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COMPARISON OF FETAL MALNUTRITION FREQUENCY IN TURKISH AND REFUGEES TERM AGA NEONATES

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ABSTRACT

Objective: To assess the nutritional status of term appropriate for gestational age Turkish and refugees neonates at birth using the Clinical Assessment of Nutritional Status Scorein identifying fetal malnutrition (FM) in term neonates.
Methods: The study was conducted on AGA singleton neonates delivered 37–42 weeks of gestation at a NICU without severe perinatal illness. The ponderal index (PI) and Clinical Assessment of Nutritional Status Score were calculated.
Results: Two hundred and forty-one neonates were analyzed. Gestational week, birth weight, birth length, head circumference, maternal age, last pregnancy weight, and status of income;
maternal preeclampsia, and maternal urinary tract infection averages of the FM group were found to be lower when compared to the well-nourished (WN) group (p=0.011). The maternal drug use and paternal occupation status of the FM group were found to be significantly higher when compared to the WN group (p=0.014). Low baby weight (p=0.0001), low last pregnancy weight (p=0.017), and low level of income (p=0.042) were found to be the factors that affect the presence of FM.
Discussion: Low birth weight, low last pregnancy weight of the mother, and low-income level of the family are related to fetal malnutrition.

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INTRODUCTION

Fetal malnutrition (FM) is a clinical condition involving undeveloped muscle tissue and deficiency of subcutaneous fat tissue and is a significant contributor to perinatal morbidity and mortality (Sankhyan, 2009; Scott, 1966; Crosby, 1991; Adebami *et al*., 2007). It is a state of poor nutrition in-utero resulting from the inadequate supply and/or utilization of nutrients, leading to the fetus failing to acquire the adequate amount of fat, subcutaneous tissue, and muscle mass during intrauterine growth (Scott, 1966). This clinical state may be present at almost any birth weight. Globally, the incidence of FM is between 2% and 10% of total births, with the highest incidences in developing countries (Crosby, 1991). Recent studies have also shown that FM may have a far-reaching effect on adult life, such as susceptibility to cardiovascular diseases and non-insulin dependent diabetes mellitus (Barker *et al*., 1993; Barker, 1993; Latha *et al*., 2009). In recent years, it has been observed that children with FM are more likely to have lower IQ scores, require special education, or have a neurologic disability, intellectual disability, learning disorders, or seizures in late childhood compared to children without FM (Sankhyan, 2009; Walker, 2008; Geva *et al*., 2006; Soundarya *et al*., 2012; Von Beckerath *et al*., 2013; Fok *et al*., 2009; Adebami, 2008; Caiza, 2003). Fetal malnutrition has different causes, although in developed countries it is most often caused by placental insufficiency. A clinical score exists that does not appear often in the literature, the Clinical Assessment of Nutritional Status Score (CANSCORE), which was validated by Metcoff (Metcoff, 1994). It is easy to learn and quick to administer and consists of evaluating nine superficial clinical signs that differentiate between newborns with adequate nutrition and those with malnutrition (Metcoff, 1994). The aim of this study was to comparison of FM in term AGA newborns by means of the CANSCORE and with ponderal index (PI) for the assessment of the results in Turkish and refugees neonates.

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METHODS

Study design

This cross-sectional observational study was performed between 1 October 2015 and 31 May 2016 in Bagcılar Training and Research Hospital, Istanbul.

Live-born babies from normal, spontaneous, and singleton pregnancy terms between 37 and 42 pregnancy weeks, according to prenatal ultrasonographic measure and the last menstruation date (LMD) and their gestational age was confirmed with New Ballard scoring who give spontaneous vaginal birth at the Gynecology and Obstetrics Clinic Childbirth Unit of Bagcılar Training and Research Hospital were included in this study. Babies born by Caesarean section, babies born with complicated vaginal birth (obstetric forceps and vacuum extraction), breech births, multiple pregnancies, premature infants (gestational age <37 weeks), post mature infants (>42 gestational weeks), small for gestational age (SGA) or large for gestational age(LGA) babies by the week of pregnancy, newborns that were actively resuscitated postnatal in the delivery room, newborns with major anomalies (choanal atresia, diaphragmatic hernia, neural tube defect, gastroschisis, etc.), and babies requiring intervention due to suspected lung pathology, cyanotic congenital heart disease, early sepsis-meningitis or methemoglobinemia following clinical examination at the neonatal intensive care unit were not included in the study. The study protocol was approved by the ethical committee of Bagcilar Training and Research Hospital and written informed consent from a parent was obtained for each child prior to the study.

