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## **Awareness of folic acid deficiency associated neural tube defect among females: a cross sectional study**

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### **ABSTRACT**

Neural tube defects are major cause of infant mortality and disability. Its occurrence has been linked to folic acid deficiency during pregnancy. Awareness of this relationship is significant to adopt appropriate measures to prevent them. The study was carried out to assess the level of this awareness among reproductive-age female of Karachi. The survey based study were designed to assess respondent's knowledge about folic acid and neural tube defects. Sample (500) was divided into two groups. Group A belong to without any history of NTD while Group B belonged to positive family history of NTD. Both group comprised of 250 respondents. The result shows that the level of awareness about the role of FA in prevention of neural NTD in Group B was high as compare to Group A. There was close association between knowledge of FA and socio demographic variables. Level of awareness about the role of FA in prevention of neural NTD among group A was low as compare to group B. There is need to enhance awareness to ensure that populations at risk benefit from research.

**Key words:** neural tube defect. Folic acid, Folic acid deficiency

**Abbreviation:** NTD: Neural tube defect. FA: Folic acid.

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### **INTRODUCTION**

Birth defects of any type have a major impact on the lives of affected children and their families. Some of these diseases can be prevented by taking adequate amount of various nutrients antenatally. Folic acid is among one of these nutrients which is water soluble vitamin (vit. B<sub>9</sub>). Its peri-conceptual use has been proved to be important in the prevention of birth defect known as neural tube defect [1, 2,3]. This term is applied to a variety of malformations resulting from incomplete to total absence of closure of the neural tube between 17 and 30 post conceptional days [4,5]. Neural tube defects are a major cause of mortality in newborns and have been estimated to affect 0.5 to 8 per 1000 live births [7] Anencephaly and spina bifida are the most common manifestations of the spectrum [4,8]. Neural tube defects are considered multifactorial in origin with a combination of genetic and environmental influences predisposing to their occurrence [8]. The neural tube defects may present with different phenotypes depending on the affected region. The most vulnerable areas of the neural tube are the anterior and posterior neuro-pores because they are

the last to close. Failure of closing the anterior neural tube region results in anencephaly. Anencephaly is the most severe form of neural tube defect and is considered a lethal malformation. Neural tube defects (NTDs), including anencephaly, encephalocele and spina bifida are common causes of morbidity and mortality among infants and neonates [9]. Folic acid deficiency is one of the most common vitamin deficiencies in women. Folic acid is essential for proper brain functioning and also aid in the production of DNA and RNA, the body's genetic material, and is especially important when cells and tissues are growing rapidly, such as in infancy, adolescence, and pregnancy. Folic acid also works closely with vitamin B12 to help make red blood cells and help iron work properly in the body [10]. Women who consume a low level of folic acid during pregnancy are at risk for poor pregnancy outcomes, including NTDs [11].

The incidence of NTDs has declined substantially over the past 60 years and is about 1–2 per 1000 babies in the general population [12]. By educating women about the importance of folic acid and encouraging them to increase their intake, the

community can have a direct impact on the lives of families and the health of their babies. Previously, in the United states approximately 4,000 pregnancies were affected annually by a defect of the spine (spina bifida) or brain (anencephaly). Since 1998 when fortification of cereal grain products was mandatory, that number of defected pregnancies per year has declined to approximately 3,000 [12].The vitamin folic acid can help to prevent 50 to 70 percent of these birth defects every year[13]. However, mostly women do not consume enough folic acid daily to protect against these serious birth defects. Public health education about folic acid is just beginning. [10].During the last decades, major interest has been devoted to preventable causes of central nervous system malformations such as neural tube defects (NTD).

This study was conducted to assess the level of Knowledge regarding folic acid awareness among pregnant and non-pregnant women and explore the predictive factors of folic acid awareness among the pregnant women seeking primary care as to prevent neural tube defects.

