KAP STUDY

# Exploring knowledge, attitudes and perceived myths towards foetal programming and factors affecting it among the public and health professionals in Pakistan: a needs assessment study

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## Abstract

**Objective:** To explore knowledge, attitudes and practices of laypersons and health professionals towards foetal programming, and factors affecting it.

**Method:** The mixed methods study was conducted at the Aga Khan University, Karachi, from January 20, 2021 to May 13, 2022, and comprised adults of either gender with access to social media platforms. Data was collected using an online survey questionnaire in English and Urdu developed to capture responses from a diverse pool of participants. The survey tool was circulated through WhatsApp, Facebook and Instagram. Two focus group discussions were conducted; one with laypersons in group A and the other with health and allied professionals in group B. Data was analysed using SPSS 21, while data related to focus group discussions was subjected to thematic analysis.

**Results:** Of the 358 participants, 173(48.3%) were in group A and 185(51.7%) were in group B. There were 34(18.4) subjects in group A and 27(15.6) in group B who had knowledge of foetal programming ($p>0.05$). Only factors related to father's health and dietary elements on the foetus were significantly different between the groups ($p<0.05$). Thematic analysis led to the formation of 3 overarching themes: parent's lifestyle, comorbidity and diet on foetal health; myths and cultural beliefs regarding foetal development; and the need for training / awareness for practitioners and community.

**Conclusion:** Lack of knowledge and misinformation about foetal programming and development was common among health professionals and laypersons.

**Key Words:** Foetal programming, Obesity, Nutrition, Midwives, Nursing, Public health.

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## Introduction

Metabolic disorders are emerging as a global threat, and Pakistan is among the top 10 countries affected by both undernutrition and overnutrition[1,2]. Data confirms that exposure to diabetes in utero has effects on the offspring's body size that are distinct from, or act in concert with, genetic susceptibility to obesity and the postnatal environment[1,2]. New-borns of mothers suffering from pre-pregnancy obesity or diabetes mellitus (DM), or those who develop gestational DM (GDM), are at a higher risk of adverse outcomes. Epigenetic modifications in major genes responsible for regulating appetite and body composition in babies born to diabetic mothers have recently been reported[3], concluding that genetic and epigenetic changes play a significant role in the prevalence of childhood obesity in low- and middle-income countries (LMICs), including Pakistan. Improvements in women and child health are at the heart of the Sustainable Development Goals (SDGs) and, hence, hold utmost importance at both institutional and national levels. Mothers strongly influence the health beliefs and practices of their children, and can be key players in efforts towards enhancing the health status of families and communities.

Contrary to the general opinion that metabolic syndrome (MetS) develops in adulthood, the Developmental Origins of Health and Disease (DOHaD) has postulated that exposure to certain environmental influences during the initial 1000 days of conception may have significant consequences on an infant's risk factors for MetS[4-6]. This means that a developing foetus, which is exposed to any hostile uterine environment, develops an adaptive response known as predictive adaptive response (PAR)[7]. These PARs may have short-term effects, such as down-regulation of endocrine or metabolic function and/or specific organ function to match the nutrient supply, and

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long-term effects resulting from disruptions in gene expression, cell differentiation and proliferation, which will lead to changes in the development, structure and function of some tissues and vital organs[8,9]. Individuals with PARs are at a higher risk for developing non-communicable diseases (NCDs)[8,9]. There is a paucity of knowledge about NCDs and their impact on foeto-maternal health in Pakistani society. Most emphasis has been on undernutrition despite the established fact that 'thrifty gene' activity i.e., deposition of visceral fat, is higher within the South Asian community compared to other communities across the globe irrespective of the individual's nutritional status[10]. The thrifty gene activity can be attributed to intrauterine factors and glycation products that regulate gene expression and programming in the foetus[11]. Given the emerging scientific knowledge of epigenetic modulation and its impact on health, there is a need for educational interventions. Foetal programming or foetal imprinting is an emerging area, which establishes that human nutrition, mental health and environmental conditions have an indirect effect on the overall genome[12]. These genomic changes, called the "epigenetic modifications", do not change the structure of deoxyribonucleic acid (DNA), but have the potential to alter functions of disease predisposing genes[12]. These changes can be transferred across generations, often resulting in long-term changes and increased risk of various chronic diseases[13]. Yet, the concept of foetal programming and the factors influencing it are neither discussed at the community level nor taught in detail at medical or nursing schools. The current study was planned to explore knowledge, attitude and practice (KAP) levels among laypersons and health professionals towards foetal programming, and the factors affecting it.

