THE TIME OF FIRST PASSAGE OF MECONIUM IN INBORN NEONATES IN BAGHDAD TEACHING HOSPITAL- MEDICAL CITY

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SUMMARY: The first passage of stool after birth (meconium), is delayed in preterm neonates compared to term neonates. Ninety-nine percent of term infants and 76% of premature infants pass a stool in the first 24 hours of life. Ninety-nine percent of premature infants pass a stool by 48 hours.

To explain the effect of some factors on the time of first passage of meconium(POM) in neonates.

Between January and March 2009, all neonates born in Baghdad teaching Hospital-medical city-Baghdad, with gestational age (GA) of 28-42 weeks and without metabolic, congenital or gastrointestinal diseases, were included. Neonates were divided into four groups: A. GA ≤ 30 weeks, B GA 31-34 weeks, C GA 35-36 weeks, D GA ≥ 37 weeks(term). Neonates were followed for first POM.

A total of 222 neonates (115 males); 12, 22, 29 and 159 neonates in group A, B, C and D respectively were included. With decreasing gestation, a trend was found for delayed first POM (P<0.0001).Compared to term neonates 157/159 (98.7%), less preterm neonates passed their first stool within 24 hours after birth group A; 2/12 (16.6%); group B; 9/22 (40.9%); and group C; 26/29 (89.6%). First POM was associated with birth weight < 2.5 kg (P= 0.0001), 42/69 (60.8%) of neonates passed their first stool within 24 hours after birth, compared to 152/153 (99.3%) of neonates > 2.5 kg. The time of first POM was associated with type of feeding (P=0.0001) and with the need for respiratory support, (P=0.0001). First POM was not associated with gender, and birth weight in relation to GA.

More than (98.7%) of term neonates passed their first stool within 24 hours after birth. The first POM was delayed in preterm neonates compared to term neonates. The first POM was significantly associated with gestational age. It was also delayed with decreasing birth weight, and in neonates who need respiratory support compared to those who did not. The first POM was earlier in breast fed neonates compared to formula fed or combined type of feeding.

Key words: factors, first passage of meconium, neonates

INTRODUCTION

The earliest stools after birth consist of Meconium, a dark, viscous material that is normally passed within the first 48 hrs of life. With the onset of feeding, Meconium is replaced by green-brown transition stools often containing curds and after 4-5 days, by yellow brown milk stools (1). Some passage of meconium (POM) usually occurs within first 12 hour after birth (2). Ninety-nine percent of term infants and 76% of premature infants pass a stool in the first 24 hours of life. Ninety-nine percent of premature infants pass a stool by 48 hours (3).

Intrauterine meconium passage in near-term or term fetuses has been associated with feto-maternal

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Table 1: The frequency distribution of some neonatal characteristics and first POM.

Characteristics value (model)		Frequency (n)	Relative frequency (%)	Cumulative frequency (%)
Gender	Male	115	51.8	51.8
	Female	107	48.2	100
Gestational age	Group. A GA ≤ 30 weeks	12	5.4	100
	Group. B GA 31-34 weeks	22	9.9	94.6
	Group. C GA 35-36 weeks	29	13.1	84.7
	Group. D GA ≥ 37 weeks	159	71.6	71.6
Birth weight	< 1.5 kg-10th-25th %	23	10.4	100
	1.5-2.5 kg- 25th-50th%	46	20.7	89.6
	2.5-3.5 kg- 50th-75th %	115	51.8	68.9
	> 3.5 kg- 75th -90th %	38	17.1	17.1
Maturity and intrauterine growth	SGA < 10th %	4	1.8	100
	LGA > 90th %	35	15.8	98.2
	AGA 10th-90th %	183	82.4	82.4
Type of feeding	Breast feeding	123	55.4	100
	Formula feeding	59	26.6	44.6
	Combined feeding	40	18.0	18
Need for respiratory support	Yes	95	42.8	100
	No	127	57.2	57.2
First Passage of meconium in hours	1st- 12th hour	128	57.7	100
	13th – 24th hour	66	29.7	42.3
	25th- 36th hour	21	9.5	12.6
	37th- 48th hour	7	31	3.1

stress factors and/or infection, whereas meconium passage in post term pregnancies has been attributed to gastrointestinal maturation (4).

