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Evaluation of the Relationship Between Internet Addiction and Depression in Adolescents

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Abstract

Objectives:

This study aims to examine the levels of internet addiction in adolescents and its relationship with depression and with certain sociodemographic characteristics.

Methods:

A cross-sectional and survey type study was conducted on 300 adolescents, aged 10-18 years.

Results:

187 (62.3%) of the 300 participants included in our study were male. Of the participants using the internet, 227 (75.6%) were normal internet users, 54 (18%) were risky internet users, and 10 (3.4%) were internet addicts (the participants were divided into three groups). There was no statistically significant difference between the groups in terms of the presence of depression ($p=0,33$). In addition, a statistically significant but weak positive correlation was found between the internet addiction level and the depression score ($r=0,194$, $p=0,001$). A statistically significant positive correlation was found between the duration of internet use and the internet addiction level (normal, risky, addict) ($r=0,34$, $p<0.001$) and the internet addiction score ($r=0,35$, $p<0.001$).

Conclusion:

The internet addiction level (moderate, risky and addict) and the duration of internet use increased with the depression score. It was concluded that internet addiction causes a tendency for depression in many aspects.

Keywords: *Internet addiction, Depression, Aggression, Adolescents*

Introduction

In virtue of the internet, information can be accessed easily and fast. In addition, information is stored and shared on this network.¹ The internet has an important place in our daily live, but recently, unhealthy internet use has increased.^{2,3} Young internet addiction is defined as an uncontrollable desire of the internet use, which is more than planned, the occurrence of internet withdrawal symptoms (intense nervousness, aggression etc.) and the progressive deterioration of the professional, social and family life of a person.⁴ In the international multicenter epidemiological studies on the prevalence of

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pathological internet use: the prevalence has been evaluated as 1% in America, 2-18% in Asian countries, 1-12% in Middle Eastern countries and 1-9% in European countries.⁵ In our country, the prevalence was found to be 4.5%.⁶

Internet use is more common among adolescents worldwide, and the prevalence of depression among adolescents is increasing due to various factors. Therefore, in recent years, the adolescence period has become the focus of studies on internet addiction and depression.⁷ The curiosity and desire to follow the technological and scientific innovations expose adolescents to the risk of internet addiction.⁸

Studies have shown that internet addiction contributes to the development of depression symptoms.⁹ So, investigating the prevalence of internet addiction in adolescents and its relationship with psychiatric disorders can provide useful information in terms of diagnosis, treatment and psychosocial support.^{10,11}

Internet addiction, as in other addictions, may cause some consequences that will affect the mental and physical health, all social relations, behaviors and attitudes of the individual negatively. As a result of mentally and continuously engaging in internet-related matters, the individual fails to fulfill the responsibilities in the professional, academic and social life and the success gradually decreases.¹²

Although there is no proven method for the treatment of internet addiction, methods such as psychotherapy and pharmacotherapy are used in order to find a solution to this problem.¹³ However, it is important to determine the spread of the internet use among the adolescents and the factors influence this, which may give some hint to fight this issue. This study is a cross-sectional and survey type study, which aims to examine the characteristics and addiction levels of internet use, and its relationship between depression and some sociodemographic characteristics in adolescents between 10-18 years of age.

Materials and Methods

The study was conducted on adolescents between 10-18 years of age, who applied to the Child and Adolescent Polyclinic of Dicle University, Faculty of Medicine, Children's Hospital. The study was a cross-sectional and survey type study. The study was conducted between the dates 22.10.2020 – 22.02.2021, which is approved by the Dicle University Medical Faculty Ethics Committee. Ethical consent was obtained from the participants.

Inclusion Criteria

Adolescents who were able to fill out the survey and the informed ethical consent were included in the study.

Exclusion Criteria

- If the person filling out the survey is illiterate, has any physical or health condition (previously diagnosed with any psychotic or mental illness including depression, has a vision disorder, motor disorders or substance addiction),
- If the person does not speak Turkish or is illiterate,
- If the person has any additional chronic disease that could affect the results (chronic respiratory, hematologic or gastrointestinal diseases), they were excluded from the study.

Data Collection Tools of the Research

Three different data collection tools were used in the study. These were Young's Internet Addiction Test, Sociodemographic Data Form and The Children's Depression Inventory.

Sociodemographic Data Form: This form was consisting of 20 questions, created by using literature information to determine the sociodemographic characteristics of the participants.

Young's Internet Addiction Test: It is a scale consisting of twenty questions and six Likert-type response anchors for each question. The scale includes the options "never", "rarely", "sometimes", "often", "very often", and "always". Participants mark only one of these options and receive 0, 1, 2, 3, 4, 5 points respectively, according to the options they marked.¹⁴ Its reliability and validity have been proven in our country.¹⁵ In our study, as a result of the statistical analysis of the validity and reliability of the data, the data were proven reliable with a Cronbach's Alpha internal consistency coefficient of 0.899, and valid with a variance rate of 53.445. In the 2001 study that Bayraktar first adapted the scale for Turkish, according to the answers given to the 20 questions, those who scored between 0-49 were classified as moderate internet users, those who scored between 50-79 as risky internet users, and those who scored between 80-100 were classified as internet addicts.¹⁶

The Children's Depression Inventory: In order to determine the depression levels of the participants in our study, the "Children's Depression Inventory" comprised of 27-items, developed by Kovacs was used,⁷ which was adapted for Turkish children and adolescents between the ages of 6-19.¹⁸ Each item receives a score of 0, 1 or 2 depending on the severity of the symptom. The maximum score is 54. The recommended cut-off score is 19, which means the scores 0-18 is considered as not-depressive and 19-54 as depressive. The depression score was calculated by adding the scores of all of the answers. The lowest score that could be obtained from this scale was 0, and the highest score was 54. In this scale, an increase in the depression score indicated an increase in the level of depression.

Statistical Analysis

Statistical analysis was carried out using the SPSS 18 software. The suitability of the variables for normal distribution was examined by visual (histogram and probability plots) and analytical methods. Descriptive statistics were presented using median for quantitative not normally distributed variables, mean for normally distributed variables, and frequency for ordinal variables. For the relationships between variables, at least one of which was not normally distributed or was ordinal, correlation coefficients and statistical significance were calculated by Spearman's test. Between the groups, not normally distributed quantitative variables and ordinal variables were compared using the Kruskal-Wallis test. Categorical variables between the groups were compared using the Chi-square test. The cases, in which the p-value was less than 0.05, were evaluated as statistically significant results.

Results

187 (62.3%) of the 300 participants included in our study were male. The sociodemographic characteristics of the participants are shown in Table 1. Most of the participants were high school students (79%). The median age of the patients was 15 (10-18). 97% of the participants were internet users.

