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Assessment of Dietary Habits and Associated Health Risks to the Pregnant Women Residing in Slummy Areas of Faisalabad

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ABSTRACT

Background: During pregnancy, balanced and healthy diet is very essential for both mother and the proper growth and development of fetus. The purpose of the study is to evaluate the dietary status and related health risk factors of pregnant mother living in slummy areas of Faisalabad. **Methods:** Various methods can be used for the dietary assessment of mother including the easiest method 24-hour dietary recall, the most preferred semi quantitative food frequency questionnaire, food diary, online questionnaire, cross sectional survey, anthropometric measurement, score method, consecutive days dietary record etc. **Result:** Maternal malnutrition is the major public health problem in both developed and under developed countries Malnutrition during gestation does not cause complications only during and after pregnancy but it also effects new born physically and mentally for remaining whole life. Food practices during pregnancy are not according to the mark and it is further stressed by poor socioeconomic status. Pre term and low birth weight are the popular poor pregnancy outcomes. Low-income mothers are mostly deficient in iron, folate, fruits and vegetables. Stress and depression because of poor socioeconomic status is further deteriorating dietary habits and food practices. **Conclusions:** This study suggested that pregnant women need dietary counselling and particularly women belong to slummy areas are also in need of dietary supplementation.

INTRODUCTION

During pregnancy mother need energy and nutrients not only for herself but also for her fetal growth. In developing countries, low birth weight is a major risk factor of poor maternal diet especially during third trimester. Low birth weight is a major cause of infant morbidity and mortality and it has irreversible lifelong effects on infant physical and cognitive development including cardiac dysfunctioning and development of type 2 diabetes in later age. A variety of poor maternal and infant outcome have been observed due to poor maternal nutrient intake during pregnancy. Insufficient intake of iron during pregnancy leads to maternal anemia which is a leading cause of maternal mortality and premature birth. Inadequate maternal folate storage during conception will ultimately cause neural tube defects (Cheng *et al.*, 2009).

Poor intake of multiple micronutrients is very common among women living in poor resource settings. Folate, zinc and iron are particularly asking for attention and giving us the direction to be used them for fortification, supplementation and enrichment. Women on monotonous diet are also deficient in other micronutrients which are receiving minimum attention (Torheim *et al.*, 2010).

Good maternal nutrition which include a variety of vitamins, minerals, and sufficient energy is very important for healthy growth of fetus and mother (Kaiser and Allen, 2008).

Women in poor socioeconomic status gain lower weight 2-7kg as compared to western or highly developed countries. Intrauterine growth retardation is a major risk factor of poor maternal nutrition during pregnancy which ultimately leads to low birth weight. Infant gain most of the body weight especially during last trimester and if mother is having poor diet in this duration it will result in low birth weight and low birth weight baby (body weight <2500g) having low chances of survival as compared to normal weight peers and is at greater risk of diseases at later ages. If low birth weight infant is getting survival, he will live with malnutrition for remaining life and also have poor cognitive abilities (Andersen *et al.*, 2003). During pregnancy only 1/3rd of women are taking sufficient folate

and iron in one of the recent British studies (Derbyshire *et al.*, 2009). Women with dark skin who are residing in northern areas are lacking vitamin D particularly during pregnancy (van der Meer *et al.*, 2006).

In western societies energy deficiency is rare but micronutrient deficiency during pregnancy is very common which cause infant malfunctioning and it is a major public health issue. That's why it is advised that the dietary recommendations must be practical and easily followed in nature. To assess women dietary intake, food pyramid is a useful tool to ensure that pregnant woman is consuming a variety of foods. Folic acid which is one of the most important nutrients need prior to conception. A lot of campaign were held to spread awareness regarding folate consumption, still its intake is not matching the recommended level (Murrin *et al.*, 2007).

Poor dietary quality is not a new thing among low-income African pregnant mothers which is leading towards the worst pregnancy outcomes. These mothers have idea that eating fruits and different vegetables will produce healthy babies but still they move towards high fat and high sugar diet because it is less costly and tastier. Having healthy and nutritious food is very difficult for them (Reyes *et al.*, 2013).

In every stage of life, no one can survive without nutrition. Nutrition plays a very important role in growth but its role becomes dual during pregnancy. Maternal diet during pregnancy provides an origin to the fetal long life. Healthy pregnancy depends upon several factors like normal weight gain, vitamins and minerals supplementation, physical activity and intake of several foods during pregnancy. Maternal nutrition is the main thing which determine birth weight, disease of the infant, healthy delivery, infant healthy long life, maternal health and reproductive capacity. Small for gestational age, low birth weight, gestational diabetes, pre-eclampsia and intrauterine growth restriction are some common poor maternal nutrition outcomes which have been reported in various studies (Paknahad *et al.*, 2019).

Maternal body weight is the best tool to determine the maternal and infant health. When women gain too little or too much weight during pregnancy it leads to poor pregnancy outcomes. Behavioral interventions are compulsory in order to gain recommended weight during gestation. But only few women get chance of being counseled. Many pregnant women have no knowledge about how much of gestational weight they need to gain (Nikolopoulos *et al.*, 2017).

At present, corona virus is highly contagious. WHO declare it global public health issue. Women who infected with corona virus during pregnancy have little known outcomes although scientists are still investigating. An in-depth interview by using video or audio call was conducted from the women who experience corona virus during pregnancy. Audio was recorded for later word to word transcription (Freitas-Jesus *et al.*, 2020).

Docosahexaenoic acid is a very essential nutrient for developing fetus found in fish but unfortunately, most of the USA pregnant mothers are lacking it in their diet because they think it contain mercury which is a toxin and can harm developing baby (Bloomingdale et al., 2010).

A lot of efforts have been undertaken in ordered to reduce poverty and improved dietary practices but still undernutrition remains a big challenge in Ethiopia. In Ethiopia, there are some barriers which are limiting the demand and supply of diet during pregnancy.
They are following: (Bezabih *et al.*, 2018)

- Poverty
- No husband supports
- Food avoidance
- High work pressure on mother
- Maternal poor educational level
- Lack of counseling
- Poor dietary habits
- Increased expenditure on cultural festivals
- Lack of health facilities
- Poor coordination with nutritionists
- Lack of nutrition information sources

Risk Factors

Morbidity and mortality

Pregnancy is celebrated in most of the regions of sub-Saharan Africa in the happiness of coming a new life in the world. But health indices related to the pregnancy outcome are very poor in these regions because of a variety of factors like poor maternal nutrition, food restrictions, poor quality of diet, lack of maternal nutritional knowledge, early pregnancies, underweight mother and food insecurity. That's why high morbidity and mortality rate has been found in these regions (Sholeye *et al.*, 2014).

