DEVELOPMENT AND VALIDATION OF A QUESTIONNAIRE ABOUT KNOWLEDGE OF BIRTH SPACING AMONG FEMALES

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ABSTRACT:

Background: *Inappropriate birth spacing is independently associated with a higher risk of perinatal, maternal, fetal, and child outcomes. However, no questionnaire has been developed to assess the knowledge of females regarding birth spacing.* ***Objective:*** *To develop a questionnaire for knowledge about birth spacing and validate it among females.* ***Methodology:*** *A questionnaire was developed containing 6 items focusing on knowledge about the term, source of knowledge, and methods of birth spacing. A total of 30 participants were included in the study for exploratory factor analysis (EFA) and 60 for confirmatory factor analysis (CFA). For data entry and analysis, IBM AMOS version 24 was also used for CFA where standardized regression weights and model fit indices were used. p-value 0.05 was considered significant.* ***Results:*** *The mean age of subjects was 27.3±6.7 years. After excluding two items due to cross-loading, EFA was run on 4 items and gave a significant Bartlett's test (p-value=0.000) and KMO measure of 0.636. All four items were in single factor (Knowledge about birth spacing) with an eigenvalue of 2.956 and a cumulative variance of 73.895%. The component matrix of all four items showed values >0.3 (0.863, 0.831, 0.849, and 0.895, respectively) and hence was included in the final version. The standardized Root Mean Square Residual (SRMR) was 0.0234, the root mean square error of approximation (RMSEA) was 0.066, the comparative fix index (CFI) was 0.997, the goodness-of-fit index (GFI) was 0.978 and the Tucker-Lewis index was 0.990.* ***Conclusion:*** *This study resulted in the development of a validated and reliable proforma to assess the knowledge about birth spacing among females.*

Keywords: *Inter pregnancy interval, birth spacing, family planning, knowledge, feto-maternal outcomes*

INTRODUCTION

Appropriate timing and space between births of children are one of the most pivotal decisions made for the health and well-being of the whole family [1]. Therefore, World Health Organization (WHO) recommends a gap of two to three years between two consecutive births to improve maternal health and reduce neonatal mortality [2]. Inappropriate birth spacing, in form of both short and long durations between two consecutive pregnancies, is independently associated with a higher risk of perinatal, maternal, fetal, and child outcomes. Gebremedhin [3] Short birth intervals (shorter than 18 months) have been reported to increase the risk of preterm birth, low birth weight, premature membrane rupture, placenta accreta, and Previa as well as abruptio placentae [4,5]. Similarly, long birth intervals (longer than 5 years) are associated with a higher risk of preeclampsia and uteroplacental bleeding disorders [6,7]. No consensus has yet been developed in the literature about the exact cause or mechanisms through which inappropriate birth spacing affects the health of mother and child [8], however, mostly, behavioral, genetic, or biological factors are assumed to play the role [9, 10]. WHO also recommended in 2005 to synthesize and develop a logical theoretical framework to explain the mechanism of potential causal effects of both short and long birth spacing [2].

Unfortunately, in developing and un er-developed countries, due to a lack of knowledge and practice of recommended birth spacing, one of every four women cannot get a method for avoiding pregnancy despite having a desire for it.[11] Another report \by United States Agency for international development in 2002 suggested that in developing countries, a birth space of a minimum of 36 months can reduce infant mortality and under five years mortality to 2% and 35% respectively. [12]

Literature has reported that knowledge of females regarding the benefits and methods of birth spacing is relatively low in developing countries.[13, 14] This lack of knowledge about birth spacing results in many misconceptions about family planning and contraceptive usages such as fear of health issues, infertility, social and religious stigmas and birth defects [15, 16] A study showed that the knowledge of husbands regarding birth space was significantly better than their wives, however, their attitude towards practices of family planning was significantly lower compared to their wives. [17]

Despite several studies reporting a lack of knowledge about birth spacing as an established factor in the failure of the appropriate inter-pregnancy interval, there is no questionnaire solely dedicated to assessing the knowledge of females regarding birth spacing. The current study was designed to develop a questionnaire for knowledge about birth spacing and validate it among Pakistani females. A few questionnaires published contained some questions about birth spacing, but only as a component of family planning and contraceptive use. Hence this study has been designed to develop a questionnaire to assess the knowledge about birth spacing and validate it among Pakistani females.