The median score of internet addiction of the participants was 36 (2-91), and the median score of depression was 27 (2-54). 291 participants using the internet were divided into three groups (moderate internet users, risky internet users, internet addicts) according to the internet addiction scale. Of the participants using the internet, 227 (75.6%) were moderate internet users, 54 (18%) were risky internet users, and 10 (3.4%) were internet addicts.

No statistically significant difference was found between the groups in terms of gender ($p=0.98$), the education levels ($p=0.57$), the age ($p=0.21$), family income ($p=0.83$), grade retention ($p=0.68$), the presence of depression ($p=0.33$, Table 2).

When the relationship between the internet addiction scores of the participants and independent factors was evaluated, no statistically significant positive relationship was found between the age and the internet addiction score ($p=0.68$, $r=-0.24$). On the other hand, a positive and statistically weak - moderately significant relationship between the internet addiction score and the depression score ($p<0.001$, $r=0.36$), a statistically significant but weak positive correlation between the internet addiction level and the depression score ($r=0.194$, $p=0.001$), a statistically significant positive correlation between the duration of internet use and the depression score

($r=0,198$, $p=0.001$), a statistically significant positive correlation between the duration of internet use and the internet addiction level (moderate, risky, addict) ($r=0,34$, $p=<0.001$) and a statistically significant positive correlation between the duration of internet use and the internet addiction score ($r=0,35$, $p=<0.001$) were found.

Discussion:

In a cross-sectional study conducted by Goel et al. on 987 adolescents between the ages of 16-18, they found that 74.5% of the participants were moderate internet users, 24.8% were possible addicts and 0.7% were internet addicts.¹⁹ In a study conducted by Siomos et al. on 2200 students between the ages of 12-18, internet addiction was detected in 8.2% of the students.²⁰ 10 (3.4%) of the participants in our study were internet addicts and so the percentage of internet addicts was relatively low, consistent with the literature.

In a survey type study conducted by Kraut et al. on 1965 participants, it was stated that males use the internet more frequently than females in the adolescence period.²¹ In an online survey conducted by Tahiroğlu et al. on 3975 adolescent students, it was found that internet use more than 12 hours per week was more frequent in males (11.1%) than females (4%).²² In a study conducted by Batıgün et al. on 213 participants between the ages of 18-27, on internet use and addiction, no difference was found in terms of gender.²³ In the survey study conducted by Griffiths et al. on 218 university students, the participants were evaluated in terms of seven different internet addictions such as Facebook addiction and gaming addiction, and it was found that internet addiction among females was higher than among males.²⁴ So, there is not enough data to reach a firm conclusion about the role of gender in internet addiction. In our study, no statistically significant difference was found between internet addiction and gender. Hence, we may conclude that the rate of internet use is independent of gender.

The number of studies examining the relationship between internet addiction level and age in adolescents is limited. In a study conducted by Bölükbaş et al. on a total of 558 participants, 283 females and 275 males attending 6th, 7th and 8th grades, using the internet addiction scale, no significant difference was found between internet addiction and age.²⁵ The current study also found no statistically significant difference between internet addiction and age.

In a study conducted on high school students, it was found that digital addiction was not affected by the class levels of the students.²⁶ A study by Lam et al. on 1618 high school students between the age of 13-18 in 2009 demonstrated that the rate of risky internet users and internet addicts decreased as the level increased.²⁷ In general, based on the literature data, the level of addiction has a decline with increasing the level of the classes. This situation can be expected due to the fact that the students

use the internet less, as they prepare for university admission tests towards the end of high school. However, as in our study, the negative correlation rate of the internet use with the education levels was not supported by other reports. The results may be affected by many factors such as access to the internet, living with family or going to a boarding school, the school policy on the internet use, type of the study, and the population of the study.

Students may spend less time doing research and homework when they spend more time on the internet than necessary. So, their academic success of students may be adversely affected.²⁸ Soydan et al. reported that internet addiction shows dependence on the academic achievements of the students, conducted on a study involving 393 university students aged 18-39 years.²⁸ The internet addiction scores of the students with medium or low academic achievements were significantly higher than those of the students with high academic achievements. Another study by Mayda et al. involving 1000 students living in university dormitories, using Goldberg's Internet Addictive Disorder Scale consisting of 22 questions indicated that the internet addiction rates of the students with a history of grade retention were found to be statistically significantly higher than those of the never-retained students.²⁹ Generally, grade retention may be an indirect indicator of academic success, but the number of studies examining the relationship between grade retention and internet addiction is limited. Basically, a large number of the work includes the university students where many factors play roles in the rate of the internet use. They may be listed as the less parental pressure, non-compulsory class attendance, the environment, the more liberal social life. In our study, no statistically significant difference was found between the retained and never-retained students in terms of internet addiction. Our study was conducted on high school and middle school students. Therefore, our results should be supported by other studies that will be conducted to university students.

Studies examining the relationship between family income and internet addiction are limited in the literature. A study by Lam et al. on 1618 high school students between the age of 13-18 presented that as the family income decreases as with decreasing the scores obtained from the internet addiction scale.²⁵ Another report by Park et al., which consisted of 903 secondary and high school students documented no relationship between the level of family income and internet addiction.³⁰ It can be deduced that the relationship between the family income and internet addiction may decrease over time due to the widespread use of devices such as tablets, computers and mobile phones that provide internet access and as the cost of internet access is reduced. In our study, no relationship was found between the family income and internet addiction. When the current studies in the literature were evaluated, family income was classified differently; and evidently it would be difficult to draw a

general conclusion on this issue, as the assessment of family income may vary according to the socioeconomic status of the country and the differences in regions, in which the studies were conducted.

Internet addiction can be a cause or an effect of depression. A person who has depression due to different psychosocial factors may turn to the internet and consequently become an internet addict, or a person may become depressed due to internet addiction. Adolescents that are addicted to the internet have stated that they think of the internet as an environment that reduces their depressive moods.⁸ There are many studies in the literature that examine the relationship between internet addiction and depression. A survey by Kim et al. on 1573 high school students, using the internet addiction scale, reported a positive significant relationship between internet addiction and depression and suicidal thoughts.³¹ A study by Liu et al., demonstrated a positive significant relationship between problematic internet use and depression, aggressive behavior and substance use in adolescents.³² A different study by Şahin et al, using the Beck Depression Inventory and the Internet Addiction Scale, showed a statistically significant relationship between internet addiction and depression.³³ In our study, no difference was found between the groups in terms of depression. The outcomes of the current work are similar to those previously conducted in our country. A statistically significant but weak-moderate positive relationship was found between the internet addiction score and the depression score. In our study, it was found that as the internet addiction level as well as the duration of internet use is positively correlated with the depression score. So, it was concluded that internet addiction causes a tendency for depression in many aspects. Consequently, our results demonstrate that the association of internet addiction with depression are multifactorial, and they are partially in line with the literature.