A complex collection of routine factors like, political, economic, cultural and social causes, lack of health system, gender inequity, geographical and physical infrastructure are the leading cause of maternal mortality. By ensuring that all women have safe delivery services, maternal mortality rate can be decreased. Various programs on reproduction and child health stressed on to deliver babies in controlled and hygienic environment under supervision of trained and experienced professional. But most of the Indian women like to deliver babies at home without professional help. Women who do not go on routine medical checkup suffer more problems during pregnancy duration. Even women who belongs to poor socioeconomic status prefer private hospitals for delivery instead of government hospitals. Therefore, programs focused to maintain all facilities and equipment for delivery in government hospitals in order to increase maternal confidence and trust about safe delivery. Wrong food beliefs and practices can be addressed by launching health and nutritional programs in vulnerable segments of a region. To reduce maternal mortality, counselling and awareness programs should be held routinely (Kotecha *et al.*, 2012).

Infant and maternal postnatal morbidity due to prolonged labor is more prevalent among obese pregnant mothers as compared to normal weight women (Heslehurst *et al.*, 2008).

Poor Pregnancy Outcomes

Maternal diet has gained much attention from last few years and this is due to increased physiological, metabolic and nutritional pressure of pregnancy on mother. Studies

have indicated, inadequate dietary intake during pregnancy leads to a variety of poor pregnancy outcomes included low birth weight baby, iron deficiency anemia, immature body organs, neural tube defects, labor issues, maternal and infant mortality and a risk factor of variety of chronic diseases (Sholeye *et al.*, 2014).

Pre-eclampsia is a major poor pregnancy outcome which is characterized by high blood pressure that first time occur during pregnancy and its relived only with delivery. Worldwide its major reason of maternal death. Etiology is totally unknown but the major risk factor is obesity, diabetes and these conditions are more often seen in women belongs to poor socioeconomic status. Maternal and infant morbidity due to pre-eclampsia can be prevented with superb delivery case (Tanya Nagahawatte and Goldenberg, 2008).

Women who have better nutritional status at the time of conception are likely to give positive health outcomes as they are able to meet pregnancy needs imposed to them. Some factors which clearly impair fetal development are maternal smoking, malaria and HIV\AIDS. In ordered to expect healthy pregnancy and better suckling during first year of infant life demands to fulfill all maternal nutritional needs during pregnancy and lactation. Using locally available and affordable dietary stuff, nutritional interventions during pregnancy is a successful approach of reducing maternal death, low birth weight and many poor pregnancy outcomes (Ojofeitimi *et al.*, 2008).

Infant multi nutrient malnutrition

In sub-Saharan Africa several studies assessed dietary habits and associated risk to the pregnant women. African overall population is suffering with multi nutrient malnutrition which is further complicated by infectious diseases. To improve nutritional status of African girls and pregnant women, world health organization established community nutritional interventions (Sholeye *et al.*, 2014).

Low birth weight

There are several factors that contribute to low birth weight for example, women who are consuming less of total calories, carbohydrate and fat during their third trimester are more likely to give low birth weight baby, mothers who give LBW babies have lower weight gain during pregnancy as well as are suffering with poor hemoglobin concentration, less frequency of protein, meat and egg, and high consumption of soft drinks and fast foods (Tehzeeb *et al.*, 2011).

The risk of preterm or low birth weight is higher among black Americans than whites (Savitz *et al.*, 2004).

Girls who experienced pregnancy during teenage are more likely living to live in non-married households, so they get fewer social support and respect from their partner. As a result, low birth weight is aggravated by depressive episodes (Moore and Chase-Lansdale, 2001).

Preterm Birth

Maternal dietary pattern during pregnancy is influenced by maternal religion, sociocultural factors and food security. Women who eat less than three major and two minor meals are at greater risk of delivering low birth weight baby as compared to women who eat more than usual frequency. Preterm birth is also associated with maternal fasting during third trimester. In west some studies also measured the association between maternal pre pregnancy body mass index and pregnancy outcome. Obesity before pregnancy cause serious complications on mother and foetus during and after pregnancy (Paknahad *et al.*, 2019).

Intra uterine growth failure

About 30% of Indian's newborn are low birth weight (less than 2500g) and most of these cases are due to intrauterine growth failure. Maternal malnutrition is a major cause of adverse pregnancy outcomes. Birth weight is strongly associated with maternal intake of fruits and green leafy vegetables especially during second trimester. Low birth weight baby is a majorly result of vitaminb12 deficiency in Indian mothers and this is because of low intake of animal foods. (Dwarkanath *et al.*, 2014).

Medical & Neurological disorders

For the proper functioning of all body systems, healthy and balanced nutrition is required by all human beings. Pregnancy is a duration during which body suffer various physiological and hormonal fluctuations. Balanced nutrition during pregnancy is compulsory for ideal maternal weight gain and healthy growth and development of foetus. It also prevents from adverse effect at the time of birth and development of chronic diseases in the later life of newborn. Imbalanced maternal nutrition give birth to a handicap infant as well as also cause a lot of medical problems and neurological disorders which are irreversible in most cases (Zelalem *et al.*, 2017).

Maternal Weight Gain

Two types of dietary patterns are associated with weight gain. One dietary pattern is characterized by increased consumption of sweets, burger, pizzas and other fast foods and second one is high consumption of alcohol and butter. There are three types of gestational weight gain; weight before conception and after delivery, net weight (excluding fetus weight gain), rate per week (weight gained during specific period) (Uusitalo *et al.*, 2009).

In 21st century, obesity (BMI ≥ 30kgm-2) is the greatest public health concern. With serious complications of health, obesity is rising day by day (Lobstein and Leach, 2007).

During gestation, obesity is a major maternal mortality factor. In UK, 1/3rd maternal deaths occurred due to gestational obesity (Deaths and Lewis, 2007).

Caring of obese pregnant women is quite challenging and there is no doubt in this. Health professional also face problems in abdominal examining if the mother is obese (Krishnamoorthy *et al.*, 2006).

Surrounding the uterus, additional abdominal fat tissue require additional ultrasound scanning to find out about fetus growth and presentation (Black, 2008).

Ultrasound signals are affected by adipose tissues, as adipose tissues absorb related energy and produce bad image quality (Ramsay *et al.*, 2006).

Women need to do a detailed discussion about gestational weight gain and postpartum weight loss once they are expecting a baby. More often weight exceeds than recommendations during pregnancy ultimately it leads to

adverse long term pregnancy outcomes. Discussion about recommended gestational weight gain should happened with all pregnant women. If weight during pregnancy exceed than recommendations then its difficult to handle thus women should teach about weight gain during early days (Nikolopoulos *et al.*, 2017).

Miscarriage

Poor nutrition during pregnancy can be a risk factor of miscarriage, maternal infection, mal gestational weight gain. During child bearing age, a women need proper micronutrient intake. Because demand of micronutrients during gestation and lactation depends upon maternal storage. Inadequate maternal nutrient storage leads to adverse pregnancy outcomes including early fetal loss. Low socioeconomic status, food insecurity and lack of knowledge about nutritional eating is a root cause of micronutrient deficiency (Zelalem *et al.*, 2017).

