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Does level of antenatal care affect birthweight? Study of a Central Anatolian Region

M. Kılıç[1], A.İ. Kılıç[2]

[1] Health School, Bozok University, Yozgat; [2] State Hospital, Yozgat (Turkey)

Summary

Purpose of investigation: The objective of this research was to measure the impact of the level and quality of antenatal care (ANC) on the birthweight (BW) of hospital-born infants. *Materials and Methods:* This study was cross-sectional research. This study was conducted at the maternity hospital and a private hospital in the center of the province of Yozgat, Turkey. Women (N=788) were included in the research who had a singleton live delivery at hospitals. *Results:* It was found that adequate receipt of ANC was significant, although had little affect on BW; the number of ANC visits or whether ANC was adequate was not found to be significant. BW increased depending on primarily the mother's gestational age (GA) and then her age, height, and weight gained during pregnancy ($p < 0.05$). *Conclusions:* It is GA that impacts BW primarily. It is recommended that necessary interventions be made to minimize the factors leading to preterm births.

Key words: Prenatal care; Birth weight; Hospital birthing centers.

Introduction

Mother and child health is one of the important subjects of public health. A healthy child is born to a healthy mother as a result of a well-managed pregnancy. Adequate and qualified antenatal care (ANC) services are required for having a healthy and safe gestation period [1]. The objective of ANC services is to prevent, mitigate or treat/manage the health problems or diseases (including those directly related to pregnancy) that are known to have negative effects on pregnancy and to provide the necessary information and give advice to women and their families/husbands about a healthy pregnancy, birthing, and postnatal period including baby care and breast feeding practices. According to the World Health Organization (WHO), a healthy pregnant woman should be monitored at least four times during her pregnancy [1]. There are many factors influencing the birthweight (BW) of an infant. One of these is the level and quality of ANC.

The number of ANC visits varies according to income levels of countries. Pregnant women who are believed to be receiving inadequate number of ANC visits are visited 8.2 to 12 times on the average in countries with high level of income, but usually less than five times in countries with low and moderate income. It was found in the researches conducted that prenatal mortality was higher in those who received inadequate ANC, but there was not a significant relationship between preterm birth and infants with a low birthweight (LBW), and the level of ANC. There is no strong evidence that the level and quality of ANC has an impact on BW [2]. It was found in a study that those pregnant women who had a preterm birth and those who delivered babies with a LBW had more ANC [3].

It is recommended in the United Kingdom (UK) that ANC start in the early weeks of pregnancy (ideally within the first ten weeks) and those who are parous with an uncomplicated pregnancy be visited seven times, and those who are nulliparous with an uncomplicated pregnancy be visited ten times for ANC [4]. The percentage of those receiving ANC in Turkey has increased in time, reaching 92% in 2008. While it is recommended that pregnant women receive ANC ideally ten times in Turkey, 73.7% of them have received ANC four times and more. It is also recommended that weight measurement, blood pressure measurement, urine and blood tests, and ultrasonic examination of the abdomen or listening of fetal heart rate be carried out at least once during ANC [5]. The ANC management guideline prepared by the Ministry of Health also mentions that pregnant women should be visited at least four times and explains in detail what should be done during each visit [6].

The purpose of this research was to measure whether the level and quality of ANC has any effect on the BW of infants of a singleton birth in a hospital.

Materials and Methods

This research was a retrospective causal study. The research was carried out in the provincial center of Yozgat, a city located in the middle of Turkey. The population of the research consisted of women who had singleton live births at the state hospital and a pri-

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Table 1. — *Distribution of mean BW according to various characteristics.*