It has been shown in many studies that there is a relationship between the increase in the duration of internet use and internet addiction.^{34,35} A common result in the studies is that addicted individuals use the internet longer in a day than non-addicts. In our study, in accordance with the literature, a positive relationship was found between the duration of internet use and the internet addiction level and the internet addiction score. It can be said that there is a positive relationship between the daily duration of internet use and internet addiction in adolescents. In addition, it can be said that the level of addiction may increase in proportion to the amount of use.

Limitations of the Study

Since our study was conducted only in Dicle University Medical Faculty and in a local area, it is difficult to draw a general conclusion and therefore it may not be accounted for the general of the adolescent population in the region. It is believed that conducting studies including adolescents from

different regions will be beneficial in terms of the reliability and efficiency of our results. In addition, the internet addiction score is used for screening purposes and cannot be used for clinical evaluation. Therefore, the fact that the patients were not clinically evaluated so could negatively affect the frequency of depression in our study.

Conclusion

In our study, it was found that as the internet addiction level (moderate, risky and addict) and the duration of internet use are positively correlated with the depression score. So, it was concluded that internet addiction causes a tendency for depression in many aspects. Since internet addiction is one of the reasons for the increase in the prevalence of depression in adolescents today, in the current health system, information, counseling and support should be provided to families about internet addiction and depression in adolescents. Families should also be educated on this issue. In schools, education about conscious use of internet for students should be emphasized. Necessary precautions should be taken for adolescents to socialize and to prevent internet addiction. Different and useful methods of screening should be developed for the early diagnosis of psychiatric symptoms due to internet addiction by conducting multicenter studies on this subject with wider participation.

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Chromosome Analysis and Rt-Pcr Results of Sox9 and Sry Genes in Patients With Gender Development Disorder

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Abstract

Objective:

In this study, we aimed to investigate the effects of SRY and SOX9 genes on changes that occur after bipotential gonad development in patients with disorders of sex development encountered in our region and to examine the relationship between mutations in these genes and testicular and ovarian development.

Method:

Blood samples were collected from 60 patients who were admitted to the Medical Biology and Genetics Department of Dicle University's Medical Faculty with suspicion of sexual development disorder. Karyotype and RT-PCR analysis of SRY and SOX9 genes were performed on blood samples of the participant patients

Results:

Molecular analyses revealed that 4 of 44 individuals with a 46, XY /47, XXY karyotype lacked the SRY gene, while 3 of 16 individuals with a 46, XX karyotype had the SRY gene. However, the SOX9 gene was positive in all individuals.

Conclusion:

The results of the present study, no significant relationship was found between the SRY and SOX9 gene regions, and more detailed studies are needed to clarify the relationship between these genes and sexual development.

Keywords: SOX9 gene, SRY gene, Gender anomaly

Cinsiyet Gelişim Bozukluğu Olan Hastalarda Sox9 ve Sry Genlerinin Kromozom Analizi ve Rt-Pcr Sonuçları

Özet

Amaç:

Bu çalışmada bölgemizde karşılaşılan cinsiyet gelişim bozukluğu olan hastalarda bipotansiyel gonad gelişimi sonrası oluşan değişiklikler üzerine SRY ve SOX9 genlerinin etkilerini incelemeyi ve bu genlerdeki mutasyonlar ile testis ve over gelişimi arasındaki ilişkiyi araştırmayı amaçladık.

Yöntemler:

Dicle Üniversitesi Tıp Fakültesi Tıbbi Biyoloji ve Genetik Anabilim Dalı'na cinsel gelişim bozukluğu şüphesiyle başvuran 60 hastadan kan örnekleri toplandı. Katılımcı hastaların kan örneklerinde karyotip analizi ve SRY, SOX9 genlerinin RT-PCR analizi yapıldı.

Bulgular:

Moleküler analizler sonucunda, 46,XY /47,XXY karyotipine sahip 44 bireyin 4'ünde SRY geninin bulunmadığı; 46, XX karyotipine sahip 16 bireyin ise 3'ünde SRY geninin tespit edildiği belirlenmiştir. Bununla birlikte, tüm bireylerde SOX9 gen bölgesi pozitif olarak değerlendirilmiştir.

Sonuçlar:

Mevcut çalışmanın sonuçlarına göre SRY ve SOX9 gen bölgeleri arasında anlamlı bir ilişki bulunamamıştır, bu genler ile cinsel gelişim arasındaki ilişkinin açıklığa kavuşturulması için daha detaylı çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: SOX9 geni, SRY geni, Cinsiyet anomalisi

Introduction

Disorders of Sex Development (DSD) are congenital conditions in which chromosomal, anatomical or gonadal sex development is incompatible¹. Sex-determining region Y protein or testis-determining factor is a DNA-binding protein encoded by the SRY gene, which is responsible for the initiation of male sex determination in therian mammals. SRY is an intron-free sex-determining gene on the Y chromosome. The transcription factor SOX-9 is a protein that is encoded by the SOX9 gene in humans. SOX9 is located on chromosome 17q24 in humans. SOX9 helps direct SRY activation in sex differentiation. Mutations in SOX9 or any related gene can cause sex reversal. There are a total of 46 chromosomes in all human cells, 23 from the mother and 23 from the father. 44 of the 46 chromosomes are autosomal and the remaining 2 chromosomes are gonosomal chromosomes and are named X and Y. Accordingly, the gonosomal chromosome in males is XY. In women, the gonosomal chromosome is XX. Some individuals may have chromosome structures differing from the normal chromosome structure of 46, XY /46, XX.² Since such differences occur in the sex chromosomes, this condition is defined as a sexual development disorder. One of the important causes of sex

development disorders is chromosome abnormalities. DSD is defined as a condition in which the chromosome structure, gonads, external genital organs and anatomical structure are incompatible with each other to varying degrees³. DSD is found in men showing 46, XY constitution. DSD is grouped within itself as testicular developmental disorders, insufficiency in androgen synthesis effect or genetic anomalies¹. The phenotype of the external genital structure in 46, XY DSD may be a normal female, ambiguous genital structure or a male with micropenis. The prevalence of 46, XY testicular disorder is approximately 1/20.000. 15 percent of this anomaly is caused by mutations in the SRY gene, DAX1 gene and SOX9 gene⁴. Therefore, it was thought that examination of the SRY gene in patients with XY and XX karyotypes with disorders of sex development would be useful in elucidating the etiology if no other cause could be identified. We found it appropriate to study the Sox9 gene because it is linked to other genes and signaling pathways responsible for sexual development, especially SRY.

In this study, we investigated the effects of SRY and SOX9 gene regions we identified using the RT-PCR method. In line with the results we obtained, we tried to learn the effect of these gene regions on sex formation. Thus, we aimed to create preliminary data for similar studies to be conducted.