Intergenerational protein energy malnutrition

Infant morbidity and mortality, micronutrient deficiency and intergenerational protein energy malnutrition is the most prevent in Ethiopia. Maternal anemia, underweight and iodine deficiency is major concerns of Ethiopian nation. Various studies reported nutrition education was associated to reduce medical and health related issues of mother and infant. World health organization also stressed on to give nutrition education to mothers on every clinic visit. Pregnancy is the right time to give education on healthy eating and lifestyle to mothers in ordered to improve optimal intake of iron, folic acid and other nutrients. To promote balanced diet, various nutrition education programs was held (Zelalem *et al.*, 2017).

Permanent physiological dysfunctioning

Dietary quality of women especially, during first three months has deep effect on pregnancy outcome. Various studies reported, poor dietary quality during critical period of fetal development led to permanent physiological dysfunctioning of foetus. Women belongs to poor households are more likely to receive inadequate diet because of lack of capacity to purchase healthier and wide variety of food (Fowles *et al.*, 2011).

In intrauterine environment, nutrition can change fetal genome and may lead to lifelong changes (Wu *et al.*, 2004).

Gestational Diabetes

Diet composition is a modifiable risk factor during pregnancy. Some studies suggested, diet high in total fat, saturated fat, trans fat, processed meat and diet high in glycemic index is related to the gestational diabetes during pregnancy. On the other hand, polyunsaturated fat, fiber and carbohydrates are beneficial. Western dietary pattern is associated with leading cause of poor pregnancy situations and gestational diabetes is one of them. Gestational diabetes first diagnosed during pregnancy and its prevalence rate is 2-5%. Total carbohydrate and total fat intake are not associated with the development of gestational diabetes but specific type of carbohydrate (simple sugar) and particular type of fat (trans fat & saturated fat) are associated (Radesky *et al.*, 2008).

Maternal obesity is a major risk factor of several killing diseases but most dangerous one diabetes and hypertension during pregnancy (Chu et al., 2007).

There are some known risk factors of gestational diabetes as maternal obesity, hypertension, smoking, age, poverty and ethnic group. Although it resolves automatically after delivery but still it increases risk of type 2 diabetes after delivery 7 folds (Kaptein *et al.*, 2015).

About 4 million live births occur each year and 2-5% are suffered by gestational diabetes and it increase the risk factors of various dangerous diseases like stillbirth, abortion, and 3-fold increased risk of mental dysfunctioning. Gestational diabetes also increases the risk of infant macrosomia and obesity & diabetes and maternal c-section risks increased. Tight glycemic control during gestational diabetes may decrease adverse pregnancy outcomes (Collier *et al.*, 2011).

Gestational diabetes management barriers: (Collier *et al.*, 2011).

- Lack of social support
- Lack of diabetic care center
- Lack of maternal confident
- Communication & information barriers
- Lack of maternal knowledge

Micronutrient Malnutrition

Micronutrients which are very important for fetal proper development are lacking in the diet of pregnant women. Supplements helps to achieve suggested intake of micronutrients but recommended intake of calcium, vitamin D and magnesium cannot be achieved through supplements. Maternal hair magnesium concentration decrease as pregnancy leads. Low intake of micronutrients put a very bad effect on mother and foetus (Kocyłowski *et al.*, 2018).

Iodine is a very important nutrient for proper development of thyroid hormone and well neurodevelopment and approximately 60% of pregnant women are iodine deficient (Bouga *et al.*, 2018).

Spina Bifida

Spina bifida and repeated miscarriage are the results of insufficient maternal folate intake as well as maternal folate storage (Byrne, 2010).

Obesity is a risk factor of spina bifida. Different congenital malformations particularly spina bifida is increased in obese pregnant women (Stothard *et al.*, 2009).

Cleft Palate

During gestation, maternal malnutrition increases the risk of development of cleft palate. Some studies also indicated that infant with cleft palate has low body weight as compared to their normal peers. Children with cleft palate has high risk of respiratory tract infection. Its seems that older mothers have high risk of development of cleft palate infants. Although inadequate maternal weight gain is associated with multiple worst outcomes but it has no relationship with cleft palate (Jia *et al.*, 2011).

Anemia

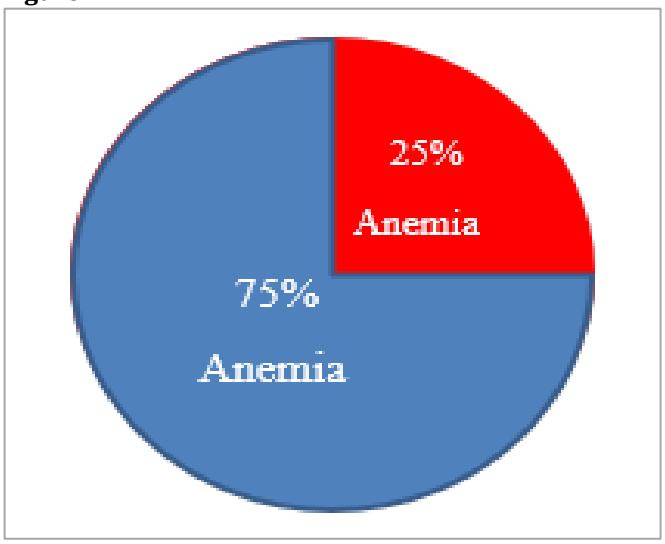
In India, anemia is a life-threatening problem. National health & family survey indicate that 59% of pregnant women are anemic. In Mumbai, 47.5% married women and 59.2% pregnant women are anemic (Rajan and James, 2008). Maternal morbidity due to anemia is highest in

India as compared to the rest of globe (General, 2006). Anemia was also reported as a major cause of maternal mortality in 2010 (Chatterjee and Fernandes, 2014).

Most of Indian women follow vegetarian diet which have non heme iron that's why most of Indian women are iron deficient (Chatterjee and Fernandes, 2014).

According to the study conducted in Faisalabad, 75% pregnant mothers were anemic and 25% were non anemic (Anjum *et al.*, 2015).

Figure 1



% distribution of anemia in pregnant women residing in Faisalabad (Anjum *et al.*, 2015).

Migration Effects on Pregnant Women

To fulfill the health care needs of migrant population is quite challenging and its more problematic if there are pregnant women because their dietary needs are very diverse as they have different cultural, political and social beliefs and practices. Migration not only effect physical but also mental health of pregnant mothers. Among public health concerns, take care of maternal health is always a biggest challenge. Almost 35,000 mother's deaths occurred each year due to pregnancy relevant issues. And the risk of maternal death is greatest in Bangladesh. Pakistan, Bangladesh, and Indian mothers have high rate of low birth weights as compared to their counterparts (Yeasmin and Regmi, 2013).

Pregnant Women in Slummy Areas

Bangladesh is the poorest country in the globe. Although urbanization is increasing rapidly around the world but its most common in Bangladesh. In Bangladesh, maternal condition during pregnancy is worst in urban slummy areas as compared to the urban non slummy areas. Some behavioral change interventions and maternal counselling session can increase maternal clinic visits. Programs that are running in urban slummy areas need to add such interventions which improve maternal support during this life-threatening period. Provide them financial and social support in ordered to increase their independency and confidence. These types of interventions may improve pregnancy outcomes in slummy areas (Choudhury *et al.*, 2012).