## Subjects and Methods

The mixed methods study was conducted at the Aga Khan University, Karachi, from January 20, 2021, to May 13, 2022, and comprised adults of either gender with access to social media platforms. After approval from the institutional ethics review committee, the sample size was calculated using Number Cruncher Statistical Systems and Power Analysis and Sample Size (NCSS-PASS) with 90% power and 0.5 effect size [calculated by NCSS PASS https://www.ncss.com/software/pass/][14].

The sample was raised from among adults of either gender with access to social media platforms via purposeful random sampling. Those without access to social media or an electronic device, such as a computer or smartphone, were excluded.

The link to the online survey was purposefully shared to ensure a diverse group of participants, representing both the laypersons as well as health and allied health professionals. The determination of the groups was done based on the different platforms where the survey was shared, like hospitals, medical schools etc., and the affiliations/qualifications shared on the Google Form; laypersons in group A and the other with health and allied professionals in group B. An informed consent statement was part of the document which every participant had to sign. Those who did not the sign statement were excluded.

The survey questionnaire was developed by a team of researchers in English after intensive literature review and consultation with subject experts to fit the local scenario[1-13]. This was then translated by a native Urdu language speaker. A pilot test was conducted to assess the construct, reliability and validity of the questionnaire. The questionnaire contained 42 items; 12 open-ended items, and 30 items with a drop-down list of options to choose from. Initially, the questionnaire had 56 items which were reduced to 42 after pilot-testing. A good internal consistency was observed for the final questionnaire (0.82). The questionnaire was circulated to the general population via different social media platforms, including WhatsApp, Facebook and Instagram. This was done due to the coronavirus disease-2019 (COVID-19) restrictions and lockdowns.

Two focus group discussions (FGDs) were also conducted; one with each of the two groups. The interview guide was developed by the researchers after an iterative process consistent with relevant literature as discussed in the introduction section[1-13]. Pilot-testing was done to assess how well the participants understood the questions in the guide. Subsequently, the participants were selected based on their response to the last question of the survey, which requested the respondents to indicate their interest in being contacted for an FGD. The FGD was conducted via Zoom, again, due to COVID-19 restrictions. At the start of FGD, the researcher conducting the session provided details, such as the purpose of the FGD, procedure and data confidentiality. Verbal consent was also obtained at the outset. The interviews were audio-taped and verbatim transcriptions of the recordings was done by a student researcher. The total duration of each FGD was 60 minutes. A semi-structured interview approach was adopted to ensure consistency in questions in the two groups, and to simultaneously allow for flexibility in response to the topics raised and the level of engagement within the group. The questions aimed at

assessing the participants' understanding of foetal programming and its associated factors, and the need for interventions in this area. Both FGD sessions were coded and transcribed by an independent researcher. The transcripts were then analysed by the principal investigator, followed by the rest of the researchers. It was also sent for member checking[15].

Study data was analysed using SPSS 21. Categorical data was expressed as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation. Chi-square test was used for comparing continuous and categorical variables, as applicable. P<0.05 was considered statistically significant. FGD data was subjected to thematic analysis.

## Results

Of the 358 participants, 173(48.3%) were in group A and 185(51.7%) were in group B. No significant difference was observed between the mean ages of the two groups (p>0.05), while socioeconomic diversity was significantly different between the groups (Table 1). The FGDs comprised 10(5.8%) subjects from group A and 10(5.4%) from group B. In group A, there were 5(50%) men and as many women. In group B, there were 5(50%) medical students and as many practitioners.

Responses related to the link between obesity and health were not significantly different between the groups (Table 2). There were 34(18.4) subjects in group A and 27(15.6) in group B who had knowledge of foetal programming (p>0.05). Only factors related to father's health and dietary elements on the foetus were significantly different between the groups (Table 3).

Collectively, the respondents were not fully cognizant of the gravity of the problem in Pakistan, which also reflected in FGDs where participants from both groups emphasised that "undernutrition was a far greater issue than overnutrition in our society". FGD participants mentioned that "all the baby fat is harmless and usually disappears on its own as the baby starts to walk; therefore, we should not be worried about it."

