

Knowledge and Practice of Umbilical Cord Clamping among Maternity Care Providers

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ARTICLE INFO	ABSTRACT
<p><i>Article type:</i> Original article</p>	<p>Background & aim: Based on the current scientific evidence, delayed cord clamping (DCC) elevates early hemoglobin concentrations and iron stores in the neonate. However, the persistent practice of early cord clamping (ECC) is still a routine care. The aim of the present study was to investigate the umbilical cord clamping practices of maternity care providers in Oman.</p> <p>Methods: This cross-sectional study was conducted on 175 maternity care providers who were registered members of the Oman Society of Obstetricians and Gynecologists and participated voluntarily in the study. The data were collected using a modified version of an online survey in form of a questionnaire developed by Stoll and Hutton (2012). The data were analyzed using descriptive statistics.</p> <p>Results: According to the results, 61% and 31% of the participants were obstetricians and midwives, respectively, with more than 10 years of experience. The findings indicated that the timing of cord clamping varied among the participants. 87.4-89.6% of the care providers considered ECC timing to be within 1 min of birth, and 70-72.6% of them clamped umbilical cord within 1 min for both normal term and preterm newborns. The most frequently listed benefits of DCC were the physiologic transitioning of the newborn, enhancement of neonatal iron stores, reduced risk of neonatal anemia, and decreased need for transfusions. 45.7% of the participants considered polycythemia and jaundice as the highest associated risks of DCC. Only 11% of the participants reported that they use hospital policy as a reference guide on decision making regarding the timing of cord clamping.</p> <p>Conclusion: Although the majority of the maternity care providers are aware of the new guidelines regarding the timing of cord clamping, they still follow ECC practice. The high prevalence of ECC highlighted the demand for the implementation of a nation- and hospital-wide policy.</p>
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Introduction

Early umbilical cord clamping (ECC) practice is a routine care performed worldwide. Delayed cord clamping (DCC) facilitates the transition of additional blood from the mother to the neonate until around 2-3 min post-birth or after the stoppage of the cord pulse. Accordingly, this practice reduces the risk of iron deficiency

anemia during the infancy. In the term newborns, DCC is associated with a higher early hemoglobin concentration, improved ferritin levels, increased iron stores, and decreased risk of iron deficiency anemia in the infancy. This practice even results in the improvement of long-term neurodevelopment (1-3).

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Even with the well-documented benefits of DCC, the majority of the maternity care providers still perform ECC, and they follow different cord clamping timing. Regarding the growing evidence showing that DCC increases early hemoglobin concentrations and iron stores in the newborns, a more liberal approach is to delay the clamping of the umbilical cord in the healthy neonates.

The systematic reviews and meta-analyses of randomized controlled trials investigating the effect of umbilical cord clamping timing by the Cochrane Collaboration have concluded that DCC is beneficial in terms of elevating early hemoglobin concentrations and iron stores in the newborn. Therefore, they have recommended a substantial approach to delay the clamping of the umbilical cord in the healthy term neonates as long as the access to treatment for jaundice requiring phototherapy is available (4).

The results of these meta-analyses suggested that enhanced placental transfusion by DCC at birth provides better outcomes for the preterm neonates, the most notable of which include reductions in overall mortality, lower risk of intraventricular hemorrhage, decreased blood transfusion incidence, and lower risk of necrotizing enterocolitis (5-7). The DCC in the very preterm newborns has been reported to be safe, feasible, and effective with no adverse consequences (8).

As indicated by a large number of studies, DCC has undisputable benefits (4, 9, 10). The DCC translates into a physiologic 'placental transfusion' of up to a 30 mL/kg of blood to the neonate, and a 40-60% increase in the red cell volume (4, 10, 11). The ECC is an intervention depriving a neonate from up to 30% of its circulatory blood volume at the most critical few minutes of his/her entire life, leading to a potential for iatrogenic hypoxia, hypovolemia, anemia, and low iron stores (9).

In response to the studies conducted over the past decade on the importance of the individual components of the active management of the third stage of labor, leading international organizations, including the World Health Organization (WHO) (12), International Federation of Gynecologists and Obstetricians, and International Confederation of Midwives (13) have redefined the criteria, which exclude

the practice of ECC.