Dietary Habits and Pregnancy

During pregnancy most of the women have changed their dietary habits. They reported that they eat fish, meat, fruits, eggs, buttermilk, vegetables and curd more frequently and in larger portion. Some pregnant women said that change in dietary habits were good for themselves, their fetus and for safe and sound delivery. Some women during pregnancy changed their dietary habits by excluding certain foods due to the vomiting and flatulence and most of these foods were potato, beans, cabbage and oily items. One woman said she is avoiding buttermilk because it will increase baby weight and leads to difficult delivery.

In both developed and underdeveloped countries, change in dietary habits during pregnancy is very common. Some women include foods and some exclude due to pregnancy. Generally, women knowledge about food and pregnancy relationship was good. The dietary advice given by the local nurse and nutritionist was based on cheap food item which were easily available but advice given by the doctors was based on expensive food items as fortified foods. Although women have knowledge about which foods they need to include during pregnancy, still nutrient content was alarmingly low and the reason given by nutritionist is lack of money and time but most of the women did only household work. Custom is a biggest obstacle in consumption of recommended foods (Andersen *et al.*, 2003).

Some women know that fish contain mercury which is a neurotoxin and that's why fish intake should be limited and very few women know that fish contain Docosahexaenoic acid which is important for fetal brain and eyes development and that's why fish intake is very essential. If women let to know which type of fish should consume and if they get proper information, fish consumption can be increased (Bloomingdale et al., 2010).

Malnutrition During Pregnancy

Malnutrition rate is gradually decreasing in almost all around of globe instead of Africa where malnutrition maternal rate is steadily increasing day by day. This information was collected by doing meta-analysis in 27 Sub- Saharan African countries. Current rate of malnutrition is 23.5% among pregnant women. This indicates malnutrition is a biggest public health problem. Maternal malnutrition is ultimately leads to worst pregnancy outcomes and increasing risk of maternal morbidity and mortality (Desyibelew and Dadi, 2019).

Table 1

Malnutrition during pregnancy, sub-group meta-analysis (N= 23, random effect model).

Variables	Number of studies	Sample size	Pooled estimate, 95%CI
Country in which the study was conducted			
Ethiopia	14	7,391	26.00(20.9,29.3)
Other African countries	9	13,281	19.52(10.0,29.0)
Measurement			
BMI	11	11,894	19.4(10.2,28.6)
MUAC	15	9,872	26.5(21.5,31.6)
<21	3	1071	32.0(28.0,36.0)
<22	6	4008	20.3(13.8,26.9)
<23	6	4,793	28.1(17.6,38.5)
Overall pooled estimate	23	20,672	23.5(17.7,29.3)

Table from (Desyibelew and Dadi, 2019).

Food Aversion and Preferences

Most of the pregnant women reported preferences of certain food and food types in pregnancy and then gradually they developed food aversions. Food preferences are particularly for water & ice (30%), more green leafy vegetables and okra (18%), citrus fruits (22%), and high frequency of meat (38%) (Landman and Hall, 1983).

These food craving and aversion is due to change in some physiological changes like taste and smell. Aversions from fatty, greasy and caffeine is common during pregnancy (Knox *et al.*, 1990).

Aims of the Study in Slummy Areas

Focus on low-income pregnant women is very important as most of the adverse pregnancy outcomes are related to them. To know the factors that affect the dietary intake of pregnant women in low income household are essential to develop food based dietary interventions in ordered to improve pregnancy outcomes (Fowles *et al.*, 2011).

Major Concerns During Pregnancy

In USA, poor diet and low physical activity is a major issue of various pregnant women. According to US healthy eating guidelines, pregnant mothers are advised to consume 340-450 kcalories per day, avoid alcohol, limit caffeine and have needed supplementation. Birth defects are associated with poor maternal diet. Most of the pregnant women consume too much fat and sugar, and they do not follow appropriate dietary recommendations (Ferrari *et al.*, 2013).

In low- and middle-income countries, maternal health issues and reducing maternal mortality remains biggest public health concern. Pregnancy is a special part of life of a mother (Bhanbhro *et al.*, 2020).

40 % of American women are not consuming recommended intake of fruits. Mean fiber intake was also low during pregnancy and as a result non-pregnancy situation (Pick *et al.*, 2005).

Despite high sunlight, pregnant women (75%) of Pakistan are lacking vitamin D and this is due to the clothing factor which is providing resistance against sunlight. Pakistani population have sunlight phobia because of fear of getting dark skin (Mahmood *et al.*, 2007).

Violence against women is another contributing factor leading towards the negative effect on maternal and newborn health. High rate of c-section is also observed in poor socioeconomic status and this is due to the many reasons like late arrival in hospital, prolonged labor, fetal distress, high wound infection etc (Aftab *et al.*, 2012).

Better education, higher income and older pregnant ladies are likely to achieve recommended dietary intake during pregnancy. Women in poor rural areas are consuming less varied diet because of lack of availability of variety of food (Murrin *et al.*, 2007).

Pregnant women are more conscious about their diet and food choices and they had more concern regarding food safety as compared to non-pregnant women. Most of the women avoid certain foods who they have doubt about unsafe food handling and also harmful foods such as tobacco and alcohol for safe pregnancy. But with respect to alcohol and environmental exposure to smoking, substantial share of women does not follow recommendations (Verbeke and De Bourdeaudhuij, 2007).

Dietary assessment of expecting ladies was quite convoluted due to different factors like dietary fluctuation and nausea (Dwarkanath *et al.*, 2014).

Pregnancy and enabling dietary change

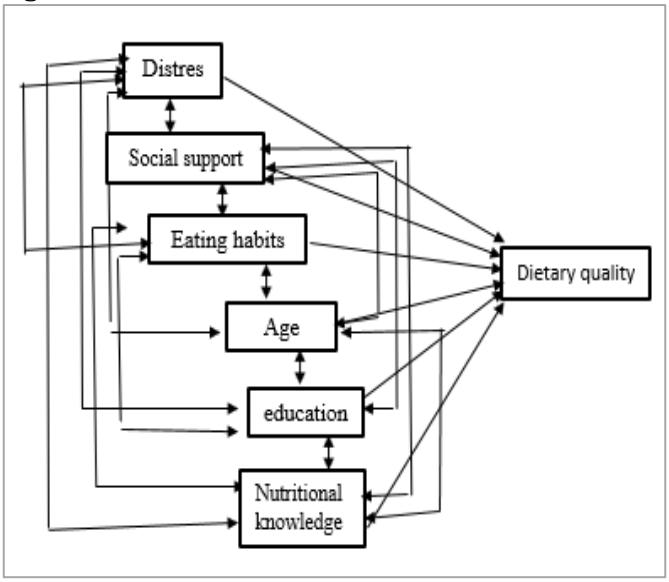
Studies have indicated that pregnancy is a window of opportunity to enable change in dietary habits of mother but this change is often limited and extent of change is unknown. These changes are limited due to financial issues and lack of family and social supports. But our young and new mothers are more motivated and want to make any change for the betterment of their fetus, they are more willing for nutritional change than professional give them credit for. These baby steps in right direction will lead to healthy pregnancy outcomes. During pregnancy, midwives play a vital role for motivating mothers to make healthy changes and giving them nutrition education and counselling. During pregnancy mothers like to get nutritional information from internet and it has been proven effective for isolated pregnant women. Studies showed women do not follow supplementation recommendations because they are not cost effective. For low income and vulnerable pregnant women, interventions to improve dietary intake, food fortification, supplementation may improve birth outcomes. Pregnancy is an opportunity and it should not be missed to improve maternal and fetal health (Rundle *et al.*, 2018).