Materials and Methods

Blood samples were taken from 60 patients aged 0-45 years who were referred to the Department of Medical Biology of Dicle University Faculty of Medicine Hospital with a preliminary diagnosis of sexual development disorder. In our study, the patient group was used alone. A control group was not used because we aimed to investigate the changes in the patient group in the gene regions we studied. Since it is difficult to find a control group in such diseases, studies were continued only on the patient group. No comparison is made in our research. A literature review reveals that such studies lack a control group. The kit includes its control group. The kit's control group was used throughout the study, and no problems with the primers were encountered. Chromosome analysis was performed by cell culture method. DNA was isolated from the patient's blood for RT-PCR analysis. In line with the chromosome analysis results obtained, the data were evaluated using the RT-PCR method with SRY and SOX9 primers for each patient. The chi-square test was used to compare the results in this study."

Results

This study included 60 patients diagnosed with disorders of sex development who were referred to the Medical Biology and Genetic Diagnostic Laboratory of Dicle University Faculty of Medicine. Studies were performed using the lymphocyte culture method, karyotype analysis, and RT-PCR

method on peripheral blood samples taken from 60 patients in our study group. As a result of karyotype analysis revealed that 1 of the 60 patients had Klinefelter syndrome (47, XXY), 43 had 46, XY (male), and 16 had 46, XX (female) karyotypes (Table 1). Based on these karyotype results, the relationship between gene regions was analyzed. Cases with different chromosome structures are presented in our study group.

Table 1: Karyotype results of the patients

Karyotype Result				
		Frequency	Percent	Cumulative Percent
Valid	46, XX	16	26,7	26,7
	46, XY	43	71,7	98,3
	47, XXY	1	1,6	100
	Total	60	100	

In this study, the effects of these genes on gender were investigated by using 2 different primers in 60 individuals. Primer binding curves of all patients were checked at the end of RT-PCR test. The results were evaluated by considering the melting curves of the bound primers.

Our findings revealed that 4 of 44 patients with 46, XY/46, XXY karyotype did not have the SRY gene region (Table 2). Only 3 out of 16 female patients with a 46, XX karyotype had the SRY gene, while the SOX9 gene was found intact in all patients (Table 3).

Table 2: Distribution of the SRY gene's RT-PCR results

Rt-PCR Result		
Karyotype	Sry gene	
	Number of positive patients	Number of negative patients
46, XY / 47, XXY	40	4
46, XX	3	13
Total	60	

Table 3: Distribution of the SOX9 gene's RT-PCR results

Rt-PCR Result		
Karyotype	Sox9 gene	
	Number of positive patients	Number of negative patients
46, XY / 47, XXY	44	-
46, XX	16	-
Total	60	

Discussion:

The Y chromosome is the determining factor for male sex development⁵⁻⁶. In mammals, sex is determined by the Y chromosome encoding a testis-determining factor (TDF). This factor causes undifferentiated embryonic gonads to develop as testes rather than ovaries. The testes then produce male sex hormones, which are responsible for all male sexual characteristics⁷. In 1980, a researcher named Peter Goodfellow studied a gene localized on the Y chromosome and responsible for sex determination. As a result of this study, he found the SRY gene⁸. It was assumed that the SRY gene alone could provide testicular development (SRY's previous name: TDF =testis-determining factor). Later, it was understood that other new genes were also involved in testicular formation (sox9, wt-1, wnt-4, sf-1 on autosomal chromosomes; dax-1 gene on the short arm of the X chromosome). Genes such as SOX9, FGF9 provide testicular development depending on the dosage, while wnt4, foxl2, dax1, b-catenin genes provide ovarian development⁹. SRY gene localized on the short arm of the Y chromosome is located close to the area called 'pseudoautosomal region 1'(PAR1).

PAR1 is the most frequent site of the so-called “crossing over” during prophase I of meiosis and in some cases the SRY gene may also participate in this crossing over. If the SRY gene undergoes crossover, the embryo having an XY chromosome structure at the stage of sex development may develop as a female because it lacks the SRY gene, and accordingly, an XX embryo may develop as a male because it has the SRY gene.¹⁰ In some studies, SRY positive 46, XX individuals are usually diagnosed during infertility investigations in adulthood¹¹. More than one transcription factor plays important role in such disorders of sex development. Studies indicate that SOX transcription factors play critical roles in various developmental processes and are associated with some clinical mutations. Zhao et al found that two SOX transcription factors, SRY and SOX9, are key regulators of male sex determination and fetal testis development in developing mouse gonads.

Their study reveals that SOX4, an important gene in the SOX family, may function as a transcriptional repressor in fetal testes and contribute to the precise regulation of the Sry and Sox9 genes.¹² Another study in mice showed that transient expression of the Sry gene increased the expression of its direct target, Sox9. SOX9 activity induces the differentiation of Sertoli cells rather than granulosa cells. It is also known that mutations in the SOX9 gene often result in XY female sex reversal. Structural mutations or deletions of Sox9 cause feminization in XY individuals in both humans and mice.¹³ As a transcription factor, SOX9 serves as the second key gene after SRY in male sex determination. SOX9 promotes Sertoli cell proliferation and suppresses ovarian development by activating the production of anti-Müllerian hormone (AMH/MIS). Upregulation of SOX9 by SRY promotes the differentiation of the bipotential gonad into a testis. In the absence of SRY, the genital

ridge develops into an ovary by default. Interestingly, SRY is sufficient but not essential for testicular development. Because high levels of SOX9 expression alone can initiate testicular development and substitute for SRY function. Indeed, inactivation of both SOX9 alleles leads to ovarian development in XY mice¹⁴

Conclusion

In our study, the Sox9 gene was present in all patients, while some XY patients lacked the sry gene. Accordingly, examination of the patients' internal and external genitalia revealed that XY patients lacking the sry gene had female developmental and reproductive problems. The absence of the SRY gene in XY patients is known to be caused by chromosomal abnormalities, such as crossing over or deletion. The presence of the Sry gene plays an important role in sex development, but since the Sox9 gene was present in all patients in our study, it is unclear whether it has a significant association with disorders of sex development. The relationship between SRY gene expression and SOX9 gene expression is noteworthy in the literature. Studies have shown that these genes can cause functional changes based on their expression levels and interactions with other genes. In our study, the presence of the SOX9 gene was detected in all patients, but expression levels and functionally related genes to these genes were not analyzed. However, the presence of the SOX9 gene in patients with disorders of sex development despite the absence of the SRY gene makes it important to investigate the possible role of this gene.

Evaluating patients with disorders of sex development concerning their internal and external genitalia is crucial in such studies. Given that the Sry region may be associated with other signaling pathways due to its absence in some patients, examining other genes in addition to these gene regions in sex-related studies is believed to provide additional information for studies of disorders of sex development. These findings also show that gender determination is a complex process regulated by more than one genetic factor

As a result, appropriate genetic counseling can be provided to individuals with genetic diseases and those with genetic diseases inherited in their family history. Awareness can be created for the individual, their family and future generations about such diseases. Clinical management of DSD can begin before the baby's birth, thanks to advances in technology today. DSD counseling is possible even at this early stage, based on prenatal ultrasound and test findings. Factors affecting sex determination include diagnosis, surgical options, genital appearance, psychological support for patients, necessary lifelong replacement therapy, and familial and cultural factors. Because DSD is a multifaceted and complex process, it requires multidisciplinary teamwork. Long-term follow-up

studies on prognostic factors and prognosis in DSD are scarce, and further research is needed on this topic.

