SHORT REPORT

The impact of modifiable lifestyle factors on women's fertility

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Abstract

The current study centred on assessing the effect of various lifestyle factors (diet, physical activity [PA] level, sleep pattern, and stress level) on women's fertility. This hospital-based comparative study was conducted at the Avicenna Medical College and Hospital, Lahore, Pakistan, with 104 females (aged 18-40 years) as participants. Half the participants had a history of infertility and 51.8% had a BMI >25. About 43% and 85% reported intake of "junk food" and "fruit and vegetable (F&V)", respectively, twice a week. DASS-21 scale endorsed "moderate-to-high-stress" in 58% of the participants. Further, moderate and intense PAable was documented in 30% and 20% of the participants. About 37% reported sleeping for ≤5 hours/day. Fertility was significantly but inversely correlated with F&V intake, stress level, and BMI. Less sleep and a sedentary lifestyle had a significantly detrimental impact on fertility. Women's fertility was positively impacted by F&V intake, moderate PA, and adequate sleep but negatively impacted by obesity and mental stress.

Keywords: Fertility, Stress, Physical Activity, Sleep, BMI.

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Introduction

World Health Organisation defines infertility as a disorder of the male or female reproductive system failing to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse.[1,2] It affects 15% of the couples worldwide, and has emerged as a problem recently due to an increase in its prevalence. Many modifiable lifestyle factors might affect female fertility. These factors include late age at first pregnancy caused by a pursuit of education and career, smoking, alcoholism, a fat-rich diet, excessive caffeine intake, mental stress, and extremes of physical activity.[3,4]

Modifiable lifestyle factors have been studied individually in different populations,[5] but sufficient work has not been done regarding lifestyle factors affecting the fertility of women in Pakistan. The purpose of this study was to identify various modifiable lifestyle factors in our community, and as female infertility treatment is invasive and costly, our study focussed on the prevention of these factors. Lifestyle factors included in this study were junk food intake, fruits and vegetables (F&V) intake, physical activity level, mental stress level, and sleep duration.

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Methods and materials

The study was conducted at Avicenna Medical College and Hospital, Lahore, Pakistan. The informed consent form was filled out by the participants before the start of the study. Permission for data collection was taken from the ethical review committee (ERC) of Avicenna Medical College and Hospital, Lahore, Pakistan, via reference number IRB-4/2021.

It was a cross-sectional study of six months' duration from March 1, 2021 to August 31, 2021. The participants for this study were selected using a purposive sampling technique. Randomisation of patients was not done. Also, the study was not blinded. The study comprised 104 females of childbearing age (18-40 years). Pregnant women were excluded from the study. In order to calculate the sample size, the following formula was used considering the literature.[6]

Sample size= $n = z^2 \times p \times (p-1)/d^2 = (1.96)^2 \times 0.22 \times (1-0.22)/(0.1)^2 = 66$ approx.

z=z-score=1.96 (corresponds to confidence level, and 95% confidence level), *p*=22%, d= Margin of error=10%

The significance level of the study was kept at 5%, and the confidence level was set at 95%.

Lifestyle-related data was collected regarding physical activity level, stress level, and other lifestyle factors including diet, along with the fertility status of all female participants. Height and weight were measured to calculate body mass index (BMI). Dietary data included a food frequency questionnaire (FFQ), which asked about the intake of "junk food" as well as fruits and vegetables. The term "junk food" is used for food that has little nutritional value but is high in fats, salt, and/or sugar. Junk food also includes Western fast foods, as well as local street foods like samosas, pakoras, etc., and every type of Western and local sweets and sweet drinks.[7] Hence, while asking for intake of

"junk food", all these foods were bracketed into one group. Intake of any of these items at least twice a week was considered "intake of junk food". Intake of fruits and/or vegetables at least twice a week was considered "healthy food" and was grouped as "F&V" (fruits and vegetables).

Stress was assessed by using the DASS-21 scale.[8] For the convenience of statistical analysis, no-stress and low-stress levels were categorised as one group, and moderate and high levels of stress were categorised as the other group. For physical activity (PA) levels, patients' self-reported activity levels were recorded, and groups were formed as sedentary, moderately active, and strenuously active lifestyles.

Statistical Analysis: Data analysis of studied variables was done on statistical software SPSS version 26. Descriptive analysis was done to calculate frequency and percentages of studied variables. Further inferential statistics including Chi-square test was performed to assess the association of studied variable with fertility status in women. Level of significance was kept at <0.05.