The thematic analysis of FGD transcripts resulted in 3 overarching themes: parent's lifestyle, comorbidity, and diet on foetal health; myths and cultural beliefs regarding foetal development; and the need for training / awareness for practitioners and community. The

**Table-1:** Demographic characteristics of the survey participants.

| | Medical Professionals n=185 | General Public n=173 | P value |
|---|---|---|---|
| **Age (years)** | 23.07±5.82 | 23.63±6.68 | 0.26 |
| **Gender** | | | |
| Male | 50 (27.0) | 41 (23.7) | 0.257 |
| Female | 131 (70.8) | 123 (71.1) | |
| Prefer not to say | 4 (2.2) | 9 (5.2) | |
| **Education Status** | | | |
| Undergraduate | 167 (90.3) | 150 (86.7) | 0.236 |
| Graduate | 15 (8.1) | 22 (12.7) | |
| Postgraduate | 3 (1.6) | 1 (0.6) | |
| **Socioeconomic Status** | | | |
| Low-Income | 32 (17.3) | 92 (53.2)* | 0.034 |
| Middle-Income | 87 (47.0) | 64 (37.0) | |
| High-Income | 44 (23.8)* | 17 (9.8) | |
| Prefer not to say | 22 (11.9) | 0 (0.0) | |
| **Are you a parent?** | | | |
| No | 161 (87.0) | 150 (86.7) | 0.995 |
| Will be soon | 2 (1.1) | 2 (1.2) | |
| Yes | 22 (11.9) | 21 (12.1) | |

Data is shown as Mean ± SD or frequencies. Values in parentheses are percentages; SD: Standard Deviation.

**Table-2:** Obesity knowledge metrics.

| | Medical Professionals n=185 | General Public n=173 | P value |
|---|---|---|---|
| **What is the best way to measure obesity?** | | | |
| Body Mass Index (BMI) | 152 (82.2) | 141 (81.5) | 0.510 |
| Waist Circumference | 5 (2.7) | 2 (1.2) | |
| Weight to Height Ratio | 4 (2.2) | 3 (1.7) | |
| Weight | 24 (13.0) | 25 (14.5) | |
| Thigh Gap | 0 (0.0) | 1 (0.6) | |
| **What is considered a healthy BMI in adults?** | | | |
| Do not know | 35 (18.9) | 40 (23.1) | 0.304 |
| BMI <18.5 | 5 (2.7) | 4 (2.3) | |
| BMI 18.5-24.9 | 132 (71.4) | 112 (64.7) | |
| BMI 25.0-29.9 | 12 (6.5) | 11 (6.4) | |
| BMI >30.0 | 1 (0.5) | 5 (2.9) | |
| **Do you think childhood obesity is an issue in Pakistan?** | | | |
| Yes | 77 (41.6) | 73 (42.2) | 0.224 |
| No | 55 (29.7) | 62 (35.8) | |
| Maybe | 53 (28.7) | 38 (22.0) | |
| **Did you know 1 in 4 children in Pakistan is overweight** | | | |
| Yes | 39 (21.1) | 38 (20.2) | 0.771 |
| No | 111 (60.0) | 102 (58.9) | |
| Maybe | 35 (18.9) | 33 (19.0) | |
| **How does it make you feel knowing the above-mentioned fact?** | | | |
| Nothing | 37 (20.0) | 25 (14.5) | 0.507 |
| Knew it already | 29 (15.7) | 25 (14.5) | |
| Surprised | 106 (57.3) | 110 (63.6) | |
| Who cares, it's just baby fat, it will go away | 13 (7.0) | 12 (6.9) | |
| **Do you think childhood obesity caused by gene modification can be prevented or reduced?** | | | |
| Strongly agree | 15 (8.1) | 10 (5.8) | 0.287 |
| Agree | 98 (53) | 86 (49.7) | |
| Neutral | 56 (30.3) | 51 (29.5) | |
| Strongly disagree | 16 (8.6) | 25 (14.5) | |