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Knowledge, Perceptions, and Experiences Regarding Factors Affecting Maternal Mortality and Child Nutrition in Afghanistan

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Abstract

Objective:

This study aimed to investigate the knowledge, attitudes, and lived experiences of healthcare workers, medical students, and community members in Afghanistan on aspects leading to maternal deaths and child malnutrition. Moreover, the study aimed to find out barriers to effective interventions on maternal and child health and to inform strategies for improving outcomes in these populations.

Method:

A descriptive cross-sectional survey using the Snowball Sampling method was conducted. Participants were healthcare providers (n=75), medical students (n=386), and community members (n=159). The data were collected through structured questionnaires. Thematic qualitative analysis was used to identify the major patterns.

Results:

Hemorrhage (72.7%) and malnutrition (41.6%) were leading causes of maternal deaths, with iron deficiency (76.6%) as the top nutritional issue. Malnutrition was linked to congenital anomalies like heart defects. Only 13% of healthcare workers fully implemented nutrition protocols, and medical students showed poor preparedness. Additionally, 76.7% of community members lacked access to government nutrition programs. Poverty was the main barrier to improving maternity and child health.

Conclusion:

Despite moderate awareness of maternal nutrition, systemic gaps, poor clinical training, and unequal access to programs hinder efforts to reduce maternal mortality and child malnutrition in Afghanistan. It is recommended that healthcare education be strengthened, program access be made equitable, and poverty be tackled through community engagement.

Keywords: Child malnutrition, birth defects, nutritional deficiencies, maternal health

Introduction

Afghanistan continues to endure heavy blows in maternal and child health. The recent estimates suggest a maternal mortality rate of 400 deaths per 100,000 live births, which ranks among the highest in the world¹. Another 40% of this population of children under 5 are affected by stunting, wasting, and micronutrient deficiencies². The effects of poverty, lack of access to healthcare, and systemic weaknesses within the health infrastructure are considered among the chief causes of these negative outcomes^{3,4}. Maternal death is most caused by hemorrhage, hypertensive disorders, infections, and complications arising from unsafe abortions, especially in low- and middle-income countries⁵⁻⁸. In Afghanistan, studies emphasize the existing regional disparity in maternal death rates—with mortality being significantly higher in rural provinces than in urban centers such as Kabul⁹. Equal factors contributory to this scenario are low literacy among women, lack of antenatal care (ANC), economic constraints, and an unstable system for the delivery of healthcare. Generally, antenatal care has been associated with better maternal and neonatal outcomes when adequately implemented^{5,8}.

The nutritional deficiencies during pregnancy are also well-established association with adverse maternal and neonatal health outcomes. Globally, pregnant women are at risk from the more common deficiencies of iron, folate, and vitamin A, which have been associated with an increased risk of maternal complications and congenital anomalies such as neural tube defects and congenital heart disease¹⁰⁻¹². Congenital anomalies have been reported to have an approximate incidence of 75 cases per 10,000 live births in Afghanistan and rank high as causes of neonatal deaths and disability-adjusted life years (DALYs)¹³.

Studies show that poor diet during pregnancy provides a woman with an additional risk factor in maternal complications and the chances of developmental disorders are highly increased in the offspring. Population studies have established the association between poor maternal nutrition and birth defects, with most cases lacking identifiable causes but often caused by preventable nutritional deficiencies^{12,13}. While some health initiatives exist and awareness among health care professionals and students is raised, access to nutritional programs and quality maternal care is still very uneven. Poor training, fewer outreach services, and fragile infrastructure continue to block the way toward addressing maternal and child health needs^{3,4,8}.

Therefore, this study aims at exploring the perceptions, knowledge, and lived experiences of healthcare professionals, medical students, and community members in Afghanistan about maternal mortality and nutrition deficiency. It seeks to garner evidence on the challenges to health interventions to improve maternal and child health outcomes.

Materials and Methods

Study Design and Sampling Approach

This study employed a descriptive cross-sectional design, conducted from January to April 2025 across four major geographic zones of Afghanistan: West, North, South, and East. The primary objective was to assess perspectives on maternal mortality and child malnutrition from three distinct populations: healthcare professionals, medical students, and community members. Due to constraints in accessing centralized records and the difficult security situation in parts of Afghanistan, we adopted a non-probability sampling strategy.

Specifically, we utilized the Snowball Sampling (SBS) method, which is well-suited for reaching dispersed or difficult-to-access populations. Although SBS is commonly used for hidden or stigmatized populations, in this context, it offered a feasible means of enrolling participants who were otherwise hard to reach due to administrative, geographical, or cultural limitations. Initial participants were purposively selected from various provinces and were then asked to refer peers and colleagues within their networks. This method allowed recruitment chains to reflect diverse regional and professional backgrounds.

Population and Sample Size

The study included a total of 620 participants distributed as follows: 75 healthcare professionals, 386 medical students, and 159 adult community members. The sample size was based on practical feasibility rather than statistical calculation, as there is no comprehensive sampling frame available for the target populations in Afghanistan. Our focus was to achieve regional and occupational representation sufficient for exploratory analysis and to capture thematic saturation within each group.

The decision to recruit 75 healthcare professionals was guided by access limitations to hospitals and health centers, particularly in rural provinces. For medical students, a larger number was obtained with the assistance of deans and faculty coordinators across several medical schools. Community members were selected with the support of local leaders, health workers, and volunteers who facilitated access to households across urban and rural areas.

Eligibility Criteria

Participants were eligible for inclusion if they were at least 18 years old and resided in Afghanistan at the time of the study. For medical students, only those in their third year and above were included, to ensure a minimum level of clinical and academic exposure. Healthcare professionals had to be currently working in a health facility (either public or private), while community participants were adult women from a variety of occupational backgrounds.

Exclusion criteria included individuals younger than 18 years, medical students in their first or second year, respondents not residing in Afghanistan, and incomplete or duplicate survey submissions. Oral informed consent was obtained from all participants prior to data collection, and participation was voluntary and confidential.

Respondent Group Characteristics

To ensure interpretive accuracy, we considered the internal diversity within each respondent group. The healthcare professionals included physicians (approximately 40%), nurses and midwives (about 35%), and nutritionists or other allied specialists (25%). Medical students were evenly distributed across academic years 3 to 6 and represented a cross-section of both public and private medical institutions. The community member group consisted primarily of women engaged in various roles—housewives, teachers, shopkeepers, and small-scale farmers—from both urban and rural regions.