Sample size calculation

Previous studies reported fetal malnutrition ratio in Turkey 4.9%. Based on previous findings, we assumed that sample size of this study would allow us to detect differences in between the two groups (α =0.05, power = 80%). The α level was set at 0.05 based on a 2-sided, 2-sample t test.

Measurements

The age of gestation was determined by hospital staff average one hour after delivery by the LMD (last menstruation date) and New Ballard scoring, independently of the CANSCORE. The weight, length, and head circumference measurements of the newborns were taken by the delivery room nurse. Height was measured by Harpenden fixed stadiometer. Birth weight (g) was measured on a SECA balance scale. Using these data and Lubchenco intrauterine growth curves, the newborns were then classified as SGA (below the 10th percentile), AGA (average for gestational age) (between the 10th and 90th percentile) and LGA (above the 90th percentile) babies. AGA babies only were included in this study. The CANSCORE was applied by same individuals to each postnatal baby. Nine indications and findings to determine malnutrition were included in the assessment. Gestation age, position in the Lubchenco intrauterine development curve, and the CANSCOREs of the newborns who were found to have fetal malnutrition were evaluated.

Nine indications and findings to determine malnutrition were included in the assessment: gestation age, position in the Lubchenko intrauterine development curve, and the CANSCORE of the newborns who were found to be fetal malnourished were evaluated. CANSCORE features the estimated physical signs of good or bad nutrition (hair, cheeks, neck, and chin fatness; skin furrows with a deficiency of subcutaneous adipose tissue in the arms, legs, back, buttocks, abdomen, and chest). Each of the signs was rated from 4 (best) to 1 (worst). Values below 25 were assessed as fetal malnutrition, while the newborns with a score of ≥25 were assessed as "well nourished" (WN).The PI was calculated for all of the newborns included in the study, calculated as weight (g) × 100/length (cm^3). API <2.2 g/cm^3 was accepted as a sign of malnutrition.

Statistical analysis

Statistical analyses were performed using the NCSS (Number Cruncher Statistical System) 2007 statistical software (Utah, USA). In the assessment of the data, in addition to the descriptive statistical methods (mean and standard deviation), an independent t-test was used in the comparison of the binary groups with normal distribution variables, and the chi-square test was used in the comparison of the qualitative data. Logistic regression analysis was performed to determine the factors that affect the presence of ≤25 CANSCORE. The results determined as significant were $p<0.05$.

RESULTS

Of the live neonates, 241 AGA term, 73 refugees and 168 Turkish, were included in the study. Birth anthropometric measurements, gestational weeks, and parent features of the newborns are shown in Table 1. The FM rate in the babies in the study group was determined to be 58.9%; the FM rate was found to be significantly higher in the refugees group (71.23% refugees vs. 53.57%Turkish). According to the PI calculation, the FM rate in the study group was determined to be 64.3% (78.0% refugees. 58.30%Turkish). The average baby weight in the Turkish group was found to be higher than the refugees group (p=0.02). There were no differences in the birth length and head circumference between the refugees and Turkish groups (p=0.323) and no differences were observed in maternal age and paternal length averages between the refugees and Turkish groups (p=0.057).

The averages of the last pregnancy weight, maternal length, gravidity and parity, abortus, paternal age and paternal weight, income status (USD), and number of rooms in the house were found to be higher in the Turkish group when compared to the refugees group. There was no difference between the average number of household members in the houses where refugees and Turkish groups lived (p=0.252). The presence of FM in the Turkish group was found to be lower than in the refugees group (p=0.01). Maternal high-school and university education, smoking, profession, maternal diabetes, preeclampsia, and drug use were found to be higher in the Turkish group than the refugees group (p=0.019). No differences were observed in maternal allergy distribution and x-ray use between the refugees and Turkish groups (p=0.542).

There were no differences in maternal urinary tract infection, vaginal discharge follow-up in pregnancy, and parental occupation between the refugees and Turkish groups (p=0.506). Paternal high school and university grades in the Turkish group were found to be higher than the refugees group (p=0.018). Gestational week, baby weight, baby length, baby head circumference, maternal age, and pregnancy weight averages of the FM group were found to be lower than the WN group (p=0.011). No difference was observed ingravitidy, parity, abortus, paternal age, paternal weight, paternal length averages between the WN and FM groups (p=0.653). The income status (USD) averages of the FM group were found to be lower than the WN group (p=0.005) but no differences were