**METHODS**

This study was a descriptive type of cross-sectional study of 500 sample size,(n=500) carried out in outpatient and inpatient departments of Abbasi Shaheed Hospital, Jinnah Post-Graduate Medical Center, Civil Hospital, Liaquat National Hospital, Lady Defrin Hospital, Sindh Government Hospital Liaquatabad, Karachi. As these are developed hospitals it was expected that a large study population would be easily available.A

Structured Questionnaire was developed in the light of objectives and variables of the study. (table# 1)

A formal written permission was taken from the concerned health authorities of the area before proceeding for data collection. After explaining the purpose of the study to the respondent and after obtaining verbal consent, data was collected by the researcher herself through face to face interview at above mentioned areas. Sample was divided into two halves, one group comprising of 250 respondents, who did not have any family history of neural tube defects (group A) while the other 250 respondents belonged to respondents with a positive family history of neural tube defects (group B). Interview was completed in one sitting. Each interview lasted 15 minutes.Data was entered into computer in statistical package for social sciences (SPSS) version 17 for windows. Appropriate statistical analysis, frequencies and percentages were used while chi square test was used to observe the association between demographical variables and awareness of folic acid and to relate variables to the objectives of the study.

**RESULTS**

After collection, the data was analyzed with the help of SPSS software according to the variables for the purpose of the study. For better understanding, the entire data was compiled and tabulated. The results have been shown in tabular and graphical form. The interpretation of the tables and graphs is as follows:

**Table -1 Distribution of respondents by age**

Age Group In Years	Without family history of neural tube defects		With family history of neural tube defects		Total
	Frequency	Percentage	Frequency	Percentage	
18- 20 yrs	18	7.2%	19	7.6%	37(7.4%)
21-30yrs	94	37.6%	63	25.2%	157(31.4%)
31-35yrs	75	30%	107	42.8%	182(36.4%)
35-45yrs	63	25.2%	61	24.4%	124(24.8%)
<b>Total</b>	250		250		500

**Mean ± SD = 34 years ±4 years**

The age of the respondents of this study ranged from 18 years to 45 years. The mean age was 34±4 years. Table-1 shows that out of 500 respondents, majority - 182 (36.4%) were in between the age group of 31-35years. Only 37(7.4%) were in the age group of 18-20 years. Among the respondents

without history of NTDs, majority - 94(37.6%) belonged to 21-30 years age group while few - 18(7.2%) were between 18-20 years. Among the respondents with history of NTDs, 107(42.8%) were between 31-35yrs and 19(7.6%) were between 18-20years.

**Table -2 Distribution of Respondents by marital status**

Marital status	Without family history of neural tube defects		With family history of Neural tube defects		Total
	Frequency	Percentage	Frequency	Percentage	
<b>Married</b>	138	55.2%	213	85.2%	351(70.2%)
<b>Unmarried</b>	83	33.2%	14	5.6%	97(19.4%)
<b>Widowed/Separated/ Divorced</b>	29	11.6%	23	9.2%	52(10.4%)
<b>Total</b>	250		250		500

Out of 500 respondents 351(70.2%) were married, 97(19.4%) were unmarried while 52(10.4%) were widowed/separated/divorced. Out of 250 respondents without family history of NTD, 138(55.2%) were married while 83(33.2%) were

unmarried, 29(11.6%) were widowed/ separated/ divorced. Among respondents with family history of neural tube defects, 213(85.2%) were married while 14(5.6%) were unmarried and 23(9.2%) were widowed/separated/divorced.

**Table -3 Distribution of respondents by Educational status**

Educational level	Without family history of Neural tube defects		With family history of Neural tube defects		Total
	Frequency	Percentage	Frequency	Percentage	
<b>Illiterate</b>	32	12.8%	35	14%	67(13.4%)
<b>Primary</b>	37	14.8%	27	10.8%	64(12.8%)
<b>Secondary</b>	26	10.4%	38	15.2%	64(12.8%)
<b>Higher secondary</b>	67	26.8%	61	24.4%	128(25.6%)
<b>Graduate</b>	74	29.6%	68	27.2%	142(28.4%)
<b>Post graduate</b>	14	5.6%	21	8.4%	35(7%)
<b>Total</b>	250		250		500