Values in parentheses are percentages

**Table-3:** Knowledge of foetal programming.

| | Medical Professionals n=185 | General Public n=173 | P value |
|---|---|---|---|
| **Have you heard about Foetal Programming?** | | | |
| Yes | 34 (18.4) | 27 (15.6) | 0.775 |
| No | 119 (64.3) | 114 (65.9) | |
| Maybe | 32 (17.3) | 32 (18.5) | |
| **Does mothers' health influence the baby's health?** | | | |
| Yes | 175 (94.6) | 166 (95.9) | 0.116 |
| No | 10 (5.4) | 5 (2.9) | |
| Maybe | 0 (0.0) | 2 (1.2) | |
| **Does father's health influence the baby's health?** | | | |
| Yes | 148 (80.0)* | 73 (42.1) | 0.000 |
| No | 17 (9.2) | 79 (45.6)* | |
| Maybe | 20 (10.8) | 21 (12.1) | |
| **During pregnancy, should certain foods be avoided?** | | | |
| Strongly agree | 30 (16.2) * | 46 (26.6) | 0.050 |
| Agree | 106 (57.3) | 81 (46.8) | |
| Neutral | 28 (15.1) | 31 (17.9) | |
| Strongly disagree | 21 (11.4) | 14 (8.1) | |
| **Which foods have a positive impact on foetal growth and development?** | | | |
| All food types | 174 (94.1) | 145 (83.8) | 0.002 |
| Vegetables and Fruits | 5 (2.7) | 11 (6.4)* | |
| Meat or Poultry or Fish | 4 (2.2) | 4 (2.3) | |
| Dairy Products | 1 (0.5) | 3 (1.7) | |
| Whole Grain and Nuts | 0 (0.0) | 4 (2.3)* | |
| Coffee and Tea | 1 (0.5) | 0 (0.0) | |
| **Which prenatal supplements are important for foetal health?** | | | |
| Folic acid or Iron or Calcium or Multivitamins | 160 (86.5) | 112 (64.7) * | <0.001* |
| Iodine | 4 (2.2) | 3 (1.7) | |
| Fish Oil | 4 (2.2) | 6 (3.5) | |
| Herbal Supplements | 7 (3.8) | 24 (13.9) * | |
| Panjeri (local mix of elements) | 10 (5.4) | 22 (12.7) * | |

Values in parentheses are percentages

participants admitted that "once we started filling the questionnaire, we had to use a search engine to find the definition of foetal programming". Group B participants also added that "this is not taught or covered in the curriculum at any level and that the concept should be incorporated". The more prevalent and common understanding among participants in both groups was that "as the baby develops inside the womb, the mother's health and nutrition are more important". Group A participants also emphasised the role of fathers health in maintaining a "good, low-stress home environment" and suggested that awareness and counselling sessions be held for both fathers and expecting mothers.

The participants highlighted additional factors to diet, such as mother's working hours, family's food choices, family history of congenital illness, and home environment, among the causes having the potential to

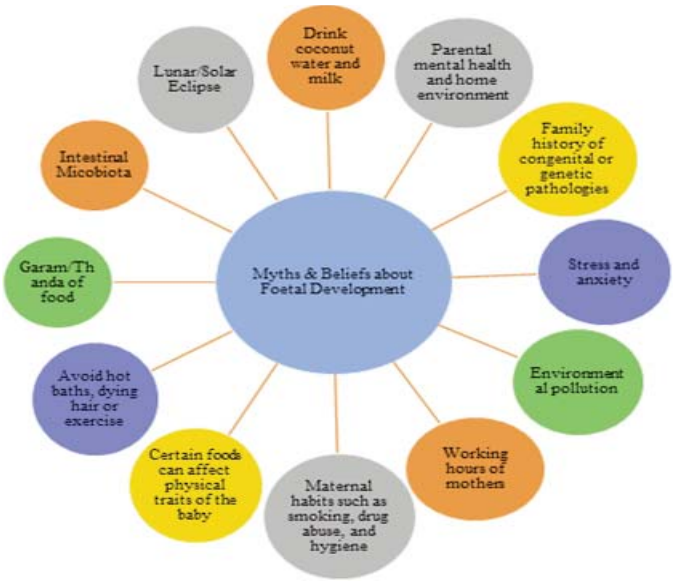


**Figure:** Common myths and beliefs found prevalent among the study participants.

negatively affect on foetal development (Figure). Lastly, 75(43.4%) subjects in group A and 103(55.7%) in group B expressed interest in attending an online course on the topics of epigenetics and foetal programming.

## Discussion

The study highlighted the lack of understanding regarding the importance of nutrition and parental health status on foetal health in Pakistan. The respondents were unfamiliar with the term foetal programming, and admitted having to use a search engine to find its meaning. During FGD sessions, undernutrition, wasting and stunting were believed to be more pressing issues than malnutrition and obesity. Through the survey responses and FGDs, it was observed that the general understanding of infantile or childhood obesity among the subjects was low, as this health issue was not considered alarming. Many respondents believed that obesity is baby fat, which dissolves on its own as the child grows. Majority of the participants could distinguish between good and poor food choices during pregnancy. Folic acid and multivitamins were a popular pick when asked about useful prenatal supplements. The study revealed that health professionals and the public perceived mother's health status to be crucial to foetal development and imprinting, while underestimating the role of paternal health. The common stressors identified as being detrimental to foetal development included, but were not limited to, poor maternal diet, age, genetic makeup, environmental stress, assisted reproductive techniques, and lifestyle choices. The effects of paternal nutrition and health, socioeconomic status, living conditions, and consumption of special local food items

during reproductive age on foetal imprinting and health were also recognised by survey and FGD participants. Existing literature also backs the idea that maternal nutrition and health have a profound effect[16] on foetal health and development. However, the lack of research on the role of paternal health and nutrition, and the mental health of both parents served as the driving force behind the current study.

