



## A STUDY ON KNOWLEDGE OF PHARMACIST ON RISK OF MEDICATION USE DURING PREGNANCY IN INDIA

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### ABSTRACT

Community pharmacists (CPs) are the most accessible health care provider to the public, and they have huge duties to improve medication use especially among the pregnant women in their community. The objective of this study was to evaluate knowledge of CPs about the medication safety during pregnancy. A prospective cross-sectional survey was carried out over practicing community pharmacists in Hyderabad. Pharmacists were asked about the safety of each medicine during pregnancy. It involved both prescription-only medications (POM) and over-the-counter (OTC) medications. Both descriptive and analytic statistics were utilized. For descriptive

analysis, results were expressed as numbers, percentages and mean ( $\pm$ SD and 95% CI). The response rate was (71.1%). Most of the respondents (69.6%) believed that alprazolam is not safe while 22% of respondents believed that it is used on basis of risk-benefit assessment. Also, most of CPs (65.2%) said that amoxicillin is safe, but a very few of CPs (11.7%) knew that tetracycline should be used only if potential benefits may outweigh the risk. Among non-prescribed analgesics, majority of CPs (92.6%) knew that acetaminophen is safe. About dietary supplements, 48.4% of CPs reported that Vitamin A supplements are not safe. There was significant difference observed between age groups of CPs in scores of knowledge test ( $P = 0.001$ ). Community Pharmacists are the most accessible health care providers who can help pregnant women with their medications use there are still gaps in knowledge where educational interventions are needed.

**KEYWORDS:** Knowledge, Pregnancy, Medication usage, Community pharmacy.

## INTRODUCTION

Community pharmacists used to be known as chemists. It is estimated that over half a million adults visit a community pharmacy in Northern Ireland each week.

Community pharmacies can be found on the high street, at the heart of the most rural villages and in the centre of the most deprived communities. Many are open long hours when other health care professionals are unavailable. There are several different types and sizes of community pharmacies, ranging from the larger multiples to the small individually owned pharmacies. The traditional role of the community pharmacist as the white coat wearing healthcare professional who dispenses prescriptions written by doctors has changed. In recent years community pharmacists have been developing clinical services in addition to the traditional dispensing role to allow better integration and collaborative working with other health and social care providers; and more importantly to deliver better patient care.

### Community Pharmacy Access

Community pharmacists are easily accessible with around 535 community pharmacies in Northern Ireland located where people live, shop and work. The widespread location of the community pharmacy across Northern Ireland along with the extended opening hours means community pharmacy is readily accessible to the public. Community pharmacy provides a convenient and less formal environment for those who cannot easily access or do not choose to access other kinds of health service. Most pharmacies now have private consultation areas specifically for confidential or sensitive discussions and people can speak to a highly trained healthcare professional without the need for an appointment.

### Community Pharmacy Services

Your community pharmacy is likely to provide many of the following services.

**Dispensing** – working to a prescription, pharmacists will provide you with your medicines labelled correctly following the directions of a GP or other healthcare provider who can write prescriptions (e.g. nurses, dentists or pharmacists). Information and advice to enable safe and effective use of the medicines supplied will also be provided. Each year community pharmacies in Northern Ireland safely dispense approx. 40 million prescription items.

Pregnancy, also known as gestation, is the time during which one or more offspring develops inside a woman.<sup>[4]</sup> A multiple pregnancy involves more than one offspring, such as

with twins.<sup>[12]</sup> Pregnancy can occur by sexual intercourse or assisted reproductive technology.<sup>[6]</sup> Child birth typically occurs around 40 weeks from the last menstrual period (LMP).<sup>[4][5]</sup> This is just over nine months, where each month averages 29½ days.<sup>[4][5]</sup> When measured from conception it is about 38 weeks.<sup>[5]</sup> An embryo is the developing offspring during the first eight weeks following conception, after which, the term *fetus* is used until birth.<sup>[5]</sup> Symptoms of early pregnancy may include missed periods, tender breasts, nausea and vomiting, hunger, and frequent urination.<sup>[1]</sup> Pregnancy may be confirmed with a pregnancy test.<sup>[7]</sup>