Factors Affecting Maternal Dietary Quality

Contextual & Psychobehavioral Factors

Contextual factors include maternal age and educational level. In Europe older pregnant women consume less fat and more fruits and vegetables as compare to the younger pregnant ladies. Well educated women eat variety of nutritious food. Maternal stress and depression are a major barrier in healthy eating and leads to poor dietary quality. Women belong to low-income families suffer more stress because of food insecurity, financial disparities and hormonal changes. Stress women consume energy dense and poor nutrient food. Chronic stress leads to low birth weight (Fowles *et al.*, 2011).

Figure 2



Full theoretical path model from (Fowles *et al.*, 2011).

Dietary Assessment Methods

Interviewed applied Semi-quantitative food frequency (FFQ) questionnaire was used to know about dietary intake of pregnant women in China. Trained staff was recruited to administer FFQ at subject's home two weeks prior to the delivery date. To calculate nutrient intake, Chinese food composition table was used. (Cheng *et al.*, 2009).

Seven consecutive days dietary record

In order to assess dietary intake of pregnant women, seven consecutive days dietary record was collected and then multiple linear regression model was used to assess dietary lifestyle and pregnancy relationship (Cuco *et al.*, 2006).

24-hour dietary recall & dietary recipes

By using 24hour dietary recall with weighing foods and recording recipes, 30 pregnant women in their last trimester were interviewed in three non-consecutive days and these visits were unannounced. To avoid bias their food intake was assessed in normal days.

To estimate portion sizes, different parameters were applied like water in glass was used to assess the liquid food portion and cooked rice and lentils were bought with interviewer to show the interviewee to let us know about how much they consumed in their utensils. Recipes of all foods eaten was measured in same way. A standard recipe was used in case if women have not idea about recipe. Condiments etc were not included in study.

Their weight and height were also noted. Data about reproductive history, food, health and socioeconomic status was gathered by using semi-structured in-depth interview guide and all this information was noted down at the same time by research assistant.

These pregnant women were registered by village health nurses and data about thirty pregnant women was collected from them , all women recruited were in last trimester which was confirmed by the date of their last menstrual period which was written on women antenatal card or either in register of nurses (Andersen *et al.*, 2003).

Qualitative plus quantitative

A study in Africa assessed dietary behavior and food & nutrient intake of pregnant women by using both qualitative (in-depth interview) and quantitative (24-hour dietary recall) dietary assessment method. Most women reported dietary restrictions during rather than high consumption. But a consistent pattern of food restricted items was not found (Sholeye *et al.*, 2014).

Anthropometric measurement

Anthropometric measurement is very simple, low cost, reliable and easy maternal nutritional assessment method. 150 pregnant women between the age of 20-40 in their first trimester were selected. Participants suffering with diabetes, hypertension, heart and kidney diseases and those who were on strict diet were excluded.

A signed consent with written research detail was taken from participants. At baseline visit, maternal demographic detail like pregnancy history, medical history and maternal height and weight was taken by using structured questionnaire and interview. Dietary intake was assessed by using 168 listed food items semi quantitative food frequency questionnaire and data from this questionnaire was converted to grams. Gestational diabetes and anemia were confirmed by using American dietetic association criteria. New born head circumferences, height, weight, gestational age was recorded at the time of birth (Paknahad *et al.*, 2019).

Table 2

Relationship between Maternal Dietary Pattern and Infant Outcome

		HCLF	HCHF	High fiber	
No. of participant		34(22.6)	55(36.3)	61(40.6)	
Sex (of the neonates)	Female	16(10.7)	29(19.3)	26(17.3)	0.55
	Male	18(12.0)	26(17.3)	35(23.3)	
Preterm newborns	46	15(32.6)	14(30.5)	17(36.9)	0.12
Fetal macrosomia	19	1(5.2)	9(47.4)	9(47.4)	0.02
LBW newborns	11	4(36.5)	5(45.4)	2(18.1)	0.07
Newborn's wight (g)		3,122.3±468.3	3,234±483.1	3273.77±381.1	0.27
Newborn's height (cm)		51±2.2	51.3±2.3	50.8±3.4	0.60
Newborn's head circumference		35.16±2.4	35.05±1.8	34.91±1.2	0.81

Table from (Paknahad *et al.*, 2019).

Semi Quantitative food Frequency Questionnaire

The most valid dietary assessment method for pregnant women is food frequency questionnaire as compared to all other methods including 24-hour recall, blood biomarkers and food diary. For population-based study, semi quantitative food frequency questionnaire (FFQ) is mostly used for evaluating long term dietary habits. Multiple 24-hour recall method required various revisions to get validated results. Various studies used urine and blood as dietary assessment tools but in pregnancy there is a fluctuation in food intake due to nausea, vomiting and constipation in first trimester. Because embryogenesis take place in first trimester. Second trimester is recognized as metabolic changes.

In this scenario, food frequency questionnaire is validated as it is culture specific and fitted in all demographic. Semi quantitative food frequency questionnaire with listen 108 food items was administered in each trimester to report about dietary habitual changes. Along with recipes, routine supplementation was also recorded. On the other hand 24hour recall was applied when pregnant women came by the clinic for routine checkup. (Dwarkanath *et al.*, 2014).

Score Method

422 pregnant in second and third trimester were selected. This selection was based on regular visits of clients in their respective health care centers. Based on their medical registration number, simple random sampling technique was used. There were two study variables, knowledge of pregnant women and healthy dietary practices among

pregnant ladies. Knowledge of pregnant women was assessed by using scores as knowledge components were 9 in number. By listing 11 healthy eating practices, healthy eating practices of pregnant women were assessed.

Covariates were also listed including age, marital status, educational status, average monthly income and occupation. Data was collected in two phases; the first data was collected right before pregnant mothers receive nutrition education then client was asked to come back after 4 weeks to complete second phase of data collection. Those who did not come, a phone interview was conducted (Zelalem *et al.*, 2017).

Cross-sectional Survey

A community based cross sectional survey was conducted during march 1 to April 1. 616 pregnant women were participated in study. All eligible pregnant women were identified through house to house visit with the help of a local lady health care worker. Cluster sampling technique was used to select eligible pregnant women. The data was collected by using interviewer-based questionnaire which was developed in English but translated to sample in local language. Mid upper arm muscle circumference, dietary habits, obesity, socioeconomic status, and dietary knowledge was assessed. To assess dietary practices, ten questions were asked. Each question gained one score if the answer is correct. If the answers were wrong, zero score was given. (Nana and Zema, 2018).

