of life of pregnant women at risk of domestic violence: a randomized controlled trial. *BMC Pregnancy and Childbirth*. 2021;21(1):221.

[15] Cilar Budler L, Budler M. Physical activity during pregnancy: a systematic review for the assessment of current evidence with future recommendations. *BMC Sports Science, Medicine & Rehabilitation*. 2022; 14(1):133.

[16] Sun J, Piernicka M, Worska A, Szumilewicz A. A socio-ecological model of factors influencing physical activity in pregnant women: a systematic review. *Frontiers in Public Health*. 2023;11:1232625.

[17] Li J, Huang D, Liang J, Chen J, Lei L, Lin M, et al. Physical activity during pregnancy and adverse birth outcome: a prospective cohort study in China. *Journal of Maternal-Fetal & Neonatal Medicine*. 2023;36(1): 2162819.