Characteristics	n (%)[a]	BW $\bar{x}$ ± SD	Characteristics	n (%)[a]	BW $\bar{x}$ ± SD
Mother's age	788	F=2.35, p=0.053	Mode of delivery	788	t=0.32, p=0.75
15-19	117 (14.8)	3212.0±531.6	Vaginal	260 (33.0)	3290.5±445.8
20-24	259 (32.9)	3233.5±557.2	Caesarean section	528 (67.0)	3278.5±574.8
25-29	217 (27.5)	3329.1±488.7	Gestational age	788	F=86.1, p<0.001
30-34	120 (15.2)	3301.9±548.4	< 37 weeks	81 (10.3)	2667.9±629.5
≥ 35	75 (9.5)	3395.5±553.9	37–39 weeks	320 (40.6)	3247.4±475.8
Mother's height	739	F=1.96, p=0.118	≥ 40 weeks	387 (49.1)	3440.1±460.2
≤ 150 cm	58 (7.8)	3176.7±392.2	Maternal weight gain	731	F=5.62, p=0.004
151–155 cm	114 (15.4)	3244.3±552.2	5–9 kg.	194 (26.5)	3204.4±612.3
156–165 cm	422 (57.1)	3286.7±558.5	10–14 kg	320 (43.8)	3275.2±499.3
≥ 166 cm	145 (19.6)	3359.8±492.2	≥ 15 kg	217 (29.7)	3379.8±516.9
Mother's education	788	F=1.89, p=0.15	Fe, vitamins use	788	t=1.90, p=0.058
≤ Elementary	411 (52.2)	3247.0±565.0	Yes	684 (86.8)	3189.7±530.1
Primary (8 years)	173 (22.0)	3322.1±524.6	No	104 (13.2)	3352.9±475.8
≥ High school	204 (25.9)	3320.3±477.7	Medical problems	778	t=3.60, p<0.001
Mother's economic level	788	F=0.10, p=0.90	Yes	279 (35.9)	3191.2±510.7
Good	101 (12.8)	3283.4±444.6	No	499 (64.1)	3332.2±531.7
Middle	457 (58.0)	3288.9±542.3	ANC level	788	t=2.48, p=0.013
Poor	230 (29.2)	3269.2±559.5	Adequate	736 (93.4)	3295.0±533.5
Interval between pregnancies	772	F=0.96, p=0.41	Inadequate	52 (6.6)	3105.2±536.1
Primigravida	300 (38.9)	3252.9±504.0	ANC: Adequate	788	t=2.27, p=0.024
< 2 years	110 (14.2)	3260.6±542.1	Adequate-qualified	518 (65.7)	3313.6±541.0
2 ≤ 3 years	78 (10.1)	3277.5±580.9	Inadequate-unqualified	270 (34.3)	3222.7±520.4
≥3 years	284 (36.8)	3325.2±558.3	Total	788 (100.0)	3282.5±535.4

[a] Percentages are based on the sum of the column of those who responded. $\bar{x}$ ± SD: mean ± standards deviation.

vate hospital in the center of the province. The sample of the research included those who had deliveries at the mentioned hospitals in the period of conducting the research. Before administering the questionnaire, those included in the research were explained the purpose of the research and that they were free to participate in the research or not and that their verbal consents were obtained. N=788 women were included in the research who agreed to participate by giving a verbal consent. Institutional permission was obtained for the research from the Governorship of Yozgat and an approval from the Ethics Committee of Yozgat State Hospital.

The data were collected by filling out the questionnaire prepared by the investigator with the help of the interviewers. The interviewers were third and fourth year students of the nursing department, who were trained by the investigator. Care was taken when administering the questionnaire to have the mothers in a rested state able to respond to the questionnaire. The questionnaire was administered after a rehearsal involving 20 mothers had been carried out and the necessary corrections had been made. The BW values were obtained from mother files.

It was considered a qualified ANC if an abdominal ultrasonic examination or listening of fetal heart rate (FHR) was carried out twice during pregnancy, mother's weight was measured, her blood pressure was measured, her urine and blood tests were performed, and two doses of tetanus toxoid injection were made. Having had at least four visits during pregnancy was considered adequate ANC [1]. Those who received both adequate and qualified ANC were considered having had adequate-qualified ANC. Their economic statuses were determined by scoring the number of persons in the family, type of the house they lived in, possession of a home, owning a car, self-perception of economic status, and income stated. The scoring interval was between six and 20; the economic condition was divided into three groups as low, moderate, and high under five-point scores.