In very low birth weight infants, delay in the passage of the first stool is a common occurrence. This delay is probably due to physiological immaturity of the motor mechanisms of the gut, and lack of triggering effect of enteral feeds on gut hormones (5).

Infants born vaginally were more acidotic and passed first stool earlier compared to those born by cesarean section. The same applies to vaginally delivered babies when comparing babies born to primipara and others (6).

This study aimed to explain the effect of some factors on the first POM in neonates delivered in Baghdad hospital-medical city-Baghdad, like gestational age, birth weight, gender, type of feeding, maturity and intrauterine growth and the need for respiratory support.

MATERIALS AND METHODS

This cross-sectional descriptive study had been carried out in the department of obstetrics and neonatal care unit of Baghdad Teaching Hospital/medical city complex, Baghdad, during the time period from first of January to first of March 2009. This Hospital contains 50 beds for maternity ward and the NCU contains 12 incubators, and receiving mothers from different governmental, privates hospitals and primary health centers and midwifes for delivery especially for high risk mothers and fetuses.

Table 2: First Passage of meconium in hours in relation to gender.

Gender	1st-12th Hr n (%)	13th-24th Hr n (%)	25th-36th Hr n (%)	37th-48th Hr n (%)	Total n (%)
Males	63 (49.2)	38 (57.6)	10 (47.6)	4 (57.1)	115 (51.8)
Females	65 (50.8)	28 (42.4)	11 (52.4)	3 (42.9)	107 (48.2)
Total	128 (100.0)	66 (100.0)	21 (100.0)	7 (100.0)	222 (100.0)

P value= 0.694.

Table 3: First Passage of meconium in hours in relation to gestational age.

Gestational age	Group-1 1st-12th Hr n (%)	Group-2 13th-24th Hr n (%)	Group-3 25th-36th Hr n (%)	Group-4 37th-48th Hr n (%)	Total n (%)
Group. A GA $\leq$ 30 wks.		2 (3.0)	5 (23.8)	5 (71.4)	12 (5.4)
Group. B GA 31-34 wks.	2 (1.6)	7 (10.6)	11 (52.4)	2 (28.6)	22 (9.9)
Group. C GA 35-36 wks.	11 (8.6)	15 (22.7)	3 (14.3)		29 (13.1)
Group. D GA $\geq$ 37 wks.	115 (89.8)	42 (63.6)	2 (9.5)		159 (71.6)
	128 (100.0)	66 (100.0)	21 (100.0)	7 (100.0)	222 (100.0)

P value = 0.0001

A total number of 222 neonates born with gestational age (GA) between 28-42 weeks and without Metabolic, congenital diseases or gastrointestinal disorders requiring surgery, were eligible for this study. Neonates who died during their Hospital stay and neonates transferred to other Hospitals were excluded.

We prepared a special questionnaire which included name, gender, age in hours, gestational age, birth weight, type of feeding, need for respiratory support, maturity and intrauterine growth, first stool; meconium or not meconium and the first passage of meconium in hours.

Stools were classified as meconium or not meconium based on consistency and color; meconium is characterized as thick, sticky and greenish black in color.

Neonates were divided into four groups in relation to their gestational age based on ultrasonography reports in the first trimester, date of the last menstrual period and clinical estimation of neonatal gestational age (Numerical score); Texture of hair, ear, Breast tissue, external genitalia and sole. The 4 groups based on their GA include: A $\leq$ 30 weeks, B 31-34 weeks, C 35-36 weeks. Less than 37 weeks neonates were preterm neonates, and D $\geq$ 37 weeks (Term).

Neonates were small for gestational age (SGA) if birth weight was lower than the 10th percentile and large for gestational age (LGA) if their birth weight exceeded the 90th percentile. Birth weight between the 10th and 90th percentile were considered normal (AGA).

Birth weight were divided into four categories as follows: < 1.5 kg; 10th -25th %, 1.5-2.5 kg; 25th-50th %, 2.5-3.5 kg; 50th-75th %, and > 3.5 kg; 75th-90th %.