This level of subgroup differentiation is important, as knowledge, perceptions, and experiences related to maternal and child health may vary widely across professional and social backgrounds. While the survey did not stratify the results by subgroup within each category, this diversity was taken into account during interpretation and discussion.

Variables and Instruments

Independent variables in the study included participant group (professional, student, or community member), age, gender, region, education level, and occupation. The key dependent variables were: (1) knowledge of maternal nutrition; (2) perceived causes of maternal mortality; (3) awareness of congenital anomalies; (4) access to nutrition programs; (5) clinical exposure (for students and professionals); and (6) perceived readiness to handle nutrition-related maternal health issues.

These variables were measured through structured, group-specific questionnaires developed by the research team and pretested for clarity and reliability. Each questionnaire contained 14 core items (see Appendix), with minor adjustments made based on group relevance. For example, professionals were asked about implementation of hospital nutrition protocols, while students were queried on their training and confidence in diagnosing maternal malnutrition.

Data Collection

Data were collected using a hybrid method. In areas with internet access and high literacy, participants completed the survey through Google Forms. In more remote or low-literacy settings, trained local enumerators administered printed questionnaires in the local language. These completed forms were then digitized and uploaded into the online dataset. This flexible approach allowed for

broader geographic and demographic inclusion, mitigating some of the access and literacy-related barriers.

This study did not require formal ethical approval. However, oral informed consent was obtained from all participants before data collection

Data Cleaning and Quality Control

All responses were reviewed for completeness, accuracy, and internal consistency. Duplicate entries—identified via matching demographic details and timestamps—were removed. Responses with more than 30% missing values were excluded from the final dataset. Minor missing fields were verified with field volunteers and filled where possible. The cleaned dataset was compiled using Microsoft Excel (Office 365), which also facilitated the generation of summary tables and figures.

Data Analysis

The cleaned dataset was analyzed using descriptive statistical methods to generate frequencies and proportions for each item across the three groups. Although the original study design intended to include qualitative thematic analysis of open-ended responses, the volume and depth of these responses were insufficient to justify formal coding or theme development. As such, thematic analysis was not conducted, and findings are reported based on structured, quantitative responses only.

Results

The survey covered all four major regions of Afghanistan, with the western (34.5%) and northern (31.5%) provinces accounting for the majority of participants. Respondents from southern (15.8%) and eastern (11.5%) regions were also included. A small proportion of entries (6.7%) were either incomplete or lacked specific geographic identifiers. Together, western and northern regions represented more than two-thirds of all participants (Table 1).

Table 1. Aggregated Regional Distribution of Total Survey Population

Region	Participants (n)	Percentage (%)
Western Afghanistan	214	34.5%
Northern Afghanistan	195	31.5%
Southern Afghanistan	98	15.8%
Eastern Afghanistan	71	11.5%
Unspecified/Other	42	6.7%
Total	620	100%

Healthcare professionals reported that nutritional deficiencies are a frequent contributing factor to maternal mortality. Nearly half (49.4%) said such cases were occasionally observed, while 22.1% had frequently encountered them. Only 5.2% had never seen nutrition-related maternal deaths.

Iron deficiency was reported as the most common maternal nutritional deficiency (76.6%), followed by folate and vitamin A. Congenital heart disease was the most frequently reported anomaly in malnourished children (51.9%), followed by neural tube defects (37.7%), limb deformities (28.6%), and cleft lip/palate (26%).

When asked about causes of maternal death, hemorrhage was most commonly cited (72.7%), followed by complications from malnutrition (41.6%), infections (22.1%), and eclampsia (20.8%). However, only 13% reported that their health facilities had fully implemented nutritional care protocols, and over half (50.6%) were unaware whether such protocols existed at all.

Access to prenatal nutrition programs was described as fully available by 40.3% of professionals, partially available by 37.7%, and completely unavailable by 15.6%. Nutritional counseling during antenatal care was described as “never provided” by 42.9% of respondents and “only occasionally” by 40.3%.

Regarding effectiveness of prenatal supplements (e.g., iron, folic acid), 77.9% believed they were moderately effective, while only 20.8% rated them as highly effective. Poverty was the leading barrier to improving maternal and child nutrition (80.5%), followed by lack of education (49.4%) and weak infrastructure (28.6%).

Age-wise vulnerability was also assessed. Most professionals (45.5%) considered women aged 26–35 as most vulnerable to nutritional complications, followed by those aged 18–25 (28.6%) and teenagers under 18 (15.6%). Notably, 46.8% disagreed with the idea that congenital anomalies are underreported, while 31.2% expressed uncertainty (Table 2).

Table 2. Key Findings from Healthcare Professionals Regarding Maternal Mortality and Child Malnutrition

Key Indicator	Response	%
Most common region of respondents	Northern Afghanistan	33.8
Frequency of maternal mortality due to nutrition	Rarely encountered	49.4
Most observed maternal nutritional deficiency	Iron deficiency	76.6
Most common birth defect in malnourished children	Congenital heart disease	51.9
Leading cause of maternal mortality	Hemorrhage	72.7
Nutrition protocols in hospitals	Unaware of protocol existence	50.6
Access to prenatal nutrition programs	Fully accessible	40.3
Frequency of nutrition education during ANC	Never provided	42.9
Main barrier to nutrition improvement	Poverty	80.5
Most affected maternal age group	26–35 years	45.5

Most students (53.4%) stated that they had never studied the connection between maternal nutrition and birth defects. Only 16.6% reported studying it in depth. While 62.4% correctly identified folic acid as a key nutrient for preventing congenital anomalies, awareness of its implications remains limited.

Clinical confidence varied: only 19.4% of students felt very confident diagnosing maternal malnutrition, 47.7% had some confidence, and 19.2% had never attempted it. About one-fourth (24.9%) reported having no clinical exposure to maternal or child malnutrition cases.

Nevertheless, awareness of prevention was relatively high. A combined 98.4% agreed or strongly agreed that antenatal care could prevent congenital anomalies. However, only 39.1% found

current public health education programs effective, and 53.4% found them only partially sufficient. The importance of maternal diet during the first trimester was acknowledged by 91.5%.

Students also showed strong public health commitment: 71% expressed interest in participating in nutrition campaigns. However, only 41.2% rated their academic preparation as strong, while 26.9% said it was weak and 12.4% were unsure. On reducing maternal mortality, 66.6% preferred better hospital care, while 21.2% emphasized nutritional education. Rural healthcare worker preparedness was rated low, with 44.8% saying they were not well-equipped (Table 3).