The independent samples T test, ANOVA, ANCOVA, and linear regression analysis were used in statistical evaluation of the data. The variables found to be statistically significant as per the independent samples T test and ANOVA were made subject to multiple ANCOVA and linear regression analyses. BW (g) was taken as the dependent variable in the multiple analyses. From the independent variables, mother's age (years), height (cm), duration of pregnancy (weeks), weight gained during pregnancy (kg), and the number of problems experienced during pregnancy were taken as covariates and having received adequate-qualified ANC was taken as the categorical variable.

Results

Of those who participated in the research, 33.6% lived in the provincial center, 35.5% of them in borough centers, and 30.8% in villages; 54.5% of them had nuclear family structure, household size was 5.1±2.2 and the mean age was 25.7±5.8, the youngest being 15 and the oldest 47 years of age. Of the women participated in the research, 8.9% stated that they had no social security and 91.7% of them that they were not working in any job; 74% of the mothers stated that they became pregnant willingly. The mean BW was not found different according to willingness for pregnancy (t = 0.81, p = 0.42). In the women studied, 93.4% received adequate ANC, 66.4% qualified ANC, and 65.7% adequate and qualified ANC (Table 1); 84.6% of those who received ANC stated that they began receiving ANC in the first three months of their pregnancy (95.7% in the first 20 weeks). The mean

Table 2. — *Factors affecting BW after standardizing experiencing of medical problems during pregnancy.*

Source [a]	F	Sig.	Partial Eta Squared
Corrected model	41.059	0.000	0.267
Intercept	27.214	0.000	0.039
Mother's age (year)	23.697	0.000	0.034
Mother's height (cm)	6.462	0.011	0.009
Numbers of ANC	2.713	0.100	0.004
Maternal weight gain (kg)	10.762	0.001	0.016
Gestational age (weeks)	178.979	0.000	0.210
Medical problems during pregnancy	8.848	0.003	0.013
Adjusted R^2			0.261

[a] General Linear Model Univariate analysis (ANCOVA).

number of weeks of beginning to receive ANC was 8.74 ± 5.65 and the median was eight weeks.

The mean BW was 3282 ± 535.4 g, the minimum being 900 g and maximum 5,000 g. Of the babies in the study, 5.7% had LBW (< 2,500 g) and 10.3% of them were born prematurely (< 37 weeks); 30.9% of those who were born preterm and 2.8% of those who were born term were babies with LBW. The mean BW was not found to differ according to the age group of mothers, their height, their living place (F=1.14, p = 0.32), mode of delivery, time between pregnancies, use of vitamin F during pregnancy or the mother's education and economic status. The mean BW differed according to the weight gained by the mother during pregnancy, gestational age, having problems during pregnancy, and the level and quality of ANC (Table 1). When an ANCOVA analysis was made after standardizing the status of having had problems during pregnancy, the number of ANC visits was not statistically significant (Table 2). While the mean BW was not significant according to the mother's age and height in the singular analysis, it was found significant in the multiple analyses (Table 2). When the level of receiving ANC was standardized, BW increased as the mother's age, height, weight gained by her during pregnancy and gestational age increased, and the number of problems experienced during pregnancy decreased. In 25.9% with change in BW can be explained by these six variables (20.9% by gestational weeks). Among these six factors, the effect of the level of receiving ANC is minimal (0.6%) (Table 3). When an ANCOVA analysis was carried out after standardizing the status of receiving adequate-qualified ANC, the effect of this variable on BW was not significant, whereas the woman's age, height, weight gained by her during pregnancy, gestational age, and experiencing problems during pregnancy were significant (Table 3). The variables that seemed to have impact on BW depending on the level and quality of ANC were analyzed separately using linear regression. BW increased in those who received ade-

Table 3. — *Factors affecting BW after standardizing the level and quality of receiving ANC.*