All data were collected and coded in a statistical package for social science- (SPSS-14 file). Summarizing data was done by using numbers and percents. Association between different variables was measured by using a chi-square test. A chi-squared test for trend was used to examine whether a relation was existed between gestational age (four groups) and the proportion of neonates having their first POM within 24 hours and 48 hours. In a multivariable linear regression mode, we examined the independent effect of gestational age (continuous)] and dependent effects of birth weight (categorical), type of feeding, need for respiratory support (yes/no), gender, maturity and intrauterine growth on time of first POM. P value of $\leq$0.05 was considered significant.

RESULTS

A total of 222 neonates, 115 males (51.8%) and 107 females (48.2%) were included in this study. Neonates were divided into four groups in relation to their gestational age(GA). Frequency distribution of GA: 12 (5.4%), 22

Table 4: Baseline characteristics and first POM.

Characteristics	Group-A	Group-B	Group-C	Group-D	P value
Gestational age	≤ 30 wks. n (%)	31-34 wks. n (%)	35-36 wks. n (%)	≥ 37 wks. n (%)	
Subject (n) and %	12 (5.4)	22 (9.9)	29 (13.1)	159 (71.6)	
Median birth weight (gm) (Min-Max)	(1100) 1000-1200	(2100) 1300-2900	(2375) 1750-3000	(3500) 2100-4900	
Type of feeding number and % of breast-fed	0 (0.0)	2 (9.9)	11 (37.9)	110 (69.1)	
Number and percent of formula fed	12 (100)	18 (81.8)	10 (34.4)	18 (11.3)	
Number and percent of combined feeding	0 (0.0)	2 (9.09)	8 (27.5)	31 (19.4)	
First passage of meconium within 24 Hr	2 (16.6)	9 (40.9)	26 (89.6)	157 (98.7)	0.0001
First passage of meconium within 48 Hr	10 (83.3)	13 (59.09)	3 (10.3)	2 (1.2)	0.0001

(9.9%), 29 (13.1%) and 159 (71.6%) for group A, B, C and D respectively.

Neonates were divided into four categorical groups based on percentile chart of their birth weight; as follows: Twenty three (10.4%), 46 (207%), 115 (51.8%) and 38 (17.1%) for group 1,2,3 and 4 respectively.

Frequency distribution of maturity and intrauterine growth was; 4 (1.8%), 35 (15.8%) and 183 (82.4%) for SGA, LGA and AGA respectively.

Regarding the frequency distribution of type of feeding, neonates were breast-fed, formula-fed and on combined type of feeding; 123 (55.4%), 59 (26.6%), and 40 (18.0%) respectively.

Frequency distribution of the need (or not) for the respiratory support; 95 (42.8%) neonates needed respiratory support while 127 (57.2%) neonates need no respiratory support.

Frequency distribution of first POM in hours were 128 (57.7%), 66 (29.7%), 21 (9.5%) and 7 (3.1%) neonates who passed their first stool within the first and 2nd half of the 24th hour and 1st and 2nd half of the 48th hour of their life respectively (Table 1).

There was no significant trend between males and female neonates in relation to the first POM in hours, P value = 0.694. Sixty three out of 115 (54.7%) of males, 65/107 (60.7%) of females, and 38/115 (33.4%) of males, 28/107 (26.1%) of females had passed their first stool during the first and 2nd halves of the 24th hour of age respectively, while 10/115 (8.6%) of males, 11/107 (10.2%) of females and 4/115 (3.4%) of males and 3/107 (2.8%) of females had passed their first stool during the first and 2nd halves of the 2nd day (48th hour) respectively (Table 2).

Frequency distribution of gestational age; group. A 12 (5.4%), group B 22 (9.9%), group C 29 (13.1%) and group D 159 (71.6%) of the total number (222) of neonates.