Pregnancy is typically divided into three trimesters.<sup>[4]</sup> The first trimester is from week one through 12 and includes conception.<sup>[4]</sup> Conception is when the sperm fertilizes the egg. The fertilized egg then travels down the fallopian tube and attaches to the inside of the uterus, where it begins to form the embryo and placenta.<sup>[4]</sup> During the first trimester, the possibility of miscarriage (natural death of embryo or fetus) is at its highest.<sup>[2]</sup> The second trimester is from week 13 through 28.<sup>[4]</sup> Around the middle of the second trimester, movement of the fetus may be felt.<sup>[4]</sup> At 28 weeks, more than 90% of babies can survive outside of the uterus if provided with high-quality medical care.<sup>[4]</sup> The third trimester is from 29 weeks through 40 weeks.<sup>[4]</sup>

Prenatal care improves pregnancy outcomes.<sup>[9]</sup> Prenatal care may include taking extra folic acid, avoiding drugs and alcohol, regular exercise, blood tests, and regular physical examinations.<sup>[9]</sup> Complications of pregnancy may include disorders of high blood pressure, gestational diabetes, iron-deficiency anemia, and severe nausea and vomiting among others.<sup>[3]</sup> Term pregnancy is 37 to 41 weeks, with early term being 37 and 38 weeks, full term 39 and 40 weeks, and late term 41 weeks.<sup>[4]</sup> After 41 weeks, it is known as post term.<sup>[4]</sup> Babies born before 37 weeks are preterm and are at higher risk of health problems such as cerebral palsy.<sup>[4]</sup> Delivery before 39 weeks by labor induction or caesarean section is not recommended unless required for other medical reasons.<sup>[13]</sup>

About 213 million pregnancies occurred in 2012, of which, 190 million were in the developing world and 23 million were in the developed world.<sup>[10]</sup> The number of pregnancies in women ages 15 to 44 is 133 per 1,000 women.<sup>[10]</sup> About 10% to 15% of recognized pregnancies end in miscarriage.<sup>[2]</sup> In 2013, complications of pregnancy resulted in 293,000 deaths, down from 377,000 deaths in 1990.<sup>[11]</sup> Common causes include maternal bleeding, complications of abortion, high blood pressure of pregnancy, maternal sepsis,

and obstructed labor.<sup>[11]</sup> Globally, 40% of pregnancies are unplanned.<sup>[10]</sup> Half of unplanned pregnancies are aborted.<sup>[10]</sup> Among unintended pregnancies in the United States, 60% of the women used birth control to some extent during the month pregnancy occurred.<sup>[14]</sup>

## SIGNS AND SYMPTOMS

The symptoms and discomforts of pregnancy are those presentations and conditions that result from pregnancy but do not significantly interfere with activities of daily living or pose a threat to the health of the mother or baby. This is in contrast to pregnancy complications. Sometimes a symptom that is considered a discomfort can be considered a complication when it is more severe. For example, nausea (morning sickness) can be a discomfort, but if, in combination with significant vomiting it causes a water-electrolyte imbalance, it is a complication known as hyperemesis gravidarum.

Common symptoms and discomforts of pregnancy include.

- Tiredness.
- Constipation
- Pelvic girdle pain
- Back pain
- Braxton Hicks contractions. Occasional, irregular, and often painless contractions that occur several times per day.
- Edema (swelling). Common complaint in advancing pregnancy. Caused by compression of the inferior vena cava and pelvic veins by the uterus leads to increased hydrostatic pressure in lower extremities.
- Increased urinary frequency. A common complaint, caused by increased intravascular volume, elevated glomerular filtration rate, and compression of the bladder by the expanding uterus.
- Urinary tract infection<sup>[22]</sup>
- Varicose veins. Common complaint caused by relaxation of the venous smooth muscle and increased intravascular pressure.
- Haemorrhoids (piles). Swollen veins at or inside the anal area. Caused by impaired venous return, straining associated with constipation, or increased intra-abdominal pressure in later pregnancy.<sup>[23]</sup>
- Regurgitation, heartburn, and nausea.
- Stretch marks

- Breast tenderness is common during the first trimester, and is more common in women who are pregnant at a young age.<sup>[24]</sup>

In addition, pregnancy may result in pregnancy complication such as deep vein thrombosis or worsening of an intercurrent disease in pregnancy.