Online Questionnaire

Two cross sectional survey was conducted by using online questionnaire. One survey was conducted from young women who gave birth and second was from health care professionals. Ethical approval was taken from research ethical committee. Before starting research, an information sheet was provided to participants. The survey used a combination of method free text and multiple choice questions (Soltani *et al.*, 2017).

Data Collection at Household and Checkup Camps

In selected villages, data was collected at household level and several health checkup camps were held. Women of the reproductive age (15-49) were recruited. At household level structured questionnaire was used to get information about socioeconomic status, dietary habits, anthropometric data, anemia, pregnancy status and kitchen gardening. Before asking questions, the purpose of study was explained to each and every woman. The interviewer asked about food groups not individual food items (Bhandari *et al.*, 2016).

Assessment of Underreporting

Among the study population Hennery Benedict equation was used to calculate Basal metabolic rate was calculated and Goldberg method was used to predict the different level of energy underreporting (Lindsay *et al.*, 2015).

Lifestyle Assessment

Along with food diary, a well-structured lifestyle questionnaire was provided to the women in their second trimester. The questionnaire was developed to well fit in pregnancy and questions related to daily activities, exercise, alcohol consumption, food choice and smoking were included. At least 30-minute moderate exercise 5 days in a week was suggested to pregnant women by one of the famous collages of America. Pre conception obese (BMI > 30kgm-2) women should gain only 5-9 kgs during pregnancy (Lindsay *et al.*, 2015).

Qualitative Data Assessment

Dietary practices were observed. Qualitative study was done by using subjective interview and focus group discussion. There focus groups including 6-12 study participant was constructed. Study participant among groups was classified in three groups mothers, health care and husbands. By using homogenous sampling technique, study participant in focus group discussion was selected. During data collection tape recorder was used in addition to typing. Individual interview took 30-45 minutes and focus group discussion took 45-1 hour. Transcription was done on same data collection day (Demilew *et al.*, 2020).

Qualitative Study Design

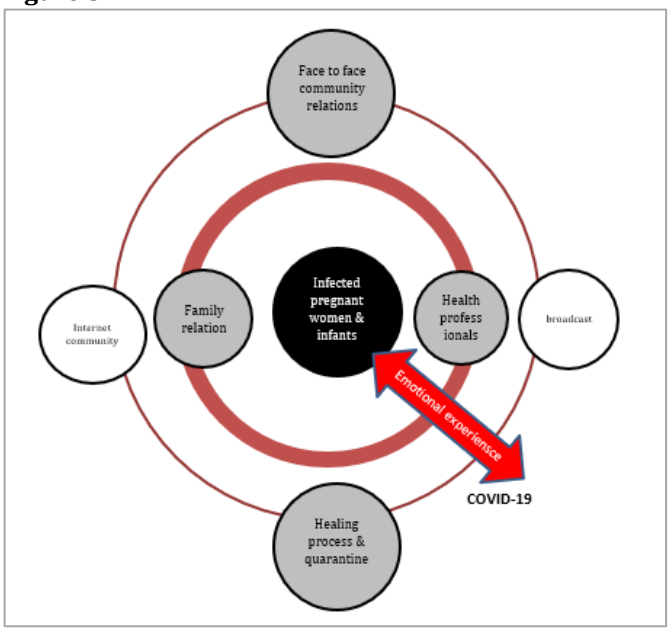
In 2011, semi structured individual interviews of pregnant mothers were conducted. Pregnant mothers who were at least 18 years of age and were in first & second trimester were recruited. 24 individual interviews were conducted from the mothers who meet recruitment criteria. Written consent and cash for travel was given to each mother. Interview was conducted by an experienced author who worked in low-income population and these interviews were held in private office near to the maternal care clinic. Interview duration was 60-90 minutes and only interviewer and interviewee were in the room. Prompting questions and interview guide was already developed by the author. Questions were like, how your eating habits are affected by pregnancy? Do you eat out or prepare meals by your own? The complete session was audio recorded which was translated later. During interview, participant was also asked to fill out a questionnaire contained questions about food security and demographics (Reyes *et al.*, 2013).

With content analysis approach, qualitative study was conducted from April to September in a city of Iran where maximum births occur annually. The inclusion criteria were based upon different factors but main was on the women who know about their pre conception heigh and weight. An individual as well as group interviews was conducted by the main author who is PhD student and have already conducted a series of qualitative studies and have experience with qualitative analysis software. Each and every step of data recording and data analysis were performed under author supervision. Participant who meets inclusion criteria were informed about study purpose and aim via telephone at first. The time of in person interview was decided on the willingness of participant. To conduct interview, semi structured questionnaire was used. Each interview was recorded and after interview, audio was converted into text immediately. Only interviewer and participant were in the room. Interview duration was 30-60 mint and each participant got a code and nickname. Until data saturation, interview continued. A total 16 individual and 3 group interview was held included 32 total samples (Kazemi and Hajian, 2018).

Pregnant women who infected with COVID-19 having 18+ age was included in the study. Women must be

mentally and physically capable of being participation in the study. Exclusion criteria was based on any factor which resist them to answer the questions during study and participant who were disagree upon the recording of their interview (Freitas-Jesus *et al.*, 2020).

Figure 3



A theoretical model of the reasons to be explored in the research (Freitas-Jesus *et al.*, 2020).

Broadcast and internet community are expended social factors health professionals, family relations, healing process & quarantine, face to face community relation are immediate social factors the personal context is infected pregnant women and infant

Qualitative Method

By using a phenomenological approach qualitative research was done. By using semi structured tape recording, data was collected from group interviews. One maternity and two community centers were picked out. Ten pregnant women were in each group. From medical research ethics, ethical approval was obtained before study (Symon and Wrieden, 2003).

Food Frequency Method

There are two types of food frequency methods:

- Wilhet food frequency questionnaire for short term dietary assessment (WFFQ)
- Cohort food frequency questionnaire for long term dietary assessment (CFFQ)

General checklist of 15 food categories is basic format of Wilhet food frequency questionnaire.

By conducting face to face interview cohort food frequency questionnaire was used (Lyu *et al.*, 2014).

Participant Recruitment

Thirsty pregnant women from last trimester were recruited from different religions as most of the women were Hindu and one was Muslim. These women were from poor social status. Their educational level was very low and most of the women's husbands were illiterate. Most families owned no land and most women were living in nuclear families (Andersen *et al.*, 2003).

Qualitative data collection and transcription:

By using in-depth interview of both working and non-working mother's data was collected from august to October. In-depth interview was not only conducted from participants, fathers, employees and care taker were also recruited. At the beginning of each session, a brief introduction and purpose of study was explained. A friendly environment was created by informing the participants that there is not right and wrong answer, their opinion matters only. Researcher conducted the interview in local language in ordered to avoid bias and better understanding. Per session took 45-90 minutes in a private room.

After conducting interview, all recordings and typing converted into transcription. Two experienced researchers with nutritional background read the transcripts carefully and independently and then they coded them into phrases. They generate codes on the basis of their knowledge and practical experience. These coded were then compiled to form themes. The themes were revised again and again. New points and themes were finalizing at the point of saturation. An ethical approval was taken at the start of study from an health research ethical committee (Kekalih *et al.*, 2019).