MATERIALS AND METHODS

Study Design: Descriptive Study-Validation of Questionnaire for both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

Sampling technique: Simple random sampling was used for both EFA and CFA

Setting: Data was collected from Lady Aitcheson Hospital, Lahore, Pakistan.

Sample size: The sample included in this study was taken as per Kline's criteria of 2-5 participants per item for EFA [18] and it was doubled for CFA. Hence, 30 females (6*5) were taken within the month of August 2020 for EFA and 60 for CFA.

SAMPLE SELECTION CRITERIA

Inclusion criteria

- Females of 18-45 years
- Females vising for routine family planning purposes.

Exclusion criteria

- Females requiring immediate medical treatment/intervention

Ethical Statement: Approval for the study was taken from the Ethical Committee of Unisza, Malaysia (REC # UniSZA/UHREC/2019/115) as well as data collection permission was taken from Lady Aitcheson Hospital, Lahore, Pakistan. No ethical concerns were involved in the study. Participants were briefed in detail beforehand about the purpose of the research and data was only collected after taking written informed consent. Other ethical concerns including autonomy, beneficence, and non-maleficence were also taken care of.

Data Collection: The finalized version of the first draft was pretested on a group of females visiting the hospital after their informed consent. They gave their opinions and suggestions about the language and contents of the questionnaire and it was concluded that it was adequate and easy to understand by experts as well. Next, study participants were briefed about the purpose of the research and were asked for their consent. Willing participants were handed over the questionnaires and were helped to understand the questions if they had some difficulty. Finally, 30 participants were included in the study for Exploratory Factor Analysis (EFA).

Content and Face Validity: For the purpose of questionnaire development, literature regarding the perceptions and practices of birth spacing was consulted extensively. The items were generated individually by all authors and a proforma was made consensually. An in-depth discussion session was arranged before finalizing the proforma. The proforma was pretested on a group of patients for the purpose of face validity. The patients showed an adequate understanding of the terms and language used in the questionnaire. The final version of the questionnaire used 6 domains with 3-4 questions in each domain.

Properties of Questionnaire: The questionnaire was developed after an extensive review of the literature. Although a number of studies had assessed awareness about birth spacing rarely have any studies focused on the knowledge aspect. Hence, this tool was developed for reliability and validity before using it to assess the knowledge about birth spacing. A total of 6 items were used focusing on knowledge about the term, source of knowledge, and methods of birth spacing.

Exploratory Factor Analysis [n = 30]

Exploratory Factor Analysis (EFA) is used to find the underlying structure of a large set of variables. It reduces data to a much smaller set of summary variables. It is used to identify the structure of the relationship between the variable and the respondent. For driving factor, Principle component factor analysis method: This method is used when we need to drive the minimum number of factors and explain the maximum portion of the variance in the original variable.

Sampling adequacy: To determine sampling adequacy, the Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity were used. If the KMO value was greater than 0.5 and Bartlett's test was significant i.e. p-value <0.05, the sample was deemed sufficient [19].

Varimax Method

The change of coordinates used in the principal component analysis (PCA) is known as Varimax rotation. It maximizes the sum of the variances of the squared loadings as all the coefficients will be either large or near zero, with few intermediate values. The goal is to associate each variable with at most one factor. So, the VARIMAX method was used to simplify the column of the factor matrix so that the factor extracts are clearly associated and there should be some separation among the variables. Criteria for Practical and Statistical Significance of Factor Loadings: Factor loading were classified based on their magnitude so we used >0.50 which is considered practically significant

Confirmatory factor analysis [n=60]

For model fit indices, chi-square fit statistics/degree of freedom (CMIN/ D.F), the standardized Root Mean Square Residual (SRMR), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the goodness-of-fit index (GFI), the Tucker-Lewis index, were used. Moreover, Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were also calculated. Good indicators were considered to be: CMIN/DF between < 3, RMSEA < 0.08, CFI > 0.90, GFI > 0.85, TLI > 0.90 [20].

DATA ANALYSIS

SPSS version 24 was used for data entry and analysis. Before applying EFA, the Kaiser-Meyer-Olkin (KMO) test for sample adequacy and Bartlett's test of sphericity were applied. Then Principal Component Analysis (PCA) was done to find the commonalities, and see Eigenvalues to find out the percentage of variances explained by the items. In case of wrong, poor, or

cross-loading as shown through the rotated component matrix, the items were treated accordingly or eliminated. Cronbach's alpha was also applied to see the reliability of the tool. IBM AMOS version 24 was used for CFA where standardized Regression Weights and model fit indices were used. P-value <0.05 was considered significant.