The above table shows the educational level of respondents. Out of 500 respondents majority 142(28.4%) were graduates, 128(25.6%) had higher secondary education, 64(12.8%) had secondary education, 64 (12.8%) had primary education, 67 (13.4 %) were illiterate and only a few i.e 35 (7%) were post graduate. Among respondents without family history of neural tube defects, 74(29.6%) were graduates, 67(26.8%) had higher secondary education, 37(14.8%) had

primary education, 26 (10.4%) had secondary education, while 32(12.8%) were illiterate and 14(5.6%) were postgraduates. Among respondents with family history of neural tube defects, majority 68(27.2%) were graduates, 61(24.4%) had higher secondary education, 38(15.2%) had secondary education, 27 (10.8%) had primary education, 35(14%) were illiterate and 21(8.4%) were postgraduates.

**Table – 4 Distributions of respondents by awareness of folic acid**

Information about folic acid	Without family history of Neural tube defects		With family history of Neural tube defects		Total
	Frequency	Percentage	Frequency	Percentage	
<b>Yes</b>	142	56.8%	204	81.6%	346(69.2%)
<b>No</b>	108	43.2%	46	18.4%	154(30.8%)
<b>Total</b>	250		250		500

The above table shows that out of 500 respondents, more than half viz. 346(69.2%) had heard about folic acid while 154(30.8%) had not heard about it. Among the 250 respondents without family history

of neural tube defects,142(56.8%) had heard about it while 108 (43.2%) did not hear about folic acid. The other group of 250 respondents with a positive family history of neural tube defects demonstrated

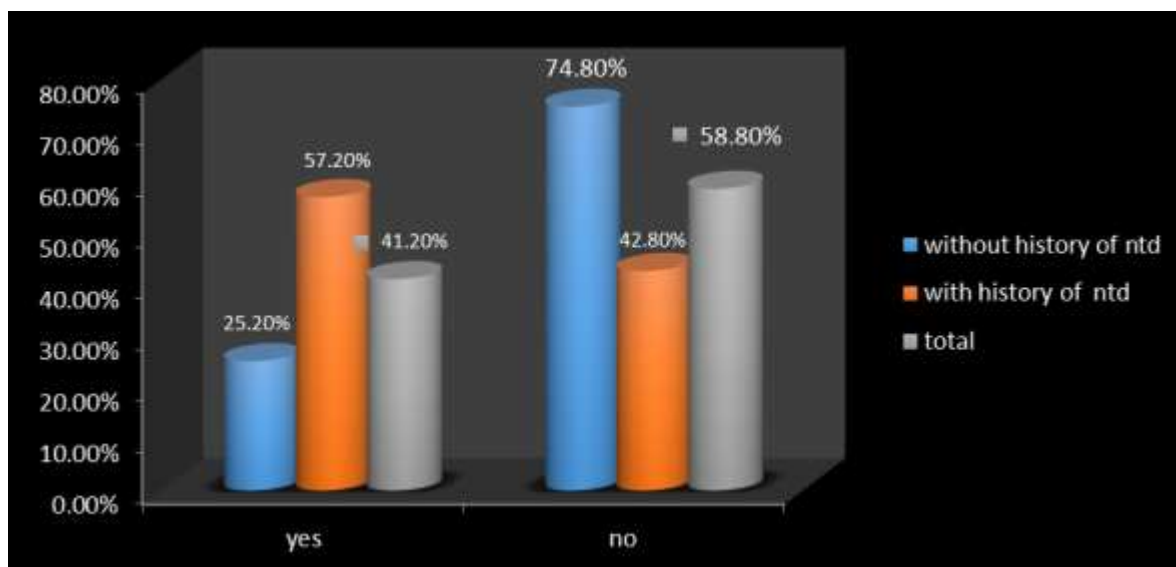
that 204(81.6%) had heard about folic acid while only 46 (18.4%) did not hear about it.