	Adequate ANC / Inadequate ANC			Adequate-qualified ANC / Inadequate-unqualified ANC		
Source [a]	F	Sig.	Partial Eta Squared	F	Sig.	Partial Eta Squared
Corrected model	40.909	0.000	0.266	40.166	0.000	0.262
Intercept	25.102	0.000	0.036	23.827	0.000	0.034
Mother's age (years)	24.376	0.000	0.035	25.004	0.000	0.036
Mother's height (cm)	5.238	0.022	0.008	5.221	0.023	0.008
Maternal weight gain (kg)	10.845	0.001	0.016	12.049	0.001	0.017
Gestational age (weeks)	178.705	0.000	0.209	177.000	0.000	0.207
Number of med. prob. during pregnancy	6.309	0.012	0.009	6.160	0.013	0.009
ANC's level	4.304	0.038	0.006	1.008	0.316	0.001
Adjusted R^2			0.259			0.256

[a] General Linear Model Univariate analysis (ANCOVA).

Table 4. — *Factors affecting BW according to the level of receiving ANC.*

	Inadequate ANC (n=52)			Adequate ANC (n=736)		
Model [a]	Standardized Coefficients β	t	Sig.	Standardized Coefficients β	t	Sig.
(Constant)		-1.331	0.197		-4.715	0.000
Mother's age (years)	0.438	3.214	0.004	0.160	4.617	0.000
Mother's height (cm)	0.063	0.480	0.636	0.075	2.173	0.030
Maternal weight gain (kg)	0.002	0.017	0.986	0.113	3.257	0.001
Gestational age (weeks)	0.543	3.991	0.001	0.438	12.769	0.000
Number of med. prob. during pregnancy	-0.146	-1.083	0.291	-0.083	-2.425	0.016
Adjusted R^2			0.560			0.242

[a] Linear regression.

Table 5. — *Factors affecting BW according to the status of receiving adequate-qualified ANC.*

Model [a]	Inadequate-unqualified ANC (n=270) Standardized Coefficients β	t	Sig.	Adequate-qualified ANC (n=518) Standardized Coefficients β	t	Sig.
(Constant)		-1.645	0.101		-4.782	0.000
Mother's age (years)	0.195	3.160	0.002	0.155	3.857	0.000
Mother's height (cm)	0.027	0.444	0.657	0.097	2.405	0.017
Maternal weight gain (kg)	0.142	2.317	0.021	0.104	2.567	0.011
Gestational age (weeks)	0.454	7.563	0.000	0.440	10.904	0.000
Number of med. prob. during pregnancy	-0.051	-0.825	0.410	-0.102	-2.540	0.011
Adjusted R^2			0.242			0.258

[a] Linear regression.

quate or adequate-qualified ANC as primarily gestational age and then the mother's age and height, and weight gained by her during pregnancy increased and the number of problems experienced during her pregnancy decreased. The mother's age and gestational age were significant in those who did not receive adequate ANC and the mother's age, weight gained by her during pregnancy, and gestational age were significant in those who did not receive adequate-qualified ANC. While adequate receipt of ANC was significant, although slight, for BW, the number of ANC visits and whether or not the ANC was adequate-qualified were not significant. However, two of the factors effecting BW, namely, weight gained during pregnancy and experiencing problems during pregnancy were both more significant in those who received adequate ANC and adequate-qualified ANC (Tables 4 and 5). This shows that the level and quality of ANC also affects BW indirectly.