## **MATERIALS AND METHODS**

**STUDY TYPE:** Observational.

**STUDY SITE:** Study is conducted at OM SAI HOSPITALS (BALAPUR)

**SAMPLE SIZE:** 25 Subjects

**STUDY DURATION:** study will be of 8 months. From Dec 2017 to March 2018.

A prospective cross-sectional survey was carried out in Hyderabad city, India. The questionnaire was confirmed for its face and content validity by experts in the field of clinical pharmacy and adjusted after a pilot study conducted on 10 Clinical Pharmacists. Ethical approval was obtained from the institutional review board before data collection. The questions used in the tool had been established based on similar previously published studies.

## **QUESTIONNAIRE DESIGN**

The questionnaire composed of two main parts. The first part is the demographic survey to collect background information regarding the age, number of working years' experience in the field of pharmacy, graduation country, and practice asking female patients about the pregnancy status. The second part comprised of a list of 22 prescription drugs, nonprescription drugs, dietary complements, and herbal medicine when they are taken in the first trimester. Pharmacists were asked about the safety of each medicine during pregnancy. It involved both prescription-only medications (POM) and over-the-counter (OTC) medications. Each question in both section would only have one of the following answers: safe in the first trimester, must weight risks and benefits for individual patients, not safe in the first trimester, and I don't know.

### **The selected medications in the survey included**

- (1) Drugs which have known risks to the fetus including isotretinoin, phenobarbital, tetracycline, valproic acid.
- (2) Drugs that are commonly used for gynecological health issues including ciprofloxacin, amoxicillin, oral contraceptives.

(3) Drugs that are used to treat other health issues that can be present during pregnancy such as paroxetine for depression; budesonide for asthma; lamotrigine for epilepsy and bipolar disorder.

(4) OTC medications that are most commonly used during pregnancy involving acetaminophen, aspirin, dextromethorphan, guaifenesin, ibuprofen, and pseudoephedrine.

All the correct answer for both prescription only medications (POM) and over the counter medications (OTC). The overall knowledge scores was calculated by adding all the correct answer for knowledge questionnaire and the maximum score was 22.

### STUDY POPULATION

The study was targeted all practicing community pharmacists in Riyadh city, SA. It was estimated that about 2000 pharmacists registered with the health affairs directorate in Riyadh city. To calculate the sample size, we assumed 50% of the pharmacists have good knowledge about drug safety during pregnant women, and a total of 350 pharmacies would provide a representative sample size with 5% margin of errors and 95% confidence level.

### STAISTICAL ANALYSIS

The data was entered into the SPSS version 22 for Windows (SPSS) for analysis. Both descriptive and analytic statistics were utilized. For descriptive analysis, results were expressed as numbers, percentages and mean ( $\pm$ SD and 95% CI). The Mann-Whitney *U* test and the Kruskal-Wallis test were used to assess intergroup differences. P-value of less than 0.05 was consider as statistically significant.

### RESULTS AND DISCUSSION

Responses were returned from 50 CPs given a response rate of 71.1%. Demographic characteristics of the participants are showed in Table 1. The age of approximately 71.5% of the study sample ranges from 25 to 35 years. About 94.9% of the participants have less than 10 years working experience in the field of pharmacy. Of all included participants, 54.7% are asking their female patients about the pregnancy status.