A recent study done in India suggested that both maternal and paternal obesity equally predicted the risk of childhood obesity and diabetes[17]. In contrast, a Brazilian study reported no link between the two[18]. The difference in findings illustrates how variations in demographics and culture differently impact the health status of populations, thus pointing towards the need to develop specific, tailored interventions to promote health. It has been proposed that poor paternal pre-conceptional health status and foetal imprinting could lead to adverse cardiovascular outcomes[19]; genetic and epigenetic nature of the sperm and seminal plasma have been proposed to modulate offspring health programming[20]. Based on such interesting findings, the concept of Paternal Origins of Health and Disease (POHaD) was recently introduced[21]. However, limited data is available related to the concept, thus necessitating the need for education programmes for general parental health. Also, more research is needed to establish the finding and to guide future interventions.

As with other low-income countries, the lack of awareness of disease prevention strategies is compounded by poor/inadequate healthcare facilities, leading to devastating health consequences for the most vulnerable segments of population. Another roadblock in the management of the conditions is the sparse and limited population-specific information on MetS and its impact on foeto-maternal health and foetal programming.

During the FGDs, female participants from the community shared that no information was offered to them by the family physician or the gynaecologist during pregnancy. They emphasised the need to have counselling sessions for newlyweds and soon-to-be parents on reproductive health topics pertaining to foetal growth and health. They also mentioned that the effect of home environment and consanguineous marriages is often overlooked. Young parents, with limited knowledge about foetal health, struggle to handle the pressures and expectations of married life, which contributes to stress and mental distress among parents, ultimately impacting the health of the baby. The impact of factors, such as faith/meditation, postpartum depression, socioeconomic status, unsubstantiated beliefs/myths, cultural norms and parental intelligence, on foetal health was recognised by the FGD participants. They recommended that these topics should be included in community awareness and counselling programmes. Latest research supports the insights on gut, mental health, and cultural beliefs shared by the participants[22].

Active engagement of health professionals and the community is required to establish optimal screening, prevention and therapeutic approaches for mothers and children at the risk of cardio-metabolic disease development. Importantly, some health professionals felt that they did not have the knowledge or understanding to effectively transfer information about foetal programming to medical / nursing students or community members. Similarly, medical students mentioned that topics like foetal programming and the effect of nutrition and environment on foetal health were not adequately covered in the medical school curriculum. A few participants mentioned that after filling the survey, they did a quick search for the term "foetal programming" on Google. They further added that "they thought that this concept needs to be emphasised more, and that if we cater to adolescent health status, this could be an impactful way to tackle the burden of non-communicable diseases in Pakistani population". The importance of community partnerships also emerged during the FGD discussions. Literature has addressed the importance of health professionals and community partnerships in improving the health status of families[23]. But no studies were found on community programmes focussing on foetal programming. Moreover, both home and community environments have been shown to have a beneficial impact on the eating habits of individuals and in improving their overall health status[24-26]. During the FGD, many health professionals believed that there was a need for faculty development programmes on the topic, and that these would have a positive academic and social impact, ultimately improving community and patient health outcomes.

Currently, opportunities to learn about foetal programming and epigenetics are scarce in Pakistan. The FGD participants in both groups found the discussion eye-opening, as many had never effectively explored this facet of chronic disease prevention and management. They mentioned that they would be sharing information about foetal programming within their families and professional circles. Many also expressed keen interest in becoming partners for future community-based interventions and campaigns.

The present study had some limitations. The results are not representative of the knowledge and views of the

entire Pakistani population since the sample comprised only individuals with access to internet and social media platforms. During the shortlisting process for FGD participants, non-response bias could have occurred, which may have led to some non-traditional views and opinions on the topic to be missed. Nonetheless, the gaps and factors pertaining to foetal programming and development identified in the study, and the recommendations received for future community awareness sessions and training courses for health professionals have the potential to improve health outcomes for Pakistani population in the long run.

## Conclusion

There was limited knowledge and misinformation among both health professionals and the general population towards foetal programming and development in Pakistan, underscoring the need for educational workshops for health professionals and community-based awareness programmes that may raise awareness about foetal programming and development in society at large.

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