**Table 5- Distribution of respondents by source of information about folic acid**

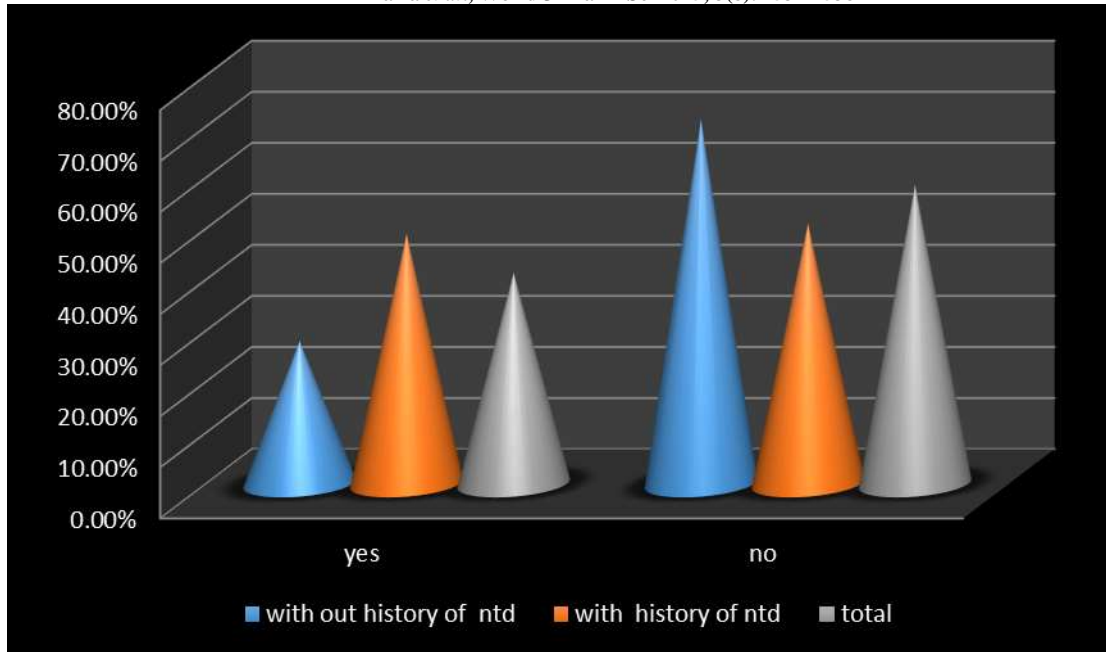
Source of information	Without family history of NTDs		With family history of NTDs		Total
	Frequency	Percentage	Frequency	Percentage	
Doctors	43	30.5%	110	54%	153(44.3%)
Nurses	8	5.5%	3	1.5%	11(3.1%)
T/V, internet	3	2%	4	2%	7(2%)
Newspapers/lectures/Pamphlets	43	30%	15	7.5%	58(16.8%)
Family/friend	46	32%	71	35%	117(33.8%)
<b>Total</b>	<b>143</b>		<b>203</b>		<b>346</b>

Table- 5 shows that, out of 346 respondents who had heard about folic acid, 153(44.3%) respondents got information about folic acid from doctors, 117(33.8%) from family and friends while 58(16.8%) got information from lectures/newspapers and some 8 (5.5%) got this information from nurses. The group of 143 respondents without family history of neural tube defects showed that, 43(30.5%) got information from doctors, 46 (32%) from family and friends while 43 (30%) from newspapers and lectures. The other group (203 respondents) with family history of neural tube defects demonstrated that 110 (54%) agreed that they got this information from doctors, 71(35%) from friends and family while a few i.e 15 (7.5%) from newspapers and lectures.

The figure 1 shows the distribution of respondents by the knowledge of importance of folic acid. Out of 500 respondents, 346 knew about folic acid so this question was asked from 346 respondents. The total bar (green bar) showed that 41.2% had knowledge of importance of folic acid while 58.8% did not know. The blue bar showed that out of the 143 respondents without family history of NTDs, about a quarter (25.5%) had knowledge of the importance and 74.8% did not know the importance of folic acid while the red bar (respondents with family history of NTDs) shows that more than half (57.2%) had knowledge of the importance of folic acid.