**Table 1: Demographic characteristics for participants.**<sup>[25]</sup>

Age	Frequency	Percentage (%)
From 25 to 35	18	71.5
From 36 to 45	7	27.3
From 46 to 55	-	-
<i>Years of working experience</i>		
Less than 10 years	24	94.9
From 20 to 30 years	1	4.3
From 31 to 40	-	-
<i>Asking for pregnancy status</i>		
Always	14	54.7
Often	9	38.3
If she looks pregnant	1	6.6
Never	-	-

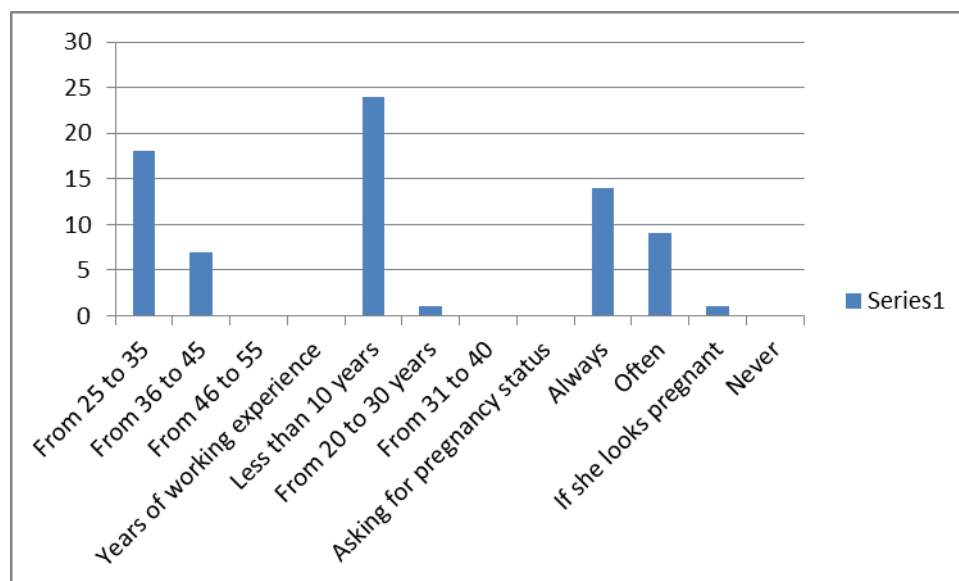
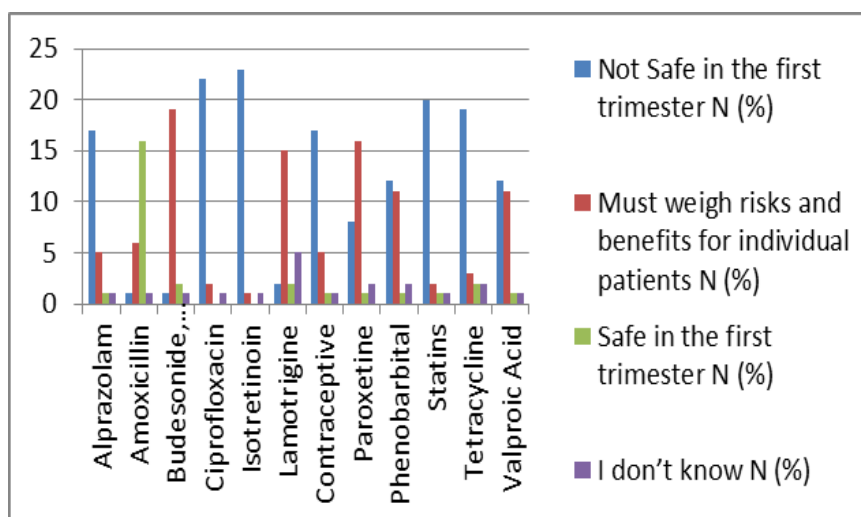
**Graph 1: Demographic characteristics for participants.**<sup>[25]</sup>

Table 2 presents the CPs' response of drug safety during pregnancy. Most of respondents (69.6%) believed that alprazolam is not safe while 22% of respondents believed that it is used on basis of risk-benefit assessment. Also, most of CPs (65.2%) said that amoxicillin is safe, but a very few of CPs (11.7%) knew that tetracycline should be used only if potential benefits may outweigh the risk. A majority of CPs (91.0%) knew that isotretinoin is unsafe to be used by pregnant. For central nerves system drugs, about 49% of CPs identified valproic acid is not safe, and approximately one-third of CPs correctly identified that lamotrigine should be used only if the potential benefit justifies the potential risk. For more details see Table 2.