Discussion

In this study, the effect of ANC on BW was examined independent of other factors. The mean BW in the research group (3,282.5 g) was slightly higher than the mean BW found in locally performed researches in Turkey (2,955 g, 3,222 g, and 3,152 g, respectively) [7-9]. The mean BW was 3,492 g in Finland (2007), 3,414 g in Germany (2007), and a research conducted in the USA revealed the mean BW to be 3,264 g [10-12]. While the mean BW in those born term and singleton in the research group (3,352.9 g) was close to those born term and singleton in the USA (3,389 g in 2005), it was higher than the mean BW of Latin American countries (3,156 g) [13, 14]. A meta-analysis of the researches made between 1970 and 1980 showed that intrauterine growth retardation was an important problem in developing countries and prematurity in developed countries. This analysis also revealed that the mean BW was 3,299 g in the USA, 3,162 g (Hungary), 3,500 g (Norway) in Europe, 3,208 g in Japan, 3,285 g in China, 3,250 in Iran, and 3,540 in Iraq [15].

Of the women in the research group, 93.4% received adequate ANC and 65.7% of them adequate-qualified ANC (Table 1). The mean weeks of beginning to receive ANC was 8.74 ± 5.65. Those taking part in the research have received more ANC (73.7% of them for four times and more) as compared to pregnant women in Turkey in 2008 [5]. In a research carried out in France, it was found that 93.3% of women received ANC at least four times and 72.6% of them received adequate ANC (whose first visit was before 15th week or who received ANC once in a month) and the mean weeks of beginning to receive ANC was 12.3 ± 5.37 and pregnant women in Finland (2007) received ANC 16.5 times on the average and the mean weeks of beginning the first visit was 9.6 weeks [10, 16]. It was found in the USA that 61.1% of pregnant women received adequate ANC in 1980 and 38.9% of them received inadequate (16.7% totally inadequate) ANC [17]. The percentage of those who received adequate ANC is similar to the results of the researches performed in France and USA.

The mean BW of the women in the research group did not differ according to their living place, mode of delivery, time between pregnancies or the mother's educational and economic status (Table 1). When receipt of adequate and adequate-qualified ANC was standardized, it was found that as the age, height, weight gained during pregnancy, and gestational age of those participated in the research increased, BW also increased; 26.6% of the change in BW can be explained by five variables (22.5% by the weeks of pregnancy) (Table 3). The fact that 30.9% of those who were born premature and 2.8% of those who were born term were babies with LBW better shows the importance of gestational age. It was found in a study conducted in Brazil that as the weight gained during pregnancy increased, BW also increased [18]. In a research carried out in Belgium, a relation with both a high birthweight (> 4,000 g) and LBW (< 2,500 g) was found in term gestational hypertension and preeclampsia [19]. In a research carried out in France, no relationship was found between the level of ANC and the risk of emerging prenatal complications [16]. It was found in a study in Canada that the risk of premature delivery increased as age increased and this risk was 80% more in the age group of ≥ 40 than in the 20-24 age group [20]. While it was found in a Cochrane review study that social support intervention did not have any important effect on preterm

and LBW, qualified ANC intervention to adolescent pregnant women increased BW and the mean weeks of pregnancy [21, 22]. In another Cochrane review study, prenatal mortality was found higher in those who received inadequate ANC and no relationship was found between preterm delivery and LBW, and the level of ANC [2]. The present results are similar to those of other researches. In a review study, of the 28 studies, 24 reported an effect on birth outcomes, five (21%) found a significant positive effect on gestational age, and seven of 17 (41%) found a significant positive effect on birth weight [23].

No significant relationship was found between the socioeconomic condition of the mothers in the research group and BW. The reason for this could be that the majority of the mothers (93.4%) had received adequate ANC. As in other researches, the present authors also did not find any significant relationship between the level and quality of ANC and BW. However, the fact that the level and quality of ANC can affect the factors influencing BW shows that ANC may have an impact on BW indirectly. Both adequate and qualified ANC must be received for a healthy pregnancy and healthy delivery of a baby. Gestational age is essentially the factor that affects BW. It is recommended that the necessary interventions be made to minimize the factors causing premature births.

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Address reprint requests to:
M. KILIÇ, M.D.
Bozok Üniversitesi Sağlık Yüksekokulu
Erdoğan Akdağ Kampüsü
Atatürk yolu 7. km
66900 Yozgat (Turkey)
e-mail: mahmutkilic@yahoo.com