There was a significant trend for delayed first POM within 24 and 48 hrs of age with decreasing gestation; (P value= 0.0001). First POM within 24th hour occurred in 157/159 (98.7%) of term neonates(group D), 2/12 (16.6%), 9/22 (40.9%) and 26/29 (89.6%) of groups A, B and C respectively. First POM within 48th hour occurred in 10/12 (83.3%), 13/22 (59.9%), 3/29 (10.3%) and 2/159 (1.2%) of group A, B, C and D respectively. So the more advanced gestational age is the earlier passage of first Meconium (Tables 3 and 4).

Frequency distribution of birth weight; group 1 23 (10.4%), group 2 46 (20.7%), group 3 115 (51.8%) and group 4 38 (17.1%) of the total number (222) of neonates.

There was a significant trend for delayed first POM within 24th and 48th hour of age with decreasing birth weight; Seven out of 23 (30.4%), 35/46 (76.8%), 115/115 (100%) and 37/38 (97.3%) neonates in group 1, 2, 3 and group 4 respectively passed their first stool within 24th hour off age (P value=0.0001). Sixteen out of 23 (69.5%), 11/46 (23.9%), 0/115 (0%) and 1/38 (2.6%) of neonates in group 1, 2, 3 and group 4 respectively passed their first

Table 5: First passage of meconium in hours in relation to birth weight.

Birth weight	Group-1 1st-12th Hr n (%)	Group-2 13th-24th Hr n (%)	Group-3 25th-36th Hr n (%)	Group-4 37th-48th Hr n (%)	Total n(%)
Group 1 < 1.5 kg		7 (10.6)	10 (47.6)	6 (85.7)	23 (10.4)
Group 2 1.5-2.5 kg	20 (15.6)	15 (22.7)	10 (47.6)	1 (14.3)	46 (20.7)
Group 3 2.5-3.5 kg	81 (63.3)	34 (51.5)			115 (51.8)
Group 4 > 3.5 kg	27 (21.1)	10 (15.2)	1 (4.8)		38 (17.1)
Total	128 (100.0)	66 (100.0)	21 (100.0)	7 (100.0)	222 (100.0)

P value = 0.0001

stool within 48th hour of age (P value = 0.0001) (Table 5).

Frequency distribution of type of feeding; group-1 123 (55.4%), group-2 59 (26.6%) and group-3 40 (18.0%) of the total number (222) of neonates.

There was a significant difference in first POM with different types of feeding, 121/123 (98.3%), 35/59 (59.3%) and 38/40 (95.0%) of neonates in group 1, 2, and 3 respectively passed their first stool within 24th hour of age. Two out of 123 (1.6%), 24/59 (40.6%) and 2/40 (5.0%) of neonates in group 1, 2, and 3 respectively passed their first stool within 48th hour of age (P value = 0.0001) (Table 6).

Frequency distribution of the need (or not) for respiratory support; group-1 95 (42.8%), and group-2 127 (57.2%) of the total number (222) of neonates.

There was a significant trend for delayed First POM within 24th hour as well as 48th hour in neonates who needed respiratory support; 68/95 (71.5%) and 27/95 (28.4%) respectively, compared with 126/127 (99.2%), and 1/127 (0.78%) respectively who need no respiratory support (P value = 0.0001) (Table 7).

Frequency distribution of maturity and intrauterine growth; SGA 4(1.8%), LGA 35(15.8%), and AGA 183 (82.4%) of the total number (222) of neonates.

There was no significant difference in First POM during the 24th and 48th hour of age between SGA, LGA and AGA groups. SGA 4/4 (100.0%), LGA 35/35 (100.0%), and AGA 155/183 (84.6%) of neonates were passing their first stool during the 24th hour of age. First POM within the 48th hour of age occurred in 28/183 (15.3%) neonates of AGA group compared with 0.0% in SGA and LGA groups (P value= 0.263) (Table 8).

In a multivariate linear regression model, we examined the independent and dependent effects of the following factors on duration of first POM. Gestational age (independent effect) P value= 0.0001. Other factors were dependent include, Gender; P value = 0.494, Birth weight; P value = 0.977, Type of feeding; P value = 0.620, Maturity and intrauterine growth; P value = 0.582, Respiratory support; P value = 0.137 (Table 9).

DISCUSSION

During the three months period of this study, 222 admitted neonates 115(51.8%) males and 107 (48.2%)

Table 6: First Passage of meconium in hours in relation to type of feeding.