Late cord clamping (performed 1-3 min after birth) is recommended for all births while initiating simultaneous essential newborn care (12). The WHO confirms this practice in their "Recommendations on Basic Newborn Resuscitation", indicating that "in newly-born term or preterm babies who do not require positive pressure ventilation, the cord should not be clamped earlier than 1 min after birth" (12).

In this regard, in the same document, the ideal timing of "around 3 min" has been considered as the "lower limit". Finally, in a statement released by the Royal College of Obstetricians and Gynecologists in 2013 (14) in response to new evidence from the Cochrane Review on the timing of cord clamping, it was recommended that the umbilical cord should not be clamped earlier than necessary, based on the clinical assessment of the situation (14).

For the healthy women with term neonates, the National Institute for Health and Care Excellence recommends not to clamp the cord in the first 60 sec, except when there are concerns about the cord integrity or neonatal heart rate. Despite the new well-established scientific evidence, the practice of ECC is a standard care routine that stubbornly persists in many countries worldwide (2).

There are many reasons accounting for the implementation of ECC, such as a desire to speed up the third stage of labor and get the mother and newborn out of the delivery room, presence of a neonatologist or pediatrician who is anxious to attend to the neonate, a desire to place the newborn in an immediate skin-to-skin contact, need for neonatal resuscitation, incidence of nuchal cord, fear of hyperbilirubinemia and/or polycythemia with DCC, and need for cord blood gases, cord blood banking, or a blood group specimen in the newborns of rhesus negative mothers (2, 9).

A number of the recent studies have reported about the national and international surveys to identify cord clamping practices of obstetricians, family physicians, and midwives (15-19). Their findings were indicative of a wide variation in cord clamping practice and lack of awareness of the benefits of DCC. Moreover, they reported that DCC is perceived as a difficult practice. Therefore, they made some

recommendations highlighting the need for the establishment of an institutional policy and clear national guidelines.

The Micronutrient Status Survey revealed that the infants under the age of 12 months had a high prevalence rate of anemia (90.7%). The Oman Ministry of Health Department of Nutrition recommends to consider anemia as a high priority and execute interventional strategies targeting the infants under the age of nine months (20). According to the Oman World Health Survey, the prevalence of anemia in pregnant women is 61% (21). The neonates born to iron-deficient mothers are at an even greater risk of iron deficiency and more likely to benefit from DCC (10).

Guidelines on the optimal timing of cord clamping would help decrease the incidence of serious preterm morbidities and address the high prevalence of anemia in all infants across Oman. This change in policy and practice is evidence-based, cost-effective, safe, and simple, and yet could significantly affect the national disease burden.

With this background in mind, the current study aimed to identify the current cord clamping practices of maternity care providers in Oman and their perceptions on the risks and benefits of this practice to the neonate and mother. The results of this study would provide baseline data for further research and policy development at the institutional and national levels.

The objectives of the study were as follows:

- To assess the knowledge on the timing of umbilical cord clamping for term and preterm neonates
- To identify the current umbilical cord clamping practices for term and preterm newborns
- To assess the perceptions of the risks and benefits of both ECC and DDC
- To determine the factors influencing clinical decision making on cord clamping practices

Materials and Methods

This non-experimental descriptive study was conducted nationally across Oman. The study population corresponded to a group of maternity care providers, namely midwives, obstetrician/gynecologists, and physicians, who

voluntarily responded to the email invitations to complete an online survey. The convenience sampling technique was performed based on the survey responses.

Formal approval was obtained from the Research and Ethics Committee of the College. In addition, permission was obtained to access the email database of the Oman Society of Obstetricians and Gynecologists. The sample size was estimated using the following formula:

$$\text{Sample size} = \frac{Z^2 \times p(1-p)}{d^2}$$

where Z is the value from the standard normal distribution showing the desired confidence level of 95% (Z score=1.96), p is the expected proportion, and d is absolute error/precision in percentage, put into decimal form.

Out of the 450 members registered in the Oman Society of Obstetricians and Gynecologists, 175 maternity care providers responded to the survey. The exclusion criteria included: 1) inability to speak English, 2) lack of active involvement in providing intrapartum care in the past 12 months, and 3) non-responding to the survey.