Table 1. General characteristics of the study population

	Refugees (n:73) Mean±SD	Turkish (n:168) mean±SD	p
Gestational Week	38.95 ± 0.9	39.11 ± 1	0.218
Birth Weight	3232.47 ± 442.32	3381.19 ± 460.07	0.02
Birth Length	49.82 ± 2.26	50.24 ± 2.19	0.175
Head Circumference	34.89 ± 1.59	35.09 ± 1.36	0.323
CANSCORE	23.84 ± 3.21	25.21 ± 3.51	0.005
Maternal Age	26.03 ± 5.48	27.74 ± 5.61	0.057
Last Pregnancy Weight	67.1 ± 9.49	71.72 ± 13.13	0.007
Maternal Length	159.32 ± 3.91	161.23 ± 6.02	0.013
Gravidity	2.34 ± 1.46	3.08 ± 1.56	0.001
Parity	2.18 ± 1.35	2.54 ± 1.24	0.042
Abortus	0.16 ± 0.44	0.54 ± 0.79	0.0001
Paternal Age	28.36 ± 6.25	32.45 ± 5.63	0.0001
Paternal Weight	74.4 ± 6.23	77.77 ± 10.76	0.013
Paternal Length	173.55 ± 3.16	174.41 ± 10.14	0.477
Status of Income (USD)	340.5 ± 65.09	510.36 ± 300.4	0.0001
Number of Rooms in the House	2.34 ± 0.63	3.05 ± 0.64	0.0001
Number of Household Members	5.83 ± 2.52	5.4 ± 2.63	0.252

Table 2. Social and parental characteristics of the study population

		Refugees N:73 (%)		Turkish N:168(%)		p
Gender	Male	40	54.8	71	42.26	0.07
	Female	33	45.2	97	57.74	
CANSCORE	≥25 CANSCORE	21	28.77	78	46.43	0.01
	<25 CANSCORE	52	71.23	90	53.57	
Ponderal Index(PI) <2.2	FM	57	78.0	98	58.3	0.003
Maternal Education	illiterate	21	28.77	19	11.31	0.0001
	Primary School	51	69.86	121	72.02	
	High School	0	0.00	22	13.10	
	University	1	1.37	6	3.57	
Smoking	Yes	1	1.37	21	12.50	0.006
Maternal Occupation	Yes	0	0.00	12	7.14	0.019
Maternal Diabetes	Yes	0	0.00	11	6.55	0.025
Maternal Preeclampsia	Yes	0	0.00	9	5.36	0.044
Allergy	Yes	0	0.00	2	1.19	0.349
Drug Use	Yes	3	4.11	32	19.05	0.002
Pregnancy exposed Rontgen	Yes	1	1.37	1	0.60	0.542
Maternal Urinary Tract Infection	Yes	22	30.14	58	34.52	0.506
Vaginal Discharge	Yes	31	42.47	71	42.26	0.977
Follow-up in Pregnancy	Yes	66	90.41	143	85.63	0.310
Paternal Education	Literate	7	9.59	9	5.36	0.018
	Primary School	62	84.93	124	73.81	
	High School	2	2.74	26	15.48	
	University	2	2.74	9	5.36	
Paternal Occupation	Yes	72	98.63	166	98.81	0.908

Table 3. General characteristics of the FM and WN groups

	Well Nourished (WN) (n:99)	Fetal Malnutrition (FM) (n:142)	p
Gestational Week	39.25 ± 0.93	38.93 ± 0.98	0.011
Birth Weight	3645.66 ± 396.93	3120.35 ± 367.31	0.0001
Birth Length	51.17 ± 1.79	49.38 ± 2.2	0.0001
Head Circumference	35.58 ± 1.33	34.65 ± 1.38	0.0001
Maternal Age	28.46 ± 6	26.51 ± 5.83	0.012
Last Pregnancy Weight	74.2 ± 12.39	67.61 ± 11.55	0.0001
Maternal Length	161.36 ± 6.15	160.15 ± 5.01	0.093
Gravidity	2.91 ± 1.64	2.82 ± 1.51	0.653
Parity	2.54 ± 1.35	2.36 ± 1.23	0.294
Abortus	0.37 ± 0.66	0.46 ± 0.76	0.375
Paternal Age	31.98 ± 6.17	30.67 ± 6.03	0.101
Paternal Weight	77.44 ± 10.01	76.27 ± 9.52	0.356
Paternal Length	174.04 ± 6.48	174.23 ± 9.89	0.871
Status of Income (USD)	535 ± 367.37	432.14 ± 187.04	0.005
Number of Rooms in the House	2.91 ± 0.66	2.8 ± 0.75	0.252
Number of Household Members	5.21 ± 2	5.75 ± 2.93	0.118

observed in gender, number of the rooms in the house, household members, and maternal education status, smoking, and profession between the WN and FM groups (p=0.252).