Results

The prevalence of studied parameters have been presented in Table 1A. The results depicted that half of the participants were infertile. About 43% of these participants reported intake of "junk food" and about 85% of participants reported intake of "F&V" at least twice a week. About 58% of these participants reported "moderate to high stress" according to the DASS-21 scale. PA level of half of the study participants was "sedentary", and out of the remaining half, about 20% claimed to indulge in "intense" PA. About 37% of the study participants reported that they slept for only five or less than five hours per day.

Table-1A: Frequencies and correlation of all variables.

Measures	Categories	n (%)
Fertility	Fertile	52 (50)
(n=104)	Infertile	52 (50)
Junk food intake	No	60 (57.7)
(n=104)	Yes	44 (42.3)
F&V[1] intake	No	16 (15.4)
(n=104)	Yes	88 (84.6)
Stress	No	44 (42.3)
(n=104)	Yes	60 (57.7)
BMI[2]	<25	50 (48.1)
(n=104)	≥25	54 (51.9)
PA[3]	Sedentary	53 (51)
(n=104)	Moderate	30 (28.8)
	Intense	21 (20.2)
Sleep hours	≤5 hours	38 (36.5)
(n=104)	>5 hours	66 (63.5)

Table-1B: Association between fertility and various lifestyle factors.

Variable 1	Variable 2	df	*p*-value	Correlation
Fertility	Junk food intake	1	0.427	-----
Fertility	F&V[1] intake	1	0.030	-0.21
Fertility	Stress	1	0.001	0.58
Fertility	BMI[2]	1	0.006	0.27
Fertility	PA[3]	2	0.001	-0.46
Fertility	Sleep hours	1	0.001	-0.56

Pearson's Chi-square test showed the association of all the studied variables with fertility status in women (Table 1B). The study findings showed that although junk food intake was higher in the infertile group, it did not have a statistically significant effect on infertility. However, fruit and vegetable intake was much higher in the fertile group and was observed to be significantly inversely related to infertility. Physical activity level was also significantly higher in the fertile group and a sedentary lifestyle was much more prevalent in the infertile group. The stress level was observed to be much higher, and significantly and directly correlated to the infertile group. BMI was noted to be significantly higher in the infertile group. Sleep hours were significantly fewer in the infertile group as compared to the fertile group.

Discussion

The study did not show a significant negative effect of "junk food" on the fertility of women. However, the study did show positive effects of fruit and vegetable intake on the fertility status of these women. Prevalence of primary infertility has been noted to be low among women who consume dark green leafy vegetables and fruits. Lower intake of fruit, as well as higher intake of fast food, and sweetened beverages have been observed to reduce fertility in women.[4] An unhealthy diet leads to obesity and polycystic ovarian syndrome (PCOs) and results in female infertility.[9] The study also showed a significant positive correlation between BMI and infertility. Although obesity is considered an important cause of infertility in women, females with lower-than-normal BMI might also suffer from infertility. Food deficit inhibits the hypothalamic-pituitary-gonads axis (HPG) at the central nervous system level, which affects the GnRH (Gonadotropin-releasing hormone) pulse. When the secretion of GnRH is inhibited, it leads to reduced follicle development and decreased synthesis of gonadal hormones.[10] However, the study showed that the fertile group had a higher number of participants with lower-than-normal BMI, as compared with the infertile group.

Regular exercise has a protective effect on both obesity and psychological stress. Exercise can facilitate conception by increasing insulin sensitivity. However, excessive exercise might induce amenorrhoea and irregular ovulation.[4] The study showed that a significant number of participants