Type of feeding	Group-1 1st-12th Hr n (%)	Group-2 13th-24th Hr n (%)	Group-3 25th-36th Hr n (%)	Group-4 37th-48th Hr n (%)	Total n (%)
Breast feeding	88 (68.8)	33 (50.0)	2 (9.5)		123 (55.4)
Formula feeding	14 (10.9)	21 (31.8)	17 (81.0)	7 (100.0)	59 (26.6)
Combined feeding	26 (20.3)	12 (18.2)	2 (9.5)		40 (18.0)
	128 (100.0)	66 (100.0)	21 (100.0)	7 (100.0)	222 (100.0)

P value = 0.0001

Table 7: First Passage of meconium in hours in relation to the need for respiratory support.

Respiratory support		Group-1 1st-12th Hr n (%)	Group-2 13th-24th Hr n (%)	Group-3 25th-36th Hr n (%)	Group-4 37th-48th Hr n (%)	Total n (%)
Group-1	Yes	35 (27.3)	33 (50.0)	20 (95.2)	7 (100.0)	95 (42.8)
Group-2	No	93 (72.7)	33 (50.0)	1 (4.8)		127 (57.2)
Total		128 (100.0)	66 (100.0)	21 (100.0)	7 (100.0)	222 (100.0)

P value = 0.0001

Table 8: First Passage of meconium in hours in relation to maturity and intrauterine growth.

Maturity and intrauterine growth	1st-12th Hr n (%)	13th-24th Hr n (%)	25th-36th Hr n (%)	37th-48th Hr n (%)	Total n (%)
SGA	3 (2.3)	1 (1.5)			4 (1.8)
LGA	25 (19.5)	10 (15.2)			35 (15.8)
AGA	100 (78.1)	55 (83.3)	21 (100.0)	7 (100.0)	183 (82.4)
Total	128 (100.0)	66 (100.0)	21 (100.0)	7 (100.0)	222 (100.0)

P value = 0.263

females. There was no significant trend or difference between male and female neonates in relation to the first passage of meconium in hours (P value= 0.694) in this study. No other previous or recent studies are found regarding the comparison between males and females in relation to the first POM in hours.

There was a significant trend for gestational age in relation to the first POM in hours (p value= 0.0001) in this study, 159 (71.6%) term neonates had passed their first stool earlier than 63(28.4%) preterm neonates. These results agree with Kumar SL *et al.* (1995)(7) who documented 172/221(78%) term neonates passing stool during the first 24 hours of age (the median age of neonates at time of first stool was 18 hours) while 49/221(22%) preterm neonates passing stool by 100 hours after birth. Bekkali (8) (2008) had documented 56/71(79%) of term neonates passed their first POM within 24 hours after birth while 80/127(67%) of preterm neonates passed their first POM within 48hours after birth.

This difference is also reported by other studies (3,5). This delay is most likely due to ongoing developmental maturation of bowel function which results in intestinal hypomolility (9). In accordance with earlier studies more than 98% of term neonates pass their first meconium stool within 48 hours of age (3,10).

Earlier studies in premature neonates showed impaired gastric electrical activity and gastric emptying, characterized by more frequent clustered phasic contractions but of shorter duration and lower amplitude (11). Furthermore manometric investigations of small intestinal motility demonstrated that duodenal clusters were less common and antroduodenal coordination was more immature in preterm neonates compared to term neonates (9, 12, 13).

Little information is available regarding the prenatal development of colonic motility. One study using amniography, showed that progression of contrast from mouth to colon took 9 hour at 32 weeks of gestational age but only half that time at term (14).

Later studies suggest that mechanism of rectal propulsion is impaired in preterm neonates leading to failure of normal expulsion of the meconium plug, or that meconium plug itself is too difficult to expel as a result of its consistency that differs in composition (glycoprotein, saccharides, calcium, copper, iron and phosphorous) from that of term neonates, making it thicker and more difficult to expel (8).

Table 9: A multivariate linear regression analysis model of variance of factors influencing First POM.