Research instruments

A revised version of an online survey software (i.e., Survey Monkey) was employed after obtaining permission from Stoll and Hutton (2012), who conducted a similar survey in Canada (17). The questions were revised following a review of the most recent literature and based on the variation in maternity care services in Oman. The questionnaire consists of 25 single and multiple response questions inquiring the maternity care providers' knowledge and practices on cord clamping in the country for the term and preterm neonates.

The participants were required to choose from a list of options and, when applicable, they could choose as many options as apply. The few open-ended questions allowed the participants to elaborate on their answers/opinions. The survey was piloted and found to be feasible and valid. The reliability coefficient of this instrument was estimated as 0.75. The completion of the survey took 10-15 min for each participant.

Ethical Considerations

Formal approval was obtained from the Research and Ethics Committee of the College. Furthermore, a permission was obtained from the president of the Oman Society of Obstetricians and Gynecologists to access the email database through the heads of the department of the ministry of health and private hospitals in Oman. The midwives were accessed after taking a permission from the Director of Nursing Services who encouraged their staff to participate in the project. The participation in the survey was quit voluntary. In addition, the subjects were assured about the confidentiality of their information. Moreover, the data were collected anonymously and stored on a password protected computer. Additionally, the online completed questionnaires were automatically imported into a spreadsheet and not linked to the email address.

Data Collection

In order to collect the data, several emails were sent to the members of the Oman Society of Obstetricians and Gynecologists. Due to receiving inadequate email responses (i.e., as few as 25 emails) even after two reminders, the researchers directly contacted the members through the heads of departments and asked them to fill out the questionnaire. Therefore, 150 participants volunteered and completed the questionnaire at their convenience. The data were analyzed using descriptive statistics, such as percentage and mean.

Results

According to the results, 106 (60.6%) and 55 (31.4%) participants were obstetricians and midwives, respectively, and the rest were maternal-fetal specialists and general practitioners. All the participants were involved in intrapartum care delivery. The majority of the participants (75.5%) were within the age group of 30-49 years, and 81.2% of them had more than five years of intrapartum experience. Most of the participants (91.3%) were practicing at governmental and university sectors of Oman during the research period. Figures 1 and 2 present the main five countries in which the maternity care providers received their basic and post-basic professional training.

The exploration of the participants' knowledge regarding the umbilical cord clamping revealed that 87.4% and 89.6% of the subjects regarded the ECC timing for the term and preterm neonates to be below 1 min. Furthermore, 50% of the participants reported that the timing of DCC is below 2 min of birth for both term and preterm newborns. In terms of DCC, 30% and 34% of the participants considered the timing of this practice to be 2-3 min for the healthy and preterm term newborns, respectively. In addition, 20% of the subjects perceived that DCC timing is after the cessation of the cord pulse.

As displayed in Table 1, 70% and 11.4% of the maternity care providers clamped the cord of a normally born term neonate within 1 and 2-3 min of delivery, respectively. Furthermore, 4%

Distribution of Basic Professional Training Countries of Maternity Care providers

■ Oman ■ India ■ UK ■ USA ■ Canada ■ Others

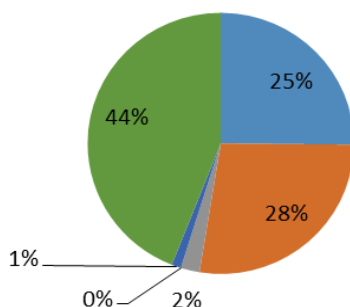


Figure 1. Distribution the participants in terms of the countries in which they received basic training

Distribution of Post-Basic Professional Training Countries of Maternity Care Providers

■ No Post basic training ■ Oman ■ India ■ UK ■ USA ■ Canada ■ Others

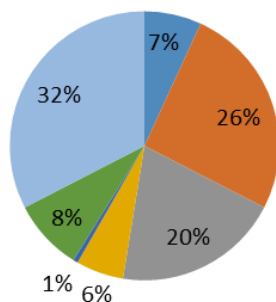


Figure 2. Distribution the participants in terms of the countries in which they received post-basic training

Table 1. Maternity care providers’ timing of cord clamping practice

	Timing of cord clamping	Cord clamping in term neonates in SVD		Cord clamping in preterm neonates in SVD	
		Frequency	%	Frequency	%
Pattern of the timing of cord clamping practices	<15 sec	38	21.7	42	24
	15-30 sec	52	29.7	42	24
	30-60 Sec	32	18.3	43	24.6
	1-2 min	26	14.9	31	17.7
	2-3 min	20	11.4	12	6.9
	After the cessation of cord pulse	7	4	5	2.8