Maternal preeclampsia and maternal urinary tract infection in the FM group were found to be statistically significantly lower than the WN group (p=0.023) but no statistically significant

Table 4. Social and parental characteristics of the FM and WN groups

		Well-nourished group (n:99)		Fetal malnourished group (n:142)		p
Race	Refugees	21	21.21%	52	36.62%	0.01
	Turkish	78	78.79%	90	63.38%	
Gender	Male	55	55.56%	61	42.96%	0.054
	Female	44	44.44%	81	57.04%	
Maternal Education	Literate	11	11.11%	29	20.42%	0.199
	Primary School	73	73.74%	99	69.72%	
	High School	11	11.11%	11	7.75%	
	University	4	4.04%	3	2.11%	
Smoking	Yes	7	7.07%	15	10.56%	0.354
Maternal Occupation	Yes	6	6.06%	6	4.23%	0.519
Maternal Diabetes	Yes	6	6.06%	5	3.52%	0.353
Maternal Preeclampsia	Yes	7	7.07%	2	1.41%	0.023
Allergy	Yes	1	1.01%	1	0.70%	0.797
Drug Use	Yes	21	21.21%	14	9.86%	0.014
X-RAY	Yes	1	1.01%	1	0.70%	0.797
Maternal Urinary Tract Infection	Yes	40	40.40%	40	28.17%	0.047
Vaginal Discharge	Yes	45	45.45%	57	40.14%	0.411
Follow-up in Pregnancy	Yes	88	88.89%	121	85.82%	0.485
Paternal Education	Literate	9	9.09%	7	4.93%	0.228
	Primary School	70	70.71%	116	81.69%	
	High School	15	15.15%	13	9.15%	
	University	5	5.05%	6	4.23%	
Paternal Occupation	Yes	96	96.97%	142	100.00%	0.037

Table 5. Logistic regression analysis of those affected by fetal malnutrition

	B	S.E.	p	OR	OR 95% GA	
					Lower Limit	Upper Limit
Gestational Week	-0.01	0.18	0.948	0.99	0.69	1.41
Birth Weight	-0.00	0.00	0.0001	1.00	0.91	1.00
Maternal Age	-0.02	0.03	0.573	0.98	0.92	1.05
Last Pregnancy Weight	-0.04	0.02	0.017	0.97	0.94	0.99
Level of Income	-0.05	0.01	0.042	1.00	0.98	1.00
Refugees race	-0.07	0.42	0.864	1.08	0.47	2.47
Hypertension	-0.73	1.11	0.513	0.07	0.04	1.13
Drug use	-0.29	0.52	0.574	1.34	0.49	3.67
Urinary Tract Infection	-0.68	0.37	0.068	1.98	0.95	2.12

differences were observed in maternal allergy distribution, x-ray use, vaginal discharge, follow-up in pregnancy and paternal education status between the FM and WN groups (p=0.797). Maternal drug use in the FM group was found to be statistically significantly higher than the WN group (p=0.014) and paternal profession in the FM group was found to be statistically significantly higher than the WN group (p=0.037). Low baby weight (p=0.0001), low last pregnancy weight (p=0.017), and low level of income (p=0.042) were determined to be the factors affecting the presence of FM.

DISCUSSION

Policies related to the health problems of refugees are being developed all over the world, especially in countries that receive immigration. In our country, especially the children brought by the refugees in recent years, as well as the pregnancies they have experienced in our country, are causing a number of new demographic features in newborn and child health. This is particularly noticeable in large cities, especially those with high migration. Our unit is a 3rd level center in Istanbul and the proportion of refugee babies born is 33%. There have been few studies classifying neonates based on the CANSCORE and analyzing its validity in detecting FM, and most of those have been conducted in developing countries (Sankhyan *et al*., 2009; Soundarya *et al*., 2012; Adebami, 2008; Velazquez, 2007). FM is prevalent in developing countries (4). FM rate has been estimated to be 8–10% in developing countries (Mehta *et al*., 1998).

The present study evaluated 142 babies for FM. The average birth weight of the babies was 3120 ± 367 g, which was higher than the 3067 g recorded in Ile-Ife in Nigeria and the 2600 g reported in India (Barker *et al*., 1993; Ezenwa *et al*., 2013), although lower than the 3290 g documented by Metcoffin the USA (15). Previous researchers have demonstrated that not all SGA babies have FM and that some AGA babies may have features of FM, for example in the study by Metcoff, in which the prevalence of FM was reported to be 5.5% in AGA babies (Metcoff, 1994), and the study by Sankhyan *et al*. (2009) where it was 3.8%. Adebami *et al***.** detected FM in 11.5% of term AGA babies using the CANSCORE[4].