	Unstandardized coefficients		Standardized coefficients		Significant
Model	B	Std. Error	Beta	T	
Gender	-5.278E-02	0.077	-0.033	-0.684	0.494
Gestational age	-0.582	0.076	-0.649	7.694	0.0001
Birth weight	2.300E-03	0.079	0.002	0.029	0.977
Maturity and intrauterine growth	5.431E-02	0.098	0.030	0.552	0.582
Feeding	2.544E-02	0.051	0.025	0.496	0.620
Respiratory support	-0.138	0.092	-0.086	1.493	0.137
A dependent variable: First POM in hours					

Motilin, an intestinal peptide that stimulates contraction of intestinal muscles is in lower concentrations in the intestine of premature neonates versus term neonates. Intestinal parasympathetic innervations and myelination also increase throughout gestation and may play a role in amplified POM in late gestation (2).

There was a significant trend for delayed first POM within 24 and 48 hours of age with decreasing birth weight in this study (P value =0.0001). This result a grees with Jhaveri (15) who documented delay due to physiologic immaturity of the motor mechanisms of the gut, lack of triggering effect of enteral feeds on gut hormones and the presence of severe respiratory distress syndrome which may singly or in concert adversely affect gastrointestinal motility. In very low birth weight infants, delay in the passage of the first stool is a common occurrence. This delay is probably due to physiological immaturity of the motor mechanisms of the gut, and lack of triggering effect of enteral feeds on gut hormones (5). Eighty-eight percent of the full term neonates passed meconium at 15.4 +/- 3.6 hrs of life while only 12.0% of them passed meconium after 24 hrs of life and all by 48 hrs of life. The mean time of passage of stools by preterm, low birth weight babies was 45.2 +/- 2.4 hrs (16). Our results disagree with Ajavi *et al.* (17) who found that volume of feeding per/day increased each week over that of preceding week but stooling frequency was not related to the increased volume or any other variables.

There was a significant difference in first POM with different types of feeding in our study (P value = 0.0001). This result disagrees with Metaj (18) , in which the type of feeding did not predict time to first stool but gestational age was important even in this near-term and term population of infants >34 weeks gestation. Our results disagrees with Ameh *et al.* study (Nigeria 2009) in which the mode of delivery, birth weight and artificial milk had no effect on time of passing meconium and the subsequent stooling pattern (19). This may be due to earlier and more frequently fed neonates than formula or combined type of feeding, in addition to the higher content of lactose in Breast milk that facilitates gastric emptying and early POM.

In our study, there was a significant trend for delayed POM in neonates who needed respiratory support compared with those who did not (P value = 0.0001). While Bekkali *et al.* (8) reported that there was no effect of the need for respiratory support on first POM. In our study, the cause may be due to stress conditions that neonates suffer during the need for respiratory support leading to Intestinal ischemia by diving reflex which shunts blood preferentially to the brain, heart and away from visceral organs during hypoxia due to increased sympathetic inflow while those who did not need respiratory support have had increased peristalsis and relaxation of anal sphincter caused by vagal outflow (20).

There was no significant trend or difference for maturity and intrauterine growth in relation to first POM, (P value=0.263). In this study, this result agrees with Bekkali (8) who documented that SGA did not delay POM stools but she found prolonged POM (univariate model) but not delayed first POM in those neonates and LGA had delayed first POM compared to neonates with normal birth weight but duration of POM was not more

prolonged in these neonates (LGA). A possible Explanation was that 80% of LGA neonates born from mothers without diabetes suffer from hypoglycemia one hour after birth. This may suggest higher circulating glucose levels during the prenatal period of LGA neonates with consequences for gastrointestinal tract motility.

In multiple regression analysis in this study, gestational age was the only significant factor (P value = 0.0001) in predicting time to first POM (independent factor). This result agrees with Metaj (18).

CONCLUSION

More than (98.7%) of term neonates passed their first stool within 24 hours after birth. The first POM was delayed in preterm neonates compared to term neonates. The first POM was significantly associated with gestational age. It was also delayed with decreasing birth weight, and in neonates who need respiratory support compared to those who did not. The first POM was earlier in breast fed neonates compared to formula fed or combined type of feeding.

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