**Table 2: Response to clinical pharmacist to use of prescribed medications during pregnancy.**

Medication	Not Safe in the first trimester	Must weigh risks and benefits for individual patients	Safe in the first trimester	I don't know
	N (%)	N (%)	N (%)	N (%)
Alprazolam	17 (69.6)	5 (22.3)	1 (2.3)	1 (5.50)
Amoxicillin	1 (5.9)	6 (23.8)	16 (65.2)	1 (4.7)
Budesonide, inhaled	1(6.6)	19 (74.2)	2 (11.3)	1 (6.6)
Ciprofloxacin	22 (68.3)	2 (8.6)	0 (0.8)	1 (3.1)
Isotretinoin	23 (91.4)	1 (4.3)	0 (0.4)	1 (3.9)
Lamotrigine	2 (8.6)	15 (59.8)	2 (9)	5 (22.3)
Contraceptive	17 (67.2)	5 (22.7)	1 (2)	1 (6.3)
Paroxetine	8 (32.4)	16 (62.5)	1(1.2)	2 (2.7)
Phenobarbital	12 (50.4)	11 (44.1)	1 (0.8)	2 (3.5)
Statins	20 (79.9)	2 (10.9)	1 (5.1)	1 (3.9)
Tetracycline	19(74.2)	3 (11.7)	2 (10.5)	2 (3.5)
Valproic Acid	12 (48.8)	11 (46.1)	1 (1.2)	1 (3.



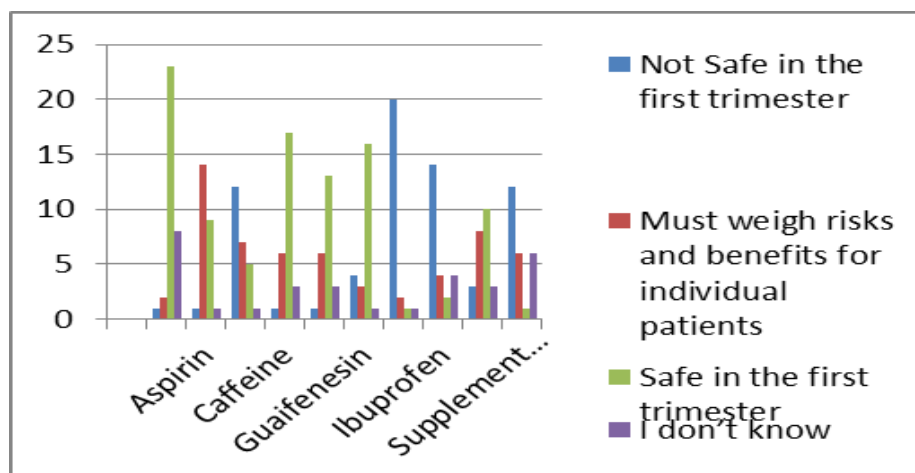
**Graph 2: Response to clinical pharmacist to use of prescribed medications during pregnancy.**

Table 3 shows the CPs' response to the use of OTC drugs during pregnancy. Among non-prescribed analgesics, majority of CPs (92.6%) knew that acetaminophen is safe; however they were in doubt about aspirin usage during pregnancy while ibuprofen may be used if the potential benefit justifies the potential risk. A very few of CPs knew that guaifenesin is used only if the potential benefit justifies the potential risk. About dietary supplements, 48.4% of CPs reported that Vitamin A supplements are not safe. Most of CPs (78.9%) said that St. John's wort is not safe for use in the first trimester.



Table 3: Response of Clinical Pharmacists to use of OTC medications during pregnancy.