Table 3. Key Findings from Medical Students Perspectives Regarding Maternal Mortality and Child Malnutrition in Afghanistan

Indicator	Most Frequent Response	%
Region of respondents	Western Afghanistan	38.9
Studied nutrition–birth defect link	Not studied	53.4
Most essential nutrient identified	Folic acid	62.4
Most recognized consequence of folate deficiency	Neural tube defects	51.6
Confidence in diagnosing maternal malnutrition	Never attempted	47.7
Frequency of clinical experience with maternal/child malnutrition	Occasionally	31.9
Belief in antenatal care preventing congenital anomalies	Agree	75.1
Evaluation of public health education programs	Partially sufficient	53.4
Importance of maternal diet in 1st trimester	Extremely important	91.5
Willingness to join health campaigns	Yes	71.0
Perception of medical school preparation	Uncertain	41.2
Best strategy to reduce maternal mortality	Better hospital care	66.6
Are rural health workers equipped to manage malnutrition-related delivery complications?	No	44.8

Among community members, the majority were from the western (57.2%) and northern (26.4%) provinces. A large proportion (91.2%) believed poor maternal nutrition could affect fetal health, and 53.5% reported personal or indirect experience with nutrition-related complications.

Most respondents (75.5%) received information from public health workers. About 49.1% said pregnant women mostly consumed fruits and vegetables, while 43.4% reported a mixed diet. However, 47.8% believed women in their communities were not receiving adequate nutrition.

Only 23.9% reported that antenatal visits occurred regularly, and supplement use (e.g., iron, folic acid) was inconsistent—64.2% reported occasional use, and 11.3% said they were rarely or never used.

While 53.5% were fully aware of the link between nutrition and birth defects, 22% had only heard of it, and 6.9% were unaware. Interestingly, 46.5% identified poverty as the root cause of child malnutrition, while 38.4% selected “all of the above” (poverty, lack of education, and limited healthcare access). Over half (52.2%) had seen children born with visible health issues. Alarming, only 23.3% had benefited from government nutrition programs (Table 4).

Table 4. Key Findings from Community Respondents on Maternal and Child Nutrition in Afghanistan

Key Indicator	Top Response	%
Region with highest community representation	Western Afghanistan	57.2
Belief that poor maternal nutrition affects fetal health	Yes	91.2
Personal or known experience with nutrition-related pregnancy issues	Yes	53.5
Received information on maternal nutrition	Yes, from public health workers	75.5
Most consumed food during pregnancy	Fresh fruits and vegetables	49.1
Belief that women have adequate nutrition during pregnancy	No	47.8
Primary source of health information	Doctors and clinics	81.8
Regular antenatal check-up attendance in community	Sometimes	23.9
Frequency of supplement use during pregnancy	Sometimes	64.2
Awareness of birth defects caused by malnutrition	Fully aware	53.5
Perception of maternal health as a priority	Somewhat important	69.2
Leading perceived cause of child malnutrition	Poverty	46.5
Reported cases of children born with visible health problems	Yes	52.2
Benefited from government nutrition programs	No	76.7

Discussion:

This study explored knowledge, perceptions, and experiences regarding maternal mortality and child nutrition among healthcare professionals, medical students, and community members across four regions of Afghanistan. The results highlight a complex interplay of individual-level awareness and system-level constraints, including limited access to services, poverty, undertrained personnel, and low implementation of maternal nutrition programs—patterns widely reported in fragile health systems in low-income countries ^{3,4,7}.

Among healthcare professionals, hemorrhage (72.7%) and malnutrition-related complications (41.6%) emerged as leading contributors to maternal mortality. These findings are consistent with WHO and global literature, which recognize hemorrhage and micronutrient deficiencies—particularly iron and folate—as leading preventable causes of maternal death ^{6,7,10,11}. Notably, only 13% of respondents confirmed the existence of functioning nutrition protocols in their hospitals. This reflects a broader structural gap in antenatal service delivery in Afghanistan, as previously documented in national surveys ⁸.

The reported presence of congenital anomalies such as congenital heart disease and neural tube defects aligns with evidence linking maternal malnutrition, particularly folate and vitamin A deficiency, to birth defects ^{11,12}. However, the fact that nearly half of the professionals either disagreed or were uncertain about the underreporting of anomalies underscores gaps in the surveillance and registration of birth outcomes ^{9,13}.

Medical students demonstrated a moderate level of knowledge, with 62.4% identifying folic acid as a key nutrient, yet 53.4% had not studied its role in preventing birth defects. Their low confidence in diagnosing maternal malnutrition (only 19.4% very confident) further highlights curricular gaps. These findings support earlier studies indicating limited nutrition and public health

education in Afghan medical schools⁹. Nonetheless, the high willingness (71%) of students to participate in public health campaigns suggests potential for future advocacy and system improvement. However, the majority preference for hospital-based interventions over preventive approaches indicates a prevailing biomedical focus in their training^{3,5}.

Community members largely recognized the importance of maternal nutrition—91.2% believed it affected fetal health—but actual engagement with services was low. Only 23.3% had access to government nutrition programs, and only 23.9% reported regular antenatal checkups. These gaps mirror WHO and UNICEF findings regarding rural inequities in Afghanistan's maternal health coverage^{1,8}. Despite public health workers being trusted sources of information (75.5%), supplement use and diet support remained inconsistent, reflecting a disconnect between awareness and access.

Across all groups, poverty was consistently cited as the main barrier to maternal and child health improvement—identified by over 80% of healthcare professionals and nearly half of community respondents. This is in agreement with broader research linking socioeconomic constraints to adverse maternal-child health outcomes in conflict-affected or underdeveloped settings^{3,4,16}.

Importantly, both students and community members expressed concern over the capacity of rural health workers to manage malnutrition-related complications. This highlights a critical workforce development need, suggesting that technical upskilling and local health system investment must be part of any strategic solution.

Limitations

This study has several limitations. First, snowball sampling may have introduced selection bias, and the findings may not be generalizable to the entire Afghan population. Nonetheless, this method was justified in a conflict-affected setting with limited institutional access^{14,15}. Second, there was overrepresentation from western and northern regions, possibly skewing regional insights. Third, although originally planned, **qualitative thematic analysis was not conducted** due to the limited depth of open-ended responses, and only structured survey results were analyzed. Finally, no biological or clinical assessments were conducted to validate self-reported health and nutrition status.

Conclusion

This study highlights key barriers to reducing maternal mortality and child malnutrition in Afghanistan. While general awareness of maternal nutrition exists among healthcare professionals, medical students, and community members, major challenges remain—particularly poverty, limited access to nutritional programs, inadequate antenatal care, and insufficient clinical training. Hemorrhage and malnutrition were the most frequently reported causes of maternal death, while folic acid deficiency and congenital anomalies were major concerns for neonatal outcomes.

Improving maternal and child health in Afghanistan requires a strengthened health workforce, more consistent antenatal nutrition services, and better public health outreach, particularly in underserved areas. These findings provide evidence to guide policy and program development toward more equitable and effective maternal healthcare delivery.