SVD: spontaneous vaginal delivery

of them waited for the cord to stop pulsation, and then cut the cord. In terms of the healthy preterm newborns, 72.6%, 7%, and 2.8% of the

participants performed this practice below 1 min of birth, within 2-3 min of delivery, and after the cord pulse stoppage, respectively. Out

of the subjects performing cesarean sections (71%), 2%, 15%, and 83% of the participants clamped the cord after the cessation of the cord pulse, within 1-3 min of delivery, and below 1 min of birth, respectively. The results also indicated that 67.4% of the participants were not practicing cord stripping.

The most frequently listed perceived benefits of ECC practice were decreased incidence of postpartum hemorrhage, part of active management of the third stage of labor, and facilitation of the initiation of routine newborn care in a timely manner, resuscitation if needed, and cord blood collection for routine testing (Table 2). In the investigation of the circumstances where immediate cord clamping is preferred, most of the participants (63%) reported the need for neonatal resuscitation, twin delivery, tight

Table 2. Benefits associated with early cord clamping

Sl No.	Benefits associated with early cord clamping	Frequency	Percentage
1.	It is part of active management of the third stage of labor.	65	37.1
2.	It decreases the incidence of postpartum hemorrhage.	34	19.4
3.	It decreases the incidence of retained placenta.	16	9.1
4.	It helps initiate routine newborn care in a timely manner.	63	36
5.	It facilitates resuscitation if needed.	118	67
6.	Mothers do not wish newborn to be placed on tummy until dried, assessed, and bundled.	13	7.4
7.	It is needed in order to collect cord blood for routine testing.	46	26.3
8.	It is needed in order to collect cord blood gases.	70	40
9.	It is needed to collect cord blood for stem cells.	34	19.4

Table 3. Benefits associated with delayed cord clamping

Sl No.	Benefits associate with delayed cord clamping	Frequency	Percentage
1.	It facilitates placental transfusion	88	50.3
2.	It increases neonatal iron stores	103	58.9
3.	It reduces the risk of neonatal anemia	105	60
4.	It decreases the need for transfusions in preterm neonates.	78	44
5.	It decreases the risk of intraventricular hemorrhage in preterm newborns.	35	20
6.	It decreases the risk of necrotizing enterocolitis in preterm neonate.	23	13.1
7.	It increased the duration of early breastfeeding.	20	11.3

Hyperviscosity (23.3%), hypothermia (18.5%), and postpartum hemorrhage were also noted as the risks of DCC.

Only 11-18% of the participants opted for DCC as it was the hospital policy and recommended by professional practice guidelines. It is notable that 15.4% of the subjects indicated that they performed ECC due to hospital policy (Table 4). In addition, 44.6% of the maternity care providers reported no changes in the implementation of cord clamping

nuchal cord, stem cells collection, routine blood works, prevention of postpartum hemorrhage, cesarean section, or any other required medical intervention as the reasons for the adoption of ECC.

As stated by more than 50% of the maternity health care providers, the most important benefits of DCC were the facilitation of the physiologic transitioning of the newborn, increase in neonatal iron stores, reduced risk of infant anemia, and decreased need for transfusions in the preterm neonates. It is notable that 13% of the participants marked no benefits for DCC (Table 3). Most of the maternity care providers (90%) rated polycythemia and jaundice as the highest associated risks of DCC.

practice over the past two years, and they still practiced EEC if possible. However, 30% of the subjects changed their practice of ECC to DCC over the past two years. Only 13.7% of them reported to continue the implementation of DCC over the past two years.

Table 4. Distribution of the guidelines of professional references about cord clamping practice

Professional References	ECC practice n (%)	DCC practice n (%)
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Hospital policy	27 (15.4)	19 (10.9)
Professional organizations' guidelines	19 (10.9)	32 (18.3)

ECC: early cord clamping, DCC: delayed cord clamping

Discussion

The present study investigated the maternity care providers' knowledge and practice of umbilical cord clamping. According to the results, 29%, 20%, and 51% of the participants considered the timing of DCC as within 2-3 min of delivery, after the cessation of cord pulse, and below 1 min of birth, respectively. Accordingly, the majority of the participants (88%) reported the timing of the ECC to be below 1 min. This finding indicated that most of the participants were not well-oriented toward the new guidelines recommended by the professional organizations.