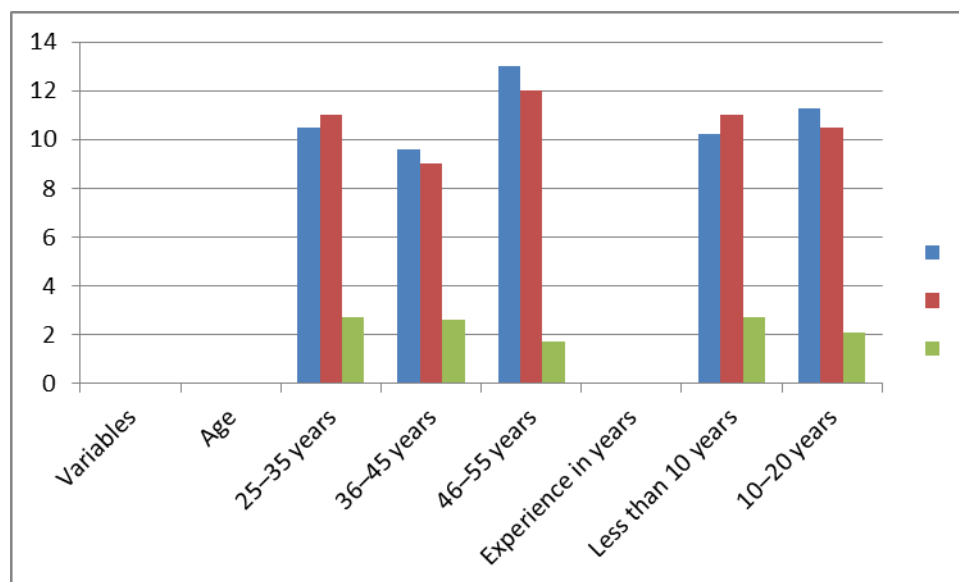
Medication	Not Safe in the first trimester	Must weigh risks and benefits for individual patients	Safe in the first trimester	I don't know
	N (%)	N (%)	N (%)	
Acetaminophen	1 (0.8)	2 (3.5)	23 (92.6)	8 (3.1)
Aspirin	1 (2.7)	14 (55.1)	9 (36.7)	1 (5.5)
Bismuth subsalicylate	12 (46.9)	7 (27.7)	5 (20.7)	1 (4.7)
Caffeine	1 (6.30)	6 (24.6)	17 (66.4)	3 (39.0)
Dextromethorphan hydro bromide	1 (4.3)	6 (25.8)	13 (53.5)	3 (15.2)
Guaifenesin	4 (16.4)	3 (12.9)	16 (64.1)	1 (6.6)
St. John's Wort	20 (78.9)	2 (9.4)	1 (3.9)	1 (7.4)
Ibuprofen	14 (56.6)	4 (18.4)	2 (9.0)	4 (15.6)
Pseudoephedrine hydrochloride	3 (12.5)	8 (34)	10 (39.5)	3 (13.7)
Supplement Vitamin A	12 (48.4)	6 (18)	1 (5.9)	6 (26.2)



In addition, there was significant difference observed between age groups and country of graduation of CPs in scores of knowledge test ( $P = 0.001$ ,  $p = 0.015$ , respectively) but no significant differences found with other variables included years of experiences ( $p = 0.299$ ) see.

Table 4: Variable influencing the pharmacist knowledge.

Variables	Mean	Median	SD	P value
<i>Age</i>				
25–35 years	10.5	11	2.7	
36–45 years	9.6	9	2.6	0.001
46–55 years	13	12	1.7	
<i>Experience in years</i>				
Less than 10 years	10.2	11	2.7	0.299
10–20 years	11.3	10.5	2.1	



**Graph 4: Variable influencing the pharmacist knowledge.**

## DISCUSSION

Studies on CPs' knowledge concerning drug safety during pregnancy are limited. To our knowledge, this is the first study was conducted to evaluate the CPs' knowledge about drug use in pregnant women. One of the most important roles of CPs as health care professionals is to ensure the safety of medications prescribed or used during pregnancy. This role can be achieved by CPs through providing medication counseling and drug information to pregnant women (George, 2011).