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Appendixes

Survey Questions

GROUP 1: PROFESSIONALS

1. Which province are you currently residing in while attending this survey?
2. How often do you encounter maternal mortality cases related to nutritional deficiencies?
 - a. Frequently
 - b. Occasionally
 - c. Rarely
 - d. Never
3. Which of the following is the most common nutritional deficiency observed among pregnant women?
 - a. Iron
 - b. Vitamin A
 - c. Folate
 - d. Calcium
 - e. Other (please specify)
4. How often are congenital birth defects reported in malnourished children?
 - a. Very frequently
 - b. Sometimes
 - c. Rarely
 - d. Not at all
5. What is the most common cause of maternal mortality you've seen?
 - a. Hemorrhage
 - b. Infection
 - c. Malnutrition-related complications
 - d. Eclampsia
 - e. Other (please specify)
6. Do hospitals in your region have protocols for dealing with malnutrition in pregnant women?
 - a. Yes, fully implemented
 - b. Yes, but poorly followed
 - c. No formal protocols
 - d. I'm not sure
7. Which birth defect do you encounter most often in malnourished children?
 - a. Neural tube defects
 - b. Cleft lip/palate
 - c. Congenital heart disease
 - d. Limb deformities
 - e. Other (please specify)
8. Are prenatal nutrition programs accessible to the general population?
 - a. Widely accessible
 - b. Somewhat accessible
 - c. Limited access
 - d. Not accessible at all
9. Do you believe current government interventions are sufficient in addressing maternal and child malnutrition?
 - a. Yes
 - b. Somewhat
 - c. No
 - d. I don't know
10. According to your experience, which age group of mothers are more likely to face nutritional complications during pregnancy in your region/province?
 - a. Under 18
 - b. 18–25
 - c. 26–35
 - d. Above 35
11. How often is nutritional education given during antenatal visits in your practice?
 - a. Every visit
 - b. Occasionally
 - c. Rarely
 - d. Never

12. Do you think birth defects in Afghanistan are underreported?
13. How effective are supplements (e.g., iron, folic acid) in reducing maternal complications in your experience?
 - a. Very effective
 - b. Somewhat effective
 - c. Not effective
 - d. Uncertain
14. What is the biggest barrier to improving maternity and child nutrition?
 - a. Poverty
 - b. Lack of education
 - c. Healthcare infrastructure
 - d. Cultural beliefs
 - e. Other (please specify)

GROUP 2: COMMUNITY PEOPLE

15. Which province are you currently residing in while attending this survey?
16. Have you ever received information about maternal nutrition during pregnancy?
 - a. Yes, from healthcare workers
 - b. Yes, from family/community
 - c. No, I did not receive
17. Do you believe poor nutrition can affect a baby's health before birth?
 - a. I strongly agree
 - b. Agree
 - c. Disagree
 - d. Not sure
18. Have you or someone you know experienced a health issue due to poor nutrition during pregnancy?
 - a. Yes
 - b. No
 - c. Not sure
19. What kind of food is mostly consumed during pregnancy in your household?
 - a. Fresh fruits and vegetables
 - b. Bread and rice
 - c. Processed food
 - d. Mixed diet
 - e. I don't know
20. Do you think women in your community get enough nutrition during pregnancy?
 - a. Yes
 - b. Somewhat
 - c. No
 - d. I don't know
21. Where do you usually get health information from?
 - a. Doctors/clinics
 - b. Family and friends
 - c. TV/radio
 - d. Social media
22. Are you aware of any birth defects caused by poor maternal nutrition?
 - a. Yes, several
 - b. Only a few
 - c. No
 - d. I've only heard rumors
23. Is maternal health considered a priority in your community?
 - a. Yes, very important
 - b. Somewhat important
 - c. Not important
 - d. Not discussed at all
24. Do mothers in your community or family regularly attend antenatal checkups?
 - a. Yes
 - b. Sometimes
 - c. Rarely

- d. Never
- 25. How often do women take supplements (like iron, folic acid) during pregnancy in your family or in your area?
 - a. Always
 - b. Sometimes
 - c. Rarely
 - d. Never
- 26. What do you believe is the main reason for child malnutrition in your community?
 - a. Poverty
 - b. Lack of knowledge
 - c. Poor access to healthcare
 - d. All of the above
- 27. How often are children born with visible health issues in your area?
 - a. Frequently
 - b. Sometimes
 - c. Rarely
 - d. Never
 - e. I don't know
- 28. Would you support government initiatives to improve maternity and child nutrition?
 - a. Yes, definitely
 - b. Maybe
 - c. No
 - d. Not sure

GROUP 3: MEDICAL STUDENTS

- 29. Which province are you currently residing in while attending this survey?
- 30. Have you studied the link between maternal nutrition and birth defects?
 - a. Yes, in depth
 - b. Only briefly
 - c. Not yet
 - d. Not sure
- 31. Based on your experience which nutrient deficiency is most critical during pregnancy to prevent birth defects?
 - a. Iron
 - b. Folic acid
 - c. Vitamin D
 - d. Calcium
 - e. I don't know
- 32. How confident are you in identifying malnutrition in pregnant women?
 - a. Very confident
 - b. Somewhat confident
 - c. Not confident
 - d. I've never tried
- 33. What is the most likely consequence of folic acid deficiency during pregnancy?
 - a. Low birth weight
 - b. Spina bifida
 - c. Anemia
 - d. Cleft palate
 - e. I don't know
- 34. How common are maternal deaths in rural areas due to nutrition-related issues (based on your knowledge)?
 - a. Very common
 - b. Somewhat common
 - c. Rare
 - d. Don't know
- 35. Have you had any clinical exposure to maternal nutrition or child malnutrition cases?
 - a. Yes, frequently
 - b. Occasionally
 - c. Rarely
 - d. Not at all
- 36. Do you believe birth defects can be largely prevented with proper prenatal care?
 - a. Strongly agree

- b. Agree
 - c. Disagree
 - d. Strongly disagree
37. Are current health education programs sufficient in preventing child malnutrition in Afghanistan?
- a. Yes
 - b. Somewhat
 - c. No
 - d. Not sure
38. How important do you consider the maternal diet during the first trimester of pregnancy?
- a. Extremely important
 - b. Moderately important
 - c. Slightly important
 - d. Not important
39. Would you be interested in working on public health campaigns to reduce malnutrition and maternal mortality?
- a. Yes
 - b. Maybe
 - c. No
 - d. Depends on conditions
40. How well are Afghan medical schools preparing students to handle cases of maternal and child malnutrition?
- a. Very well
 - b. Adequately
 - c. Poorly
 - d. Not sure
41. What's the most effective way to reduce maternal mortality in your opinion?
- a. Better nutrition education
 - b. Improved hospital care
 - c. Community health outreach
 - d. Government policy reform
 - e. I don't know
42. Do you think rural health care workers are well-equipped to deal with malnutrition-related birth complications?
- a. Yes
 - b. Somewhat
 - c. No
 - d. Don't know