In 2018, data was collected from January to march. Firstly 21 semi-structured in-depth interviews were conducted along with 12 health care professional and 9 mothers, and three focus group discussion with 20 mothers. Mothers' interviews were conducted in a local health center which is a designated place within a community and mothers visit it for children vaccination. At their workplace, health care professionals were interviewed. These interviews were conducted live in local language (Urdu) by one of two authors who have more experience in public connection. Research assistance were recruited due culture of rural Punjab where male and female interaction is strictly restricted.

In-depth interview took 25-30 minutes and focus group discussion lasts for 40-50 minutes. All these interviews were audio recorded in nature but research assistance also make typing notes of discussion. Recording was quickly transcribed word to word into English language. After this data was analyze by two co-authors independently with thematic manual analysis procedure. Transcript were also verified by research assistance. To formulate study theme, inductive method was applied (Asim *et al.*, 2021).

Qualitative Research

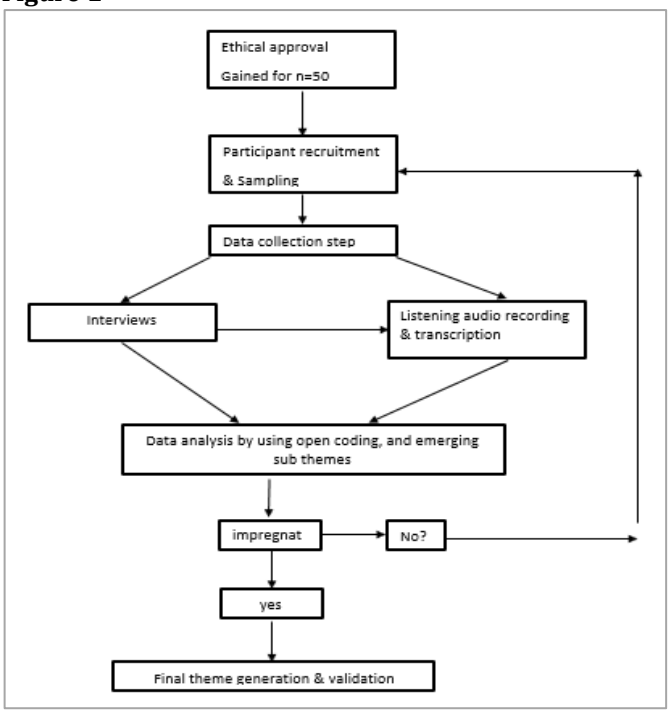
In ordered to investigate dietary behavior, qualitative research is the best to answer a series of complex questions as it finds out **how** and **why** certain behavior take place. Qualitative research is gaining popularity day by day thus, in decision making process, it should play a vital role. With respect to the nutrition and dietetic field, qualitative research has little discussion (Swift and Tischler, 2010).

Qualitative research is not performed by applying predefined recipes (Willig, 2013).

Qualitative research provide more in-depth information and related factors about a particular phenomenon (Kazemi *et al.*, 2017).

A flow chart of iterative method of participant recruitment, data collection and finally content analysis:

Figure 1



from (Padmanabhan *et al.*, 2015).

Table 3

Estimating odd ratio and 95% CI of adjusted and crude models for observing maternal and neonatal outcomes in terms of identified dietary patterns

Variable	OR type	HCLF	P value	HCHF	P value	High fiber (Reference pattern)
GDM	Crude	12.8(1.47-24.54)	0.02	3.46(0.34-34.3)	0.28	1
	Adjusted	15.08(1.5-26.4)	0.01	5.4(0.4-61.3)	0.18	1
Anemia	Crude	0.17(0.02-1.4)	0.10	1.1(0.4-3.09)	0.81	1
	Adjusted	0.24(0.02-2.15)	0.20	1.3(0.41-4.5)	0.59	1
Preterm neonates	Crude	2.04(0.84-4.9)	0.11	0.88(0.38-2.01)	0.76	1
	Adjusted	2.33(0.89-6.11)	0.08	0.78(0.31-1.93)	0.59	1
Fetal macrosomia	Crude	1.44(0.2-3.46)	0.65	2.26(0.2-25.6)	0.51	1
	Adjusted	1.03(0.34-5.61)	0.91	2.38(0.17-32.52)	0.23	1
Neonates LBW	Crude	3.93(0.68-22.7)	0.12	2.95(0.54-15.86)	0.20	1
	Adjusted	3.41(0.57-21.4)	0.19	3.23(0.56-18.57)	0.18	1

Table from (Paknahad *et al.*, 2019).

Spearman Rank Corella Rankings

Incoming from FFQ and 24-HDR multiple comparisons using 1 sample. Spearman rank corella rankings were used to examine the relationship between the elements measured by FFQ and 24-hour dietary recall rating. As we know food frequency questionnaire basically involves people, the consensus in the middle of food frequency questionnaire and 24-HDR bulk were also tested by checking the number of participants which falls under the same quintile for the distribution of elements both ways. Ongoing measurement of limited performance has been achieved by combining Spearman's interactions between genetic inclusions and biologic prodrugs of their condition (Dwarkanath *et al.*, 2014).

The data was compiled and c2 test was used to determine the relationship between food habits and anemia during pregnancy (Sharma *et al.*, 2003)

Statistical Analysis

Microsoft Excel Sheet

By using Microsoft excel, mean values, confidence interval and standard deviations was calculated. By using anova table, relationship between dietary data and socioeconomic status was calculated (Andersen *et al.*, 2003).

Anova Table

Factor analysis and varimax rotation have been used to differentiate major dietary patterns. The matrix loading values of the matrix larger than 0.3 are considered to determine the head elements of each dietary pattern [31]. One-way analysis of variance (ANOVA) with Pearson's $\chi 2$ the tests were selected to find significant differences in quantity and category variable, respectively.

The detection of an excellent prediction of dietary patterns was tested parallel analysis of the line. The odds (OR) rate has been adjusted for maternal age, disease history, disease control, and energy consumption. The high fiber diet pattern was thought to be reference pattern in this model. All analyzes were performed with SPSS ver. 24 (SPSS Inc., Chicago, IL, USA) and $p < 0.05$ were taken as the level of significance (Paknahad *et al.*, 2019).

Qualitative Data Analysis

To get an overview and whole sense of a written contextual material, each interviewer firstly read the complete text. The text is then analyzed again and again in ordered to understand the meanings and real aim of the interview and ultimately this text is condensed that is shortened in nature but core massage is still there. Finally, the tentative codes are assigned. Codes are applied in various domains of questioning. The tentative codes are revised and sorted in subthemes. An example is given below:

Condensed meaning units you talked with your friend who have been pregnant

Codes talking with friends, relatives, read information from internet, getting advice from midwife

Subthemes having private talks and reading by oneself

Themes finding results by oneself and getting advice from professional in case medical problem occur (Hamberg *et al.*, 1994).