RESULTS

Exploratory Factor Analysis [n = 30]

There were 6 questions related to birth spacing so the total participants were subjected to 5 multiplied by no of questions. The mean age of females was 32.10 ± 8.73 with minimum and maximum ages of 18 and 44 years. A total of 6 questions were asked from 30 females regarding knowledge

of birth spacing where a Likert scale was used comprising of strongly disagree, disagree, don't know, agreed, and strongly agree. The mean score for contraception methods that are good for birth spacing was 3.30 ± 1.47, the score for pregnancy is risky before 2 years was 2.80 ± 0.96 and the mean score for pregnancy is risky after 5 years was 2.43 ± 1.25. The mean score for short birth space caused per-vaginal bleeding was 3.30 ± 1.42, the mean short birth space caused anemia was 3.53 ± 1.50, and the mean score for short birth score cause poor nutrition to the fetus was 3.80 ± 1.32.

We started exploratory factor analysis using all 6 questions where the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy[21] was 0.519 with a significant p-value i.e. ≤ 0.001. The total initial Eigenvalues for the full variable was 2.99, and the cumulative percentage of variance was 94.707%. For the reduced model the KMO measure of sampling adequacy was 0.636, the total initial Eigenvalues were 2.9956 and the cumulative percentage of variance was 73.89%. Chronbach's alpha was used to assess the reliability of the full and finalized tool termed "Knowledge about Birth Spacing" and was found to be 0.526 for the full and for the reduced tool was 0.873. Hence the tool was reliable enough to measure the knowledge about birth spacing among females.

At the initial stage, when 6 variables were taken, using principal component analysis 3 components/factors were extracted. There were 5 elements that gave a positive high correlation i.e. all were > 0.9. So factors analysis was again run for these 5 factors where only one component was extracted with no further rotation keeping 4 questions as a final and single component having a positive correlation >0.8.

Confirmatory Factor Analysis [n = 60]

For confirmatory factor analysis 60 pregnant females coming for their regular antenatal visits were taken, the mean age was 30.70 ± 8.32 years with minimum and maximum ages of 18 and 45 years. The mean score for question pregnancy is a high risk after >5 years was 3.72 ± 1.24, and the mean score for short birth space cause anemia was 3.87 ± 1.16. The mean score for pregnancy occurring before < 2 years was 3.67 ± 1.17 and the mean score for short birth space causes poor nutrition to the fetus was 4.13 ± 1.07. Confirmatory factor analysis (CFA) was done using AMOS version 23. CFA was conducted to examine the dimensionality of the tool about **birth space knowledge, with 4** items. A total of 60 females were taken meeting inclusion criteria. All indices suggested the tool is reliable enough to be utilized for data collection. The standardized regression weight for pregnancy after 5 years is a high-risk pregnancy, Short birth space cause anemia, pregnancy before 2 years is high-risk Pregnancy, and short birth space causes poor nutrition to the fetus were 0.90, 0.87, 0.87, and 0.64 respectively.

The value for chi-square fit statistics/degree of freedom (CMIN/ D.F) was 1.25 with insignificant p-value i.e. >0.285 (>0.05), the standardized Root Mean Square Residual (SRMR) was 0.0234, the root means a square error of approximation (RMSEA) was 0.066, the comparative fit index (CFI) was 0.997, the goodness-of-fit index (GFI) was 0.978 and the Tucker-Lewis index was 0.990. The values of the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were 18.51 and 19.99. Good indicators were considered to be: CMIN/DF between < 3, RMSEA < 0.08, CFI > 0.90, GFI > 0.85, and TLI > 0.90 [20].

Hence all the indicators were good in the current study.

Table 1: Descriptive statistics of the age of females and items for EFA and CFA

Exploratory factor analysis (n=30)			Confirmatory factor analysis (n=60)	
	Mean	**S.D**	**Mean**	**S.D**
Age (years)	32.10	8.73	30.70	8.32
Contraception methods are good for BS	3.30	1.47		
< 2 years is high-risk Pregnancy	2.80	0.96	3.67	1.17
>5 years is high-risk Pregnancy	2.43	1.25	3.72	1.24
Short BS cause Per-vaginal bleeding	3.30	1.42	3.87	1.16
Short BS causes anemia	3.53	1.50		
Short BS cause poor nutrition in the fetus	3.80	1.32	4.13	1.07