Most of the maternity care providers in Oman are still clamping the umbilical cord within 1 min of birth for both term and preterm newborns. Similarly, the majority of the subjects performing cesarean section adopted ECC with the same timing. Based on this evidence, in Oman, ECC is more frequently practiced than DCC. This finding is also supported by the results reported by Chaparrow in 2011(2). As the result of the present study demonstrated, the timing of cord clamping varied among the participants for both term and preterm neonates.

Although 50% of the participants defined DCC timing correctly, only 14% and 10% of them adopted DCC practice for the term and preterm newborns, respectively. This finding of variation in cord clamping timing and less complaints to new recommendations. Clearly highlighted the need for employing a uniform practice and resolving the knowledge gap in this regard. About 13% of the participants described their non-use of DCC to their unawareness of the current evidence on the benefits of this practice. This finding also suggest the implementation of a uniform policy at a national level.

Our results are in line with those of the previous studies exploring the same context (15-19). Major reasons for the utilization of ECC by the majority of the participants included the need for neonatal resuscitation, facilitation of active

labor management, reduction of postpartum hemorrhage incidence, and preterm status of the newborn. Accordingly, the care providers attributed the unemployment of DCC to their doubt about the feasibility of this practice in the neonates who are in need of resuscitation and immediate procedures. These findings are also consistent with those revealed by Chaparrow (2011) and Hutchon (2012) (2, 9).

In line with the findings of the previous studies, the majority of the maternity health care providers noted the DCC benefits as the facilitation of the physiologic transitioning of the newborn, increase in neonatal iron stores, reduced risk of neonatal anemia, decreased need for neonatal transfusion, reduced risk of intraventricular hemorrhage, and decreased risk of necrotizing enterocolitis in the preterm newborns (1, 2, 4, 7, 9, 11).

The participants reported polycythemia and jaundice as the major risks associated with DCC, which is in congruence with the findings obtained in the previous studies (2, 9). Even though the majority of the maternity care providers were aware of the current evidence and new recommendations of WHO, as well as the guidelines of other professional organizations regarding the use of DCC, they still followed EEC since they considered this practice as part of the old recommendation of the active management of the third stage of labor and due to other perceived benefits of ECC. This finding is in agreement with those of the previous studies (2, 9).

The unemployment of DCC deprives the neonates of the current reported and published benefits of DCC, such as increased placental blood transfusion at birth and reduced preventable harm to newborn, like iron deficiency anemia, which is already at an alarming prevalence rate in Oman (4, 9-11, 21). Regarding this, the present study strongly recommends to make a national and hospital-wide policy targeted toward the implementation of DCC practice.

Limitations and strengths of the study

One of the imitations of the present study was that it was limited to 175 Omani maternity care providers. However, this sample size could represent the population of maternity care providers in Oman. This study laid a platform to

throw lights on the current cord clamping practices, which demands the direction of more attention to the evidence-based practice in this context.

Recommendations for further studies

The maternity care providers' noncompliance to the current guidelines released by the WHO and other professional organizations regarding DCC underscores the need for the establishment of a national policy and hospital protocols about the cord clamping practice. The findings of the present study could be used as baseline evidence for policy makers. Although this study was conducted in Oman, the participants' nationality and place of receiving professional training varied (within more than five countries). This issue also highlights the need for a national policy in this regard. It is recommended to investigate this subject using a large-scale study.

Conclusion

As the findings of the present study revealed, ECC was a very common practice in Oman. It is notable that although most of the maternity care providers were aware of the new guidelines regarding the timing of cord clamping, they mostly followed the ECC practice. The knowledge gap about the current evidence on the timing of cord clamping could be rectified with the implementation of a country-based cord clamping policy. Therefore, the high prevalence of ECC practice necessitates the execution of a nation- and hospital-wide policy.

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Conflicts of interest

This study is neither funded nor applied for any funds. No conflict of interest is declared.

References

1. McAdams RM. Time to implement delayed cord clamping. *Obstetrics & Gynecology*. 2014; 123(3):

549-552.