Some medications are teratogenic in their natures (Garcia-Bournissen *et al.*, 2008). Numerous medications have proven to associate with increased risks of birth defects. To protect pregnant and fetus from teratogenic events from using some drugs, the US Food and Drug Administration (FDA) has established five categories (A, B, C, D, and X) to indicate drugs' potential for causing teratogenicity. Generally, category D or X drugs are considered potentially teratogenic drugs. Many medications used to treat diseases such as hypertension and seizures are categorized as class D or X (Kamuhabwa and Jalal, 2011). In addition, there are numerous drugs with other ratings that, depending on the timing of drug use and dose of the exposure, can also cause fetal damage (Kamuhabwa and Jalal, 2011).

This study revealed that CPs have inadequate knowledge in providing information about safety of medications used during pregnancy. It has documented that CPs do not always offer correct advice to pregnant women (Damase-Michel *et al.*, 2008, Lapeyre-Mestre, 2004). The lack of well-designed focused didactic or training and the scarce availability of continuing

education programs about drugs usage in pregnancy may contribute to the inadequate knowledge of CPs towards medications safety during pregnancy.

The knowledge of CPs about the risks of different medications use during pregnancy varies according to the medication type. The majority of CPs in this study identified drugs with potentially teratogenic effects such as isotretinoin and statins that are unsafe for use in the first trimester. They also correctly identified drugs that are the most prescribed during pregnancy (i.e. amoxicillin, acetaminophen) as being safe for use in pregnant women. These results are consistent with a study conducted in Palestine which found about 82% of CPs correctly identified that isotretinoin is contraindicated during pregnancy (Arah, 2012). Another study conducted among health care professionals included gynecologists found same finding (Morgan et al., 2010). However, Morgan et al. reported that only 6% of gynecologist correctly identified that tetracycline can be used in pregnant women on basis of benefit-risk assessment. Less than half of CPs in our study correctly identified that Paroxetine and valproic acid are contraindicated in pregnancy. Our findings are similar to previous study found that 35% and 38.9% of community pharmacists correctly identified that paroxetine and valproic acid are contraindication drugs to use during pregnancy (Arah, 2012). Another study was conducted among health care professionals included general practitioner (GPs) and CPs found that 19% of GPs and 33% of CPs stated that there are no teratogenic risk for valproic acid (Damase-Michel et al., 2008).

Pharmacists can play an important role in selecting and providing information or medication counseling regarding the safety of OTC drugs, dietary supplements and herbal products to use in pregnancy. Most of OTC drugs have been linked with adverse effects during pregnancy (Verstappen, Smolders, Munster, Aarnoudse, & Hak, 2013). Although CPs showed lack of sufficient knowledge in providing information about safety of OTC drugs and herbal medications to use in pregnancy, pregnant women in SA take consume good amount of OTC drugs and herbal products (Zaki and Albarraq, 2014). In this study, a few of CPs correctly identified the safety use of OTC drugs during pregnancy including guaifenesin (12.9%), ibuprofen (18.4%). These findings are similar to the results of previous studies (Arah, 2012) & (Morgan et al., 2010).

## CONCLUSION

Community Pharmacists are the most accessible health care providers who can help pregnant women with their medications use. Although there are some areas where pharmacists are

knowledgeable about drug safety during pregnancy, there are still gaps in knowledge where educational interventions are needed. This study has some limitations. Firstly, the study was restricted to Hyderabad; therefore results may not represent the knowledge of community pharmacist practicing in other regions of India. Secondly, the study used self-administrated questionnaire this could lead to desirability bias. However, a nation study involving is recommended in order to confirm some of the results of this study.