Table 2: Statistical Measures of Finalized Tool [n = 30]

Statistical Measures	**Values**
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.636
Bartlett's test of sphericity	0.000
The eigenvalue of the significant factor	2.956
Cumulative percentage of variance	73.895%
Cronbach's Alpha	0.861

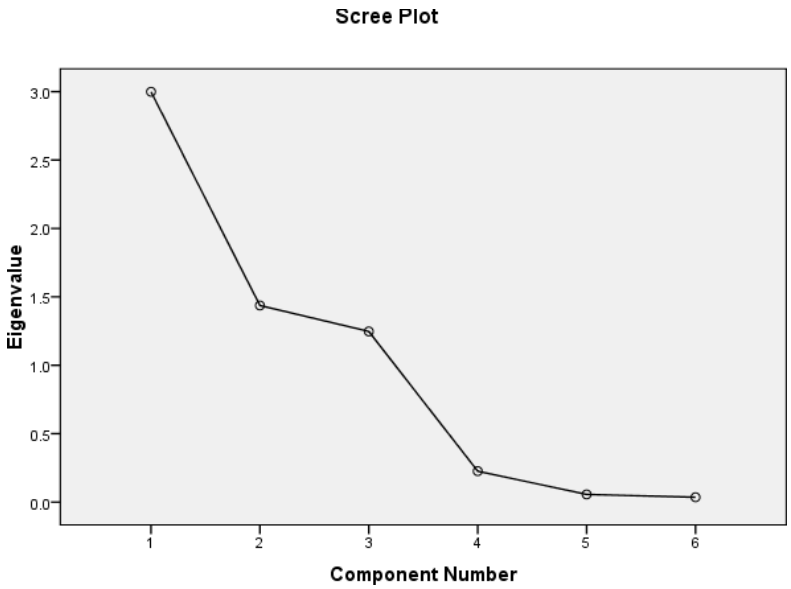

Fig1: Scree plot

Table 3: Results of Principal Component Analysis (PCA) on Finalized Tool regarding birth space [n = 30]

	Full				Final	
Items	**Communalities**	**Factor 1**	**Factor 2**	**Factor 3**	**Communalities**	**Component matrix**
Q5	0.925	0.918			0.720	0.849
Q6	0.968	0.918			0.801	0.895
Q2	0.955		0.90		0.69	0.831
Q1	0.965	-0.508		-0.676	0.744	0.863

Q1: Contraception methods are good for BS, Q2: < 2 years is high risk Pregnancy, Q5: Short BS cause anemia, Q6: Short BS cause poor nutrition to the fetus,

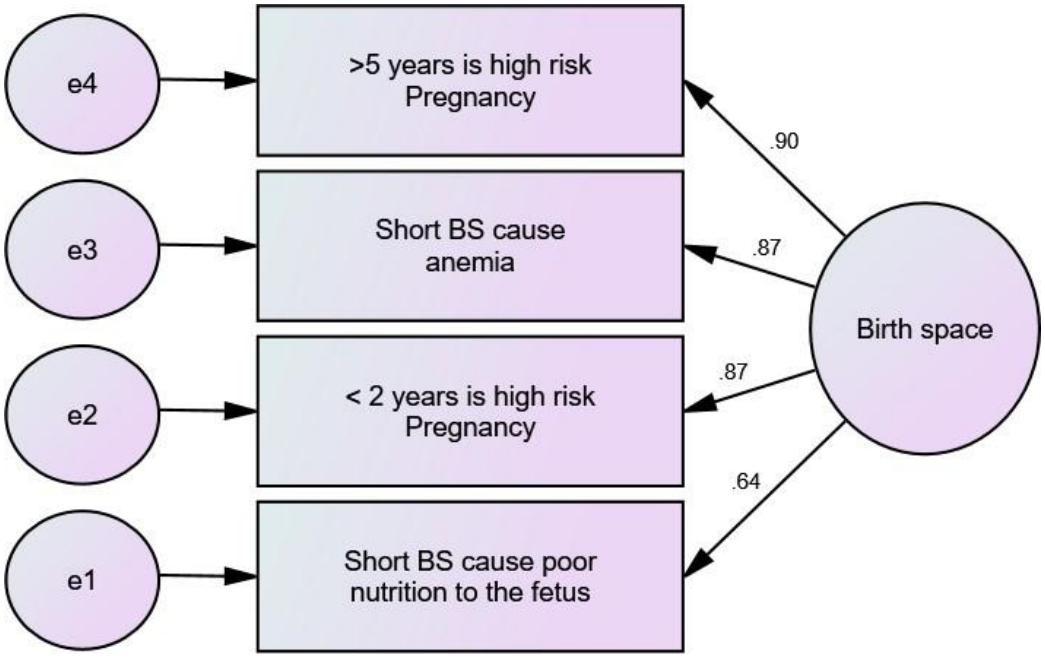

Fig-2: Path diagram about birth space knowledge

Table 4: Fit Indices of the CFA Model [n = 60]