**Fig -1 Distribution of respondents by knowledge about importance of folic acid**



**Fig -2 Distribution of respondents by knowledge of sources of folic acid**

The above figure shows the distribution of respondents by their knowledge about the sources of folic acid. Less than one third of respondents (28%) belonging to the group without family history of neural tube defects (blue bar) were

aware of sources of folic acid while 48% of those with a family history of NTDs (red bar) knew about them. Totally (green bar) 41.3% respondents had knowledge of sources of folic acid.

**Table -6 Distributions of respondents by knowledge of various sources of folic acid**

Various sources of folic acid	Without family history of NTDs		With family history of NTDs		Total
	Frequency	Percentage	Frequency	Percentage	
Green vegetables	10	33.3%	80	70.9%	90(63%)
Fruits	8	26.8%	20	17.7%	28(19.6%)
Meat	3	10%	1	0.9%	4(2.8%)
Cereals	2	6.6%	8	7%	10(6.9%)
Green vegetables, fruits	5	16.7%	4	3.5%	9(6.3%)
Green vegetables, fruits, meat	2	6.6	0	0%	2(1.4%)
<b>Total</b>	<b>30</b>		<b>113</b>		<b>143</b>

Table 6 above shows that, 143 respondents knew about the particular sources of folic acid. 90 (63%) knew that folic acid is in green vegetables, 28 (19.6%) told folic acid is in fruits. Few 4 (2.8%) told that it is in meat. Out of the 30 respondents without family history of neural tube defects, 10 (33%) had knowledge that folic acid is in green

vegetables, 8 (26.8%) told it is in fruits, few 2 (6.6%) agreed for cereals. The other group of 113 respondents with history of Neural tube defects demonstrated that, 80 (70.9%) of them agreed for green vegetables, 20 (17.7%) gave positive response for fruits and 8 (7%) told that folic acid is present in cereals.

**Table 7** Distribution of respondents by source of information about awareness of neural tube defects

Source of information	Without family history of Neural tube defects		With family history of Neural tube defects		Total
	Frequency	Percentage	Frequency	Percentage	
<b>Doctors</b>	3	6%	88	55%	91(43%)
<b>T/V, internet</b>	7	13.7%	1	0.6%	8(3.8%)
<b>Newspaper/lectures/Pamphlets</b>	16	31.3%	12	7.5%	28(13.3%)
<b>Family/friend</b>	25	49%	59	36%	84(39.9%)
<b>Total</b>	51		160		211

Most of the respondents with a positive history of NTDs had got this information about NTDs either from their doctors (55%) or family / friends (36%). On the other hand, family / friends contributed to this knowledge among 49% of those without history of NTDs. Only 6% of them had heard about this from their doctors. 31.3% came to know from newspapers / pamphlets / lectures and 13.7% had seen on TV / internet. This response was out of 211 respondents who had heard about neural tube defects.

**DISCUSSION**

This cross sectional study generated the information regarding the awareness of folic acid among females of reproductive age group to prevent neural tube defect. It also tries to find out knowledge of females about folic acid and neural tube defect and relates it with the socio demographic characteristics of the female of reproductive age group. In country’s maternal and child health program, birth defects are an important concern, which constitute a substantial percentage of affected families. Some socio demographic characteristics are responsible for low knowledge about folic acid to prevent neural tube defects among females of reproductive age group. In this study 56.8% respondents had heard about folic acid among group of women who had no history of neural tube defect in the family while awareness among the group of female with history of neural tube defect was 81.6%. Other studies showed somehow similar results. Abdulrazzaq *et al* in the UAE and Bener *et al* in Qatar showed that the awareness of folic acid in women was 46.6% and 54%, respectively. Furthermore, Nawapun and Phupong showed that the awareness of folic acid was 24.4 % among Thai women [15,16,17].