In order to explain, women way of dietary management and their dietary experience during pregnancy, three domains have been found and they are listed below

Table 5

Three domians

Domains	Subthemes	Themes
Dietary information acquired	Private talks Oneself reading Guidelines for symptoms gained	Finding out by oneself If there is health problem, getting professional advice
Feedback to dietary information	Being confused and motivated Feeling guilt & fear	Being unreliable
Dietary handling	Looking food content Listening to bodily signals	Being responsible but with a pinch of salt

Table from (Wennberg *et al.*, 2013)

IBM version, SPSS 20 software

Data were entered for refinement and analysis using IBM version, SPSS 20 software of statistics. Descriptive data analysis is performed on generate waves and sizes from each variable in relation to outcome variability.

Part of the pre-test information was compared with their post-test questions to see the value of switch to each question. In each episode Confidence Time for the rate in the pre- and post-counseling category was also calculated noticed spacing. Change each item from the original post counseling was said to be important if the confidence period of the two dimensions is incompatible. The same N process was used on practice points for each part of the diet. Not general knowledge and practice a lot of pre-pregnant women and nutrition education was tested using a paired t-test (Zelalem *et al.*, 2017).

QRS Nvivo computer software

By using professional transcription services, data can be transcribed in word to word. Against audio recording different staff members then verify this transcript.

QRS Nvivo computer software

By using professional transcription services, data can be transcribed in word to word. Against audio recording different staff members then verify this transcript. Two investigators independently read give code, themes and sub themes to the contextual material and then this interpretation is compared if they applied the same interpretation process. By using open coding method, a code list is generated. To reflect the social ecological model, the code list was organized. Qualitative data management is then assisted by using QRS Nvivo computer software (Goodrich *et al.*, 2013).

MAXODA software

By using, MAXODA software data analysis was done, immediately after data collection. Based on similarities and difference, codes, themes, subthemes and categories were extracted. (Kazemi and Hajian, 2018).

Nvivo 11 software

Audio recording of focus group was manually transcribed. Participant's names were removed and replaced with numbers. Transcripts were judged and primary theme list was generated and analyzed. Initial themes were discussed with senior researchers. Compiled themes were applied to the transcripts by using Nvivo 11 software. Themes were revised again and again. Coded transcript was verified by external verification committee (Latuskie *et al.*, 2019).

Thematic analysis phases

There are some phases of thematic analysis: (Freitas-Jesus *et al.*, 2020)

1- Introduce yourself with contextual data
2- Initial code generation process
3- Looking for themes
4- Rechecking the themes
5- Explaining and meaning the themes
6- Generating the final report

Inductive Data Analysis

Inductive interpretation means that the themes, categories and different patterns of analysis come from the narrative data, they generate from the obtained text rather than being imposed on the data prior to collection and analysis (Patton, 1980).

And these patterns, categories and different themes do not emerge on their own. Their driven depends upon the interviewer that what he wants to know and how he wants to analyze (Bruce, 2007).

General Coding Process

In inductive analysis, the coding process is listed below:

Firstly, read the whole text data	Look for particular parts of information	To create categories, label the segments of information	Among categories, minimize overlapping & redundancy	By incorporating the most important categories, create a model
You have many pages of text at this stage	Now you have different parts of text	At least you have 30-40 categories now	Minimize categories 15-20 minimum	Finally, 3-8 categories

From (Thomas, 2003).

Dietary & nutritional guidelines during pregnancy

- Nutritional guidelines during pregnancy are based on Food guide pyramid. Because of increase pregnancy need of protein, high consumption of meat, eggs and fish is suggested (Ortega, 2001).
- Red meat such as beef is particularly recommended because of an important source of iron (Kaiser and Allen, 2008).
- To prevent food related various diseases during pregnancy, safe food handling is very important (Gilbert, 2002).
- Moderate exercise is a key component to promote healthy pregnancy (Morris and Johnson, 2005).
- During pregnancy, active and passive both exposure of tobacco smoking is extremely important (Lindbohm *et al.*, 2002).
- During pregnancy, to reduce the vitamin D deficiency, women are highly suggested to increase

the consumption of fatty fish such as salmon and herring (Burgaz *et al.*, 2007).

- In some studies fatty fish from sea is not recommended during pregnancy because it contains mercury and dioxin which are very toxic for both mother and fetus (Cox and Phelan, 2009).
- According to gynecologists, women without pregnancy complications and preexisting complications should do 30 minute exercise per day (Lewallen, 2004).
- To avoid fetal alcoholic syndrome, women who are or who are going to become pregnant should avoid alcohol (Eschleman, 1996).

Limitations

Most of the studies indicate dietary intake of pregnant women but very few studies include the parameters of poor socioeconomic status. Other studies were conducted solely with intention to determine the food choices and food beliefs of women during pregnancy (Andersen *et al.*, 2003).

The study was done on a very small sample size and serum micronutrient concentration was not determined. The dietary assessment methods like Food frequency questionnaire and anthropometric measurements are prone to bias and these methods are time consuming and very boring for both patient and interviewer (Paknahad *et al.*, 2019). We considered only few macros and micronutrients which were feasible to take into account (Dwarkanath *et al.*, 2014).

A very little research has been done to assess dietary intake of women belongs to low socioeconomic status particularly in the first trimester when a stage is set for fetal development (Fowles *et al.*, 2011). Findings from the study on low income pregnant women cannot be applied on rich women (Fowles *et al.*, 2011). Qualitative research was done by recruiting very small number of the participant which lack generalization. Few participants who attend the session were not available at the time of interview (Symon and Wrieden, 2003).

CONCLUSION

Poor nutrient intake of iron, folate, zinc and riboflavin was reported in pregnant women and these were the nutrients which were crucial for pregnancy (Cheng *et al.*, 2009). To control weight gain and improve pregnancy outcomes, healthy lifestyle during pregnancy is very essential. Women have no knowledge about healthy weight gain during gestation but at some places knowledge about healthy lifestyle is very high but women face different barriers (Goodrich *et al.*, 2013). During first trimester, more than 45% women do not meet the recommended allowance of vitamins, and the women quickly follow the recommendations of quitting smoking & alcohol as compared to increase uptake of fruits and vegetables (Crozier *et al.*, 2009). Unplanned pregnancies had no concern about supplementation guidelines (Sen *et al.*, 2001). As compared to Indian recommendations, pregnant women were deficient in all nutrients except fat. Low intake of food due to poor economic status showed women were also lacking micronutrients. Many women express their wishes to have more fruits, vegetables, cereals and milk if they can afford it. Few women also said that they will follow dietary advice if they have money (Andersen *et al.*, 2003). As compared to the dietary recommendations, the mean nutrient intake was found extremely insufficient but nutrient intake of rural women was high as compared to urban pregnant ladies. (Sholeye *et al.*, 2014). Mothers who were taking high fiber diet before pregnancy reported healthy pregnancy outcomes (Paknahad *et al.*, 2019). After giving nutrition education, nutrition knowledge and pregnancy specific dietary practices of Ethiopian women improved (Zelalem *et al.*, 2017).

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