Model	CMIN/D.F	p-value	SRMR	RMSEA	CFI	GFI	TLI	AIC	BIC
	1.25	0.285	0.0234	0.066	0.997	0.978	0.990	18.51	19.99

Table 4. Final questionnaire: development and validation of questionnaire about knowledge of birth spacing among females

	Strongly disagree	Disagree	Don't Know	Agree	Strongly agree
< 2 years is high-risk Pregnancy					
>5 years is high-risk Pregnancy					
Short BS cause Per-vaginal bleeding					
Short BS cause poor nutrition in the fetus					

Choose appropriate options by scoring 1-5 where 1 shows strongly disagree and 5 strongly agree

Interpretations: The total minimum and maximum score is 4-20 whereas higher score shows better knowledge about birth spacing

DISCUSSION

The annual population growth has been reported as 1.23% by The United Nations (UN) between the time periods of 2000-2010. [22] The Asian countries have topped the list with China being at the top proceeded by India. However, due to timely and massive steps taken by the Chinese government, their population growth has significantly dropped and it is estimated that India may surpass China and become the most populous country by 2030 [23, 24]. One of the most significant reasons for uncontrolled population growth is the lack of awareness and knowledge among partners or spouses which leads them to make unwise decisions about their family size.[25] Particularly, among females, the knowledge about birth spacing is very limited and is not focused upon due to societal pressures and the taboo attached.[26] Studies have reported the knowledge about birth spacing being as much as 100% in the US to as low as 23% in India,[27] However, these assessments have been made subjectively or as part of some bigger study question.

Despite its significance, no validated proforma is available in Pakistan to measure knowledge about birth spacing, which is why we aimed to conduct this study. In this study, we designed and developed a questionnaire to assess the knowledge about birth spacing which was later validated using Explanatory Factor Analysis and tested for reliability using Chronbach's Alpha. The Face validity of the questionnaire showed adequate understanding of the language and content used in the questionnaire. Moreover, initially, 6 items were included among which 2 were having an issue of cross loading and were subsequently deleted. The remaining four items were found to be significantly validated as well as reliable to be used in the final version of the tool. The limitation of this study is, however, that the data was collected only from one setting. It is therefore recommended for other researchers use the tool on community-based and large populations for confirmatory analysis.

CONCLUSION:

This study resulted in the development of a validated and reliable proforma to assess the knowledge about birth spacing among females.

REFERENCES

1. Miller R, Karra M. Birth Spacing and Child Health Trajectories. Population and Development Review. 2020;46(2):347-71.
2. Organization WH. Report of a WHO technical consultation on birth spacing: Geneva, Switzerland 13-15June 2005. World Health Organization; 2007.
3. Gebremedhin AT, Regan AK, Malacova E, Marinovich ML, Ball S, Foo D, et al. Effects of interpregnancy interval on pregnancy complications: protocol for systematic review and meta-analysis. BMJ open. 2018;8(8):e025008.
4. Haight SC, Hogue CJ, Raskind-Hood CL, Ahrens KA. Short interpregnancy intervals and adverse pregnancy outcomes by maternal age in the United States. Annals of Epidemiology. 2019;31:38-44.
5. Nyi Nyi N, Wan Arfah Nadiah WAJ, Asif H. Determinants of short inter pregnancy interval: a systematic review. Scientific international Lahore. 2020;32(6):679-84.
6. Cheslack Postava K, Winter AS. Short and long interpregnancy intervals: correlates and variations by pregnancy timing among US women. Perspectives on sexual and reproductive health. 2015;47(1):19-26.
7. Cheslack- Postava K, Sourander A, Suominen A, Jokiranta- Olkoniemi E, McKeague IW, Brown AS. Increased risk of ADHD at short and long Interpregnancy intervals in a national birth cohort. Paediatric and Perinatal Epidemiology. 2021;35(4):392-400.
8. Molitoris J, Barclay K, Kolk M. When and where birth spacing matters for child survival: an international comparison using the DHS. Demography. 2019;56(4):1349-70.
9. Ewemade J, Akinyemi J, DeWet N. The effect of child death on birth spacing in Nigeria. Journal of Biosocial Science. 2020;52(3):330-7.
10. Sujan AC, Class QA, Rickert ME, Van Hulle C, D'Onofrio BM. Risk factors and child outcomes associated with short and long interpregnancy intervals. Early Child Development and Care. 2021;191(14):2281-92.and child nutritional status. World Applied Sciences Journal. 2014;31(11):1971-8.
11. Nti CA, Gadegbeku C, Sarah N, Ofosu B, Akoto E, Agbi-Dzorkar M. Knowledge, attitude and practice of birth spacing among Ghanaian mothers: implications for