## REFERENCES

1. Al-Hassan M. Community pharmacy practice in Saudi Arabia: an overview. *Internet J. Pharmacol*, 2011; 9(1).
2. Arah, E.M.A.A.A., 2012. Community Pharmacists' Medication Knowledge: A Nation-wide Study in Palestine. Faculty of Graduate Studies Community Pharmacists' Medication Knowledge: A Nation-wide Study in Palestine By Enass Majed Abd Alrahman Abu Arah Supervisor Prof. Waleed Sweileh Co-supervisor Dr. Adham Abu-Taha This Thesis is Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Clinical Pharmacy, Faculty of Graduate Studies, An-Najah National University.
3. Baldon J.P., Correr C.J., Melchioris A.C., Rossignoli P., Fernandez-Llimos F., Pontarolo R. Community pharmacists' attitudes and knowledge on dispensing drugs to pregnant women. *Pharm. Pract*, 2006; 4(1): 38–43.
4. Bercaw J., Maheshwari B., Sangi-Haghpeykar H. The use during pregnancy of prescription, over-the-counter, and alternative medications among Hispanic women. *Birth*, 2010; 37: 211–218.
5. Damase-Michel C., Pichereau J., Pathak A., Lacroix I., Montastruc J.L. Perception of teratogenic and foetotoxic risk by health professionals: a survey in Midi-Pyrenees area. *Pharm. Pract. (Internet)*, 2008; 6: 15–19.
6. Garcia-Bournissen F., Tsur L., Goldstein L.H., Staroselsky A., Avner M., Asrar F., De Santis M. Fetal exposure to isotretinoin – an international problem. *Reprod. Toxicol*, 2008; 25: 124–128.
7. George J. Optimising medication use during pregnancy: the potential role of pharmacists. *Int. J. Pharm. Pract*, 2011; 19: 81–83.
8. John L.J., Shantakumari N. Herbal medicines use during pregnancy: a review from the Middle East. *Oman Med. J*, 2015; 30: 229.

9. Kamuhabwa A., Jalal R. Drug use in pregnancy: knowledge of drug dispensers and pregnant women in Dar es Salaam, Tanzania. *Indian J. Pharmacol*, 2011; 43: 345.
10. Lapeyre-Mestre M. Drug counselling in pregnancy: an opinion survey of French community pharmacists. *Pharmacoepidemiol. Drug Saf*, 2004; 13: 711–715. [[PubMed](#)]
11. Mayet Ahmed Y., Al-Shaikh Ghadeer K., Al-Mandeeel Hazem M., Alsaleh Nada A., Hamad Amani F. Knowledge, attitudes, beliefs, and barriers associated with the uptake of influenza vaccine among pregnant women. *Saudi Pharm. J*, 2017; 25(1): 76–82.
12. Morgan M.A., Cragan J.D., Goldenberg R.L., Rasmussen S.A., Schulkin J. Obstetrician–gynaecologist knowledge of and access to information about the risks of medication use during pregnancy. *J. Matern.-Fetal Neonat. Med*, 2010; 23: 1143–1150.
13. Zaki N.M., Albarraq A.A. Use, attitudes and knowledge of medications among pregnant women: a Saudi study. *Saudi Pharmaceut. J*, 2014; 22: 419–428.
14. "What are some common signs of pregnancy?". Eunice Kennedy Shriver National Institute of Child Health and Human Development. 12 July 2013. Archived from the original on 19 March 2015. Retrieved 14 March 2015.
15. The Johns Hopkins Manual of Gynecology and Obstetrics (4 ed.). Lippincott Williams & Wilkins. 2012. p. 438. ISBN 9781451148015. Archived from the original on 10 September 2017.
16. "What are some common complications of pregnancy?". Eunice Kennedy Shriver National Institute of Child Health and Human Development. 12 July 2013. Archived from the original on 26 February 2015. Retrieved 14 March 2015.
17. "Pregnancy: Condition Information". Eunice Kennedy Shriver National Institute of Child Health and Human Development. 19 December 2013. Archived from the original on 19 March 2015. Retrieved 14 March 2015.
18. Abman, Steven H. (2011). *Fetal and neonatal physiology* (4<sup>th</sup> ed.). Philadelphia: Elsevier/Saunders. pp. 46–47. ISBN 9781416034797.
19. Shehan, Constance L. (2016). *The Wiley Blackwell Encyclopedia of Family Studies*, 4 Volume Set. John Wiley & Sons. p. 406. ISBN 9780470658451. Archived from the original on 10 September 2017.
20. "How do I know if I'm pregnant?". Eunice Kennedy Shriver National Institute of Child Health and Human Development. 30 November 2012. Archived from the original on 2 April 2015. Retrieved 14 March 2015.