In our study, the CANSCORE identified FM in 58.9% of term AGA babies, which indicated that these babies suffered from FM in spite of having normal birth weight and thus that FM is not rare in AGA neonates. In fact, the incidence of FM in Turkish and refugees infants is around 50%, taken together, with the ratio being higher in refugees than in Turkish neonates. Considering the nutritional conditions and antenatal care of pregnant mothers who migrate from other countries and their low level of income, the reason for this situation can be understood. As a result of political events, Turkey has taken the immigrant migrants from refugees to the Turkey and created a living space for them. For this reason, these migrant mothers give birth and treat their neonates. The PI has been used by various authors to classify the intrauterine growth in FM infants. The present study recorded an FM prevalence of 64.31% in term babies using the PI.

This is higher than the prevalence recorded by Mehta *et al.* (29.19%) and Kashyap *et al*. (27.8%) (Villar, 2006; Vedmedovska *et al*., 2010). It is, however, comparable with the lower prevalence of 8.1% documented by Adebami *et al.* (2007) both Mehta *et al.* and Kashyap *et al.* combined late gestational preterm babies of ≥ 35 weeks with the analysis of their results, which may thus have contributed to their higher prevalence (Mehta *et al*., 1998; Kashyap, 2006). Of the babies with normal PI, 142 (58.9%) were found to be malnourished using the CANSCORE in the present study, which underscores the limitations of the PI in identifying FM. Similar results were obtained by the Nigerian study by Ezenwa *et al*. (2016) which calculated the PI and CANSCORE Ein FM neonates and reported that PI was not accurate as a single identifier of FM in neonates. In the present study, logistic regression analysis was performed with gestational week, birth weight, maternal age, last pregnancy weight, level of income, refugees race, hypertension, drug use and urinary tract infection variables. Low birth weight, low last pregnancy weight (p=0.017), and low level of income (p=0.042) were determined to be risk factors.

The study carried out by Villar*et al*.[19]on the relationship between preeclampsia and gestational hypertension with intrauterine growth restriction reported that morbidity and mortality problems significantly increased in preeclampsia and gestational hypertension. In our study, maternal preeclampsia was found to be higher in the WN group. That hypertension was not determined as a risk factor in the regression analysis suggests that hypertension alone is not sufficient to identify fetal malnutrition. Vedmedovska *et al*. (2010) reported that fetal growth retardation was more evident in the babies of mothers with preeclampsia and urogenital infection during pregnancy when compared to the control group. In their study on the maternal and perinatal results of women who had urinary tract infection in pregnancy. In our study, no difference was determined in smoking, despite it being high in the mothers of the FM group. Preeclampsia and maternal urinary tract infection were found to be higher in the WN group, though.

Hatfield *et al*. (2011) and Hay (2012) reported that babies with gestational diabetes had numerous problems, such as intrauterine growth restriction. In our study, the gestational diabetes mellitus frequency was found to be higher in the WN group, although no significant difference was determined. The study carried out by Bernstein *et al*. (2000), investigating the relationship between fetal growth and maternal smoking, reported that fetal muscle mass and fetal growth decreased in the babies of the mothers who smoke. The study carried out by Harrison *et al*. (1983) on maternal smoking and fetal body composition reported that birth weight and birth length of the babies whose mothers smoked were lower than non-smoking mothers. The study conducted by Davies *et al*. (1976) on the relationship between smoking and fetal growth in the second half of pregnancy reported that there was a significant difference between birth weight, birth head circumference, and birth length between the babies with mothers who smokedand those who did not. No significant difference was determined in our study, however, although the level of smoking was higher in the FM group. There are some limitations of this study. Firstly our study has only included AGA term neonates. Premature neonates, and SGA and LGA neonates were not included to study.

As a result, the relatively small number of cases can be restrictive for results. However, our study is important in terms of comparing the babies of mothers who have different cultures within the same country. The results are valuable in terms of assessing the situation of the migrant mothers only AGA neonates included to study. In summary, the low maternal last pregnancy weight and the low level of income of the family were found to be related to fetal malnutrition. The FM rate in refugees AGA babies was found to be higher than Turkish AGA babies. We believe that the factors of forced migration, nutrition, and accommodation were likely to be causative.

Declaration of ConflictingInterests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/orpublication of thisarticle.

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