In this study, the comparison of knowledge was done among two groups, one had no family history (group A) and other had family history of neural tube defect (group B). It was observed that group A was less aware (56.8%) of folic acid as compare to group B (81.6%). In Group A knowledge about

importance of folic acid was 25.2%. Out of this 49% knew that folic acid was meant to prevent anemia while only 23 % had information that it was to prevent neural tube defect. In group B knowledge about importance of folic acid (57.2%) is better than group A (25.2%). More than one third 39.8% (gr. B) had information that folic acid is used to prevent neural tube defect. This rate is higher than Kondo *et al* study that less than 15% of Japanese women were aware of a link between folic acid and NTDs. It was observed in this study that 29% of group A while 40% of gr. B taken folic acid during the periconceptual period. Folic acid intake rate in this study is better than the study in Qatar (20.3%) by Benner *et al.*, but lower than the rate from other report related to the USA (45%) [18,19,20].

Also, folic acid taken rate in this study is higher than the studies from Spain (6.9%) by Coll *et al*, Thailand (9.7%) by Nawapun and Phupong, Ireland (2.7%) by Sayers *et al* and the United Arab Emirates (8.3%) by Abulrazzaq *et al* [16,22,23,24]. The folic acid taken rate in this study indicates an urgent need of a systematic plan for improvement in the use of periconceptual folic acid supplement. In this study, group A (28%) and group B (49%), subjects knew the sources of folic acid while 33% (gr. A), 70.9% (gr. B) identified green leafy vegetables are rich in folic acid. This rate is little higher than other studies. Nawapun and Phupong among Thai women reported that 32.4% women could identify types of natural foods rich in folic acid [21,19]. Also, Kloeblen study among 251 low-income, predominantly minority, pregnant women in Atlanta, USA, determined that only 30% of the women could list any food sources of folic acid [24]. This may suggest that folic acid intake through diet in the population could be due to the impact of healthcare recommendations. Despite the existence of scientific evidence on the effectiveness of folic acid supplementation in the prevention of NTDs, and its recommendation by healthcare authorities, only 29% (group A) and 40% (group B) women in this setting took folic acid during pregnancy. This finding is similar to other reports



from developed and developing countries where 20.3-70% of women take folic acid during the periconceptional period. The poor intake of folic acid in Karachi region may be due to certain reasons. First, the awareness of the population about the need to take folic acid during reproductive age group is low (9.5% group A, 38.8% group B). This is considerably lower than the report from Netherlands by De walle *et al* with 74%<sup>(18)</sup>. Also a reason may be that folic acid is not prescribed in time. A late medical appointment is an important factor in this regard. Another reason is that the doctors and other health care providers do not inform the purpose of folic acid that it is used to prevent neural tube defect as in this study 8.9% (gr. A) and 27.3% (gr B) told that they were informed about purpose of folic acid. This rate is too low which need to educate our doctors and health care providers regarding this issue. According to chi square test, we found relation between socio demography and the awareness about folic acid. It was seen that female between 26-35 years were more aware about folic acid and graduates and above had more knowledge than others. In other studies also these relations have been reported.

Bener *et al* study showed that awareness of folic acid among Qatari women was significantly associated with education of the mother[16]. Also women with higher education (from high school to university level) knew more about folic acid, and used it more often in the periconceptional and first trimester period. Nawapun and Phupong study among Thai women also showed that the educational level was related to the intake of folic acid during the correct period [17,19]

The sources of information reported by the subjects were not similar to those reported in previous studies. In this study, one third of group A (30.5%) while half of group B (54%) got information about folic acid from the doctors, which is similar in some studies, a majority of women recalled hearing about folic acid from their doctors. Bener *et al* reported that the most common sources of information about folic acid were the physicians (63.4%) and newspaper/magazine/books (21.7%)[18]. French *et al* also reported that a majority of women recalled hearing about folic acid from their doctors[25]. Furthermore, in several studies the majority of women recalled hearing about folic acid from the media. Gjergja *et al* reported that among Croatian pregnant women, the media (TV, radio, newspapers, internet, etc.) was the most frequent source of information about folic acid (40.68%) and the physician was the second source of information (30.82%) while in this study they got information from media 18.8% which is