2. Chaparro CM. Timing of umbilical cord clamping: effect on iron endowment of the newborn and later iron status. *Nutrition Reviews*. 2011; 69(Suppl 1):S30-S36.
3. Hutton EK, Hassan ES. Late vs early clamping of the umbilical cord in full-term neonates: systematic review and meta-analysis of controlled trials. *JAMA*. 2007; 297(11):1241-1252.
4. McDonald SJ, Middleton P, Dowswell T, Morris PS. Effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes. *Evidence-Based Child Health: A Cochrane Review Journal*. 2014; 9(2):303-397.
5. Backes CH, Rivera BK, Haque U, Bridge JA, Smith CV, Hutcheon DJ, et al. Placental transfusion strategies in very preterm neonates: a systematic review and meta-analysis. *Obstetrics & Gynecology*. 2014; 124(1):47-56.
6. Garofalo M, Abenhaim HA. Early versus delayed cord clamping in term and preterm births: a review. *Journal of Obstetrics and Gynaecology Canada*. 2012; 34(6):525-531.
7. Rabe H, Diaz-Rossello JL, Duley L, Dowswell T. Effect of timing of umbilical cord clamping and other strategies to influence placental transfusion at preterm birth on maternal and infant outcomes. *Cochrane Database of Systematic Reviews*. 2012; 8:CD003248.
8. Chiruvolu A, Tolia VN, Qin H, Stone GL, Rich D, Conant RJ, et al. Effect of delayed cord clamping on very preterm infants. *American Journal of Obstetrics and Gynecology*. 2015; 213(5):676-e1.
9. Hutcheon DJ. Immediate or early cord clamping vs delayed clamping. *Journal of Obstetrics and Gynecology*. 2012; 32(8):724-729.
10. Mercer JS, Erickson-Owens DA. Rethinking placental transfusion and cord clamping issues. *The Journal of Perinatal & Neonatal Nursing*. 2012; 26(3):202-217.
11. Farrar D, Airey R, Law GR, Tuffnell D, Cattle B, Duley L. Measuring placental transfusion for term births: weighing babies with cord intact. *BJOG: An International Journal of Obstetrics & Gynecology*. 2011; 118(1):70-75.
12. World Health Organization. Guidelines on basic newborn resuscitation. Geneva: World Health Organization; 2012.
13. Essential competencies for basic midwifery practice 2010. International Confederation of Midwives. Available at: URL: <http://www.internationalmidwives.org/assets/uploads/documents/CoreDocuments/ICM%20Essential%20Competencies%20for%20Basic%20Midwifery%20Practice%202010,%20revised%202013.pdf>; 2013.
14. Clamping of the umbilical cord and placental

- transfusion. Royal College of Obstetricians and Gynecologists. Available at: URL: <https://www.rcog.org.uk/en/guidelines-research-services/guidelines/sip14/>; 2015.
15. Jelin AC, Kuppermann M, Erickson K, Clyman R, Schulkin J. Obstetricians' attitudes and beliefs regarding umbilical cord clamping. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2014; 27(14):1457-1461.
 16. Lundberg C, Øian P, Klingenberg C. Umbilical cord clamping at birth-practice in Norwegian maternity wards. *Tidsskrift for den Norske Laegeforening: Tidsskrift for Praktisk Medicin, Ny Raekke*. 2013; 133(22):2369-2373.
 17. Stoll K, Hutton E. A survey of umbilical cord clamping practices and attitudes of Canadian maternity care providers. *Canadian Journal of Midwifery Research and Practice*. 2012; 11(3):18-29.
 18. Matar HE, Almerie MQ, Alsabbagh M, Jawoosh M, Almerie Y, Abdulsalam A, et al. Policies for care during the third stage of labour: a survey of maternity units in Syria. *BMC Pregnancy and Childbirth*. 2010; 10(1):32.
 19. Ononeze AB, Hutchon DJ. Attitude of obstetricians towards delayed cord clamping: a questionnaire-based study. *Journal of Obstetrics and Gynecology*. 2009; 29(3):223-224.
 20. Department of Nutrition. National nutrition surveillance report. Oman: Oman Ministry of Health; 2009.
 21. Morsi M, Elaty A, Attia M, Al Riyami A. Oman world health survey: part 1-methodology, sociodemographic profile and epidemiology of non-communicable diseases in Oman. *Oman Medical Journal*. 2012; 27(5):425-443.