maternalof respiratory tract infections among Malaysian Hajj pilgrims.BMC Public Health. 2020;20(1):1-10.
12. Beracochea E, Pruyn N. Optimal birth spacing program: operational research in Mozambique, 2004-2005. Management Sciences for Health [MSH], Advance AfricaProject, 2005 Sep 33 p. 2005.
13. Sunita K, Reena R, Deepika R. Knowledge Regarding Birth Spacing Methods of Contraception among Postnatal Mothers in PGIMS, Rohtak, Haryana.
14. Mubarik M, Jameel N, Khalil R. Knowledge, attitude and utilisation of sub-dermal birth control implants among married rural women of Pakistan. Int J Res Med Sci. 2016;4:2229-39.
15. Santoso BI, Surya R. Knowledge, attitude, and practice of contraception among pregnant women in Ende district, East Nusa Tenggara, Indonesia. Journal of South Asian Federation of Obstetrics and Gynaecology. 2017;9(2):110-8.
16. Saad A, Akinsulie B, Ega C, Akiode A, Awaisu A. Misconceptions and current use of contraception among women of reproductive age in six major cities in Nigeria. The European Journal of Contraception & Reproductive Health Care. 2018;23(6):415-20.
17. Shafei M, Shah M, Tengku Ismail T. Knowledge and attitude towards family planning practice and prevalence of short birth spacing among residents of suburban area in Terengganu, Malaysia. J Community Med Health Educ. 2012;2(180):2161-0711.1000180.
18. Kline RB. Principles and practice of structural equation modeling (3. Baskı). New York, NY: Guilford. 2011;14:1497-513.
19. Goni MD, Naing NN, Hasan H, Wan-Arfah N, Deris ZZ, Arifin WN, et al. Development and validation of knowledge, attitude and practice questionnaire for prevention.
20. Lee T-Y, Hsing S-C, Li C-C. An Improved Stress-Scale Specifically Designed to Measure Stress of Women with Newly Diagnosed Breast Cancer. Int J Environ Res Public Health. 2021;18(5):2346.
21. Selvaraj S, Naing NN, Wan-Arfah N, Karobari MI, Marya A, Prasadh S. Development and Validation of Oral Health Knowledge, Attitude and Behavior Questionnaire among Indian Adults. Medicina. 2022;58(1):68.
22. Schneider A, Mertes CM, Tatem A, Tan B, Sulla-Menashe D, Graves S, et al. A new urban landscape in East– Southeast Asia, 2000–2010. Environmental Research Letters. 2015;10(3):034002.
23. Kaur R, Bisht N, Dhillon A, Kumar S. A Study of Knowledge, Attitude and Practice of Contraception in Reproductive Age Group in Amritsar District of Punjab. HINDU.64:32.
24. Rapaport Pasternak H, Sheiner E, Goldbart A, Wainstock T. Short and long interpregnancy interval and the risk for pediatric obstructive sleep apnea in the offspring. Pediatric Pulmonology. 2021;56(5):1085-91.
25. Rajan V, Kandasamy S. Awareness regarding birth spacing family planning methods among antenatal mothers. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2021;10(1):93-7.
26. Nabi N, Qidwai W, Batool F, Azam I. Awareness about reproductive health and rights among students of a public university in Karachi, Pakistan: a cross sectional study. Journal of Dow University of Health Sciences. 2007;1(2):59.
27. Yadav B, Pandey S. Study of knowledge, attitude, and practice regarding birth spacing and methods available for spacing in rural Haryana, India. International Journal of Reproduction, Contraception, Obstetrics and Gynecology. 2018;7(4):1389-94.