too low than other studies, need to improve awareness system in media[26]. Nawapun and Phupong also reported that the media was the most frequent source of information (48.6%) for Thai women and other sources of information were doctors and health care personnel (20.8%) and friends/relatives (6.7%)[17]. Awareness of use of folic acid during pregnancy in this study was 22.8% (gr A) and 68.3% (grB) while 19% (grA) and 60% (gr B) had knowledge that folic acid should be taken three months before pregnancy. Only 30.7% (gr A) had heard about NTDs and their most frequent (49%) source of information were families and relatives. But only 10.4% (gr A) and 62.2% (gr B) knew that folic acid deficiency can produce NTD. The findings was much lower than the study of Iran in which Nosret *et al* observed in urban area of Northern Iran that only 27.6% knew that folic acid was something important in the prevention of neural tube defects[27]. Al Hakeem *et al* (2013) mentioned in the study of Riyadh that usage of folic acid supplementation in pre-pregnancy stage was only 31.5%, but 51.6% had received folic acid during their previous pregnancies and 65.4% were aware that they need folic acid supplementation during first three months of pregnancies[28-29]. These results resemble present study.

In this study it is clear that group who had NTD babies in family had more knowledge of folic acid and NTD than those who did not have NTD babies in their families. In this aspect their doctors (55%) play important role to inform them about folic acid and their importance and its association with NTD. In this study subjects wanted to improve the awareness of folic acid to prevent NTD by public awareness (23.6%) and multimedia 27.9% while in the study conducted in Riyadh by Al Hakeem showed that study subjects (41.7%) wanted to attend lectures and workshops on folic acid supplementation and 99.1% of them were of the view that physicians and gynecologists should play a role in educating women of child bearing age on the importance of folic acid[27].

This study was undertaken in a major city like Karachi and hence may not be representative of the entire country. Hence, further in-depth prospective research studies on the subject should be undertaken throughout Pakistan - especially in semi-urban and rural areas to help the authorities in coming up with better solutions in tackling this issue and help in saving many women from the agony of conceiving children with such problem

## CONCLUSION

It was revealed that graduates and above had more information (45.1%) regarding folic acid than other group of education. It means education helps the

community to increase the knowledge about folic acid and its role to prevent neural tube defect. Relationship with age and awareness of folic acid showed that between the age group (26-35 years) had more knowledge (54.6%) about folic acid than other groups. There is need to increase awareness among 18-25 years age groups as they are important reproductive age groups. It is observed that married respondents had more knowledge (75.7%) than other groups because they underwent pregnancies and were informed by health providers. It is concluded that the unmarried women should be educated regarding this issue to improve the pregnancy outcome. It is concluded from data and analysis that respondents with the history of neural tube defects had more knowledge about folic acid and neural tube defect as they were affected and got awareness from their health providers than those who had no family history of neural tube defects. These groups are needed to be educated regarding this issue. Majority of respondents (30.2%) took folic acid is for mouth sores. There is need to train the doctors and health providers to improve their knowledge regarding prescribing folic acid. Less than half (45.3%) of the respondents knew that folic acid should take during pregnancy. Majority (61.2%) got information from doctors while the role of multimedia in this issue

very low (1.8%). There is needed to make strategies by enhancing the awareness program in multimedia to improve the community knowledge regarding folic acid and neural tube defects. It was concluded that less than half (38%) had knowledge that folic acid should be taken three months before pregnancy and their doctors (57.4%) played important role. This area requires attention in awareness program that three months before folic acid intake reduces the risk of neural tube defects. More than one third (37.6%) had knowledge that folic acid deficiency can prevent neural tube defect. Periodical counseling, awareness lectures, posters, messages between television programs by health authorities and professionals are required to emphasize importance of folic acid periconceptionally among all child bearing women to prevent neural tube defect. Few (18.7%) were informed from their health providers that folic acid is given during periconceptional period to prevent neural tube defect. This finding will help health education campaigns aimed at raising the awareness of women about the role of folic acid in pregnancy, particularly through premarital counseling programs. Even though this study may not be completely representative of general population, but the findings could be useful to implement appropriate intervention programs.

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