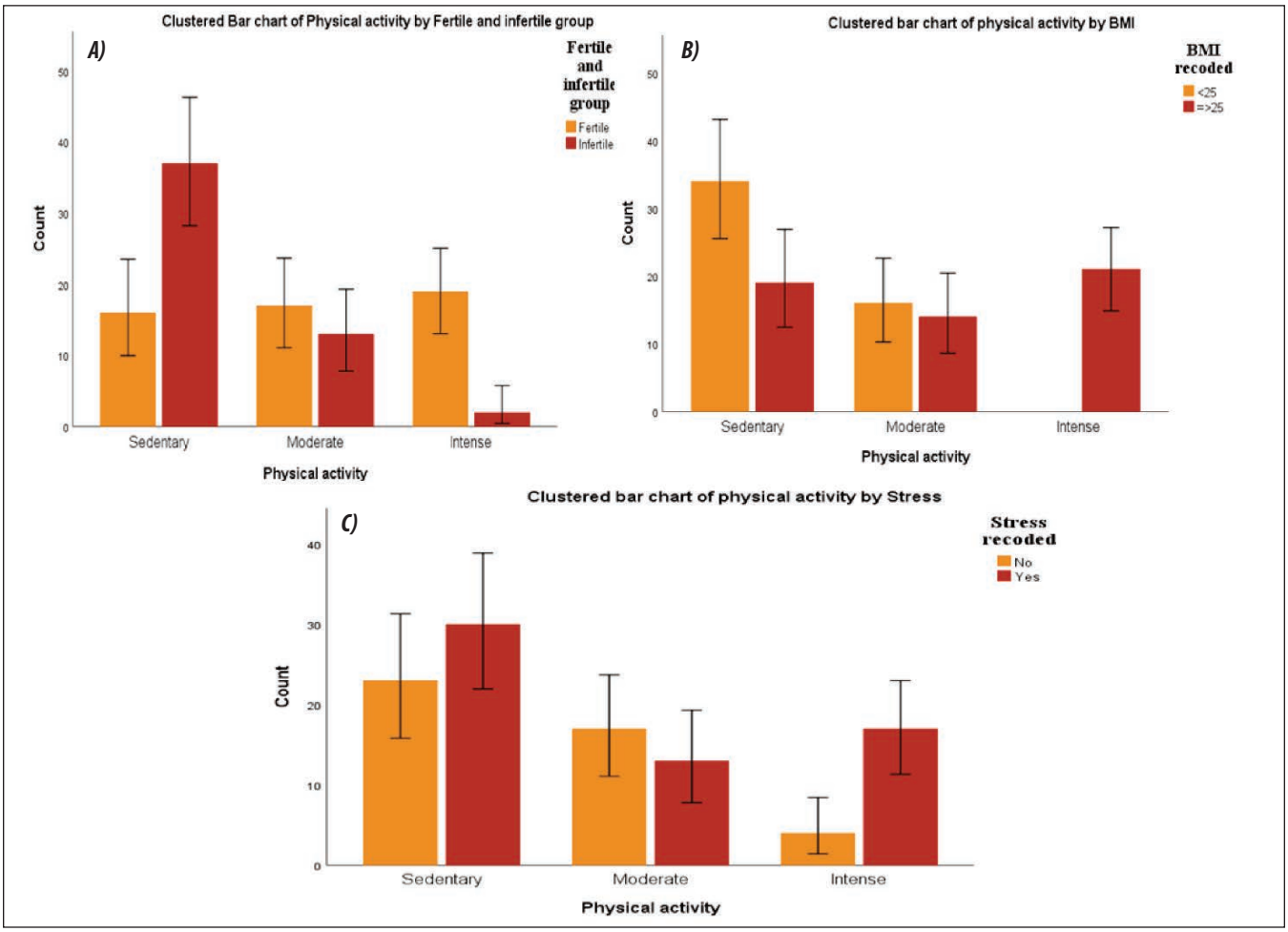

Figure: Correlations of physical activity level with A) fertility B) BMI C) stress.

who had a sedentary lifestyle were infertile, while a positive effect of moderate and high physical activity level was seen on fertility (Figure 1A). But interestingly, the study showed that the majority of participants with sedentary lifestyle fell in the lower BMI group, and moderate to intensely active group fell in higher-than-normal BMI (≥25 kg/m^2) group (Figure 1B). Similarly, it was revealed that both the sedentary and intensely active participants were more stressed as compared to those who were moderately active (Figure 1C).

Under stressful conditions, the hypothalamus releases corticotropin-releasing hormone (CRH), which signals the pituitary gland to secrete adrenocorticotropin hormone (ACTH). ACTH, in turn, helps the adrenal cortex to release corticosteroids, especially cortisol. Increased circulating cortisol can affect GnRH-induced luteinising hormone (LH) release, hence affecting LH-induced ovulation.[10] Psychological symptoms have a negative effect on fertility.[11] Women's emotional stress can reflect in tubal spasms, and anovulation. Although infertile persons are prone to develop psychological disorders compared with healthy couples, high levels of psychological stress can itself be a cause of infertility.[11] It is recommended that infertile couples should be encouraged to avoid anxiety and depression, and should get psychological treatment.[9] The study results were in accordance with literature, as it showed significant positive correlation between stress and infertility.

Sleep is essential for general wellness. Inadequate sleep alters the circadian rhythm of hormones and disrupted sleep has negative effects on reproductive outcomes.[12] Less than six hours of sleep per day was observed to be associated with reduced fertility.[12,13] Our study also noted that less than six hours of sleep was associated with infertility (p<0.000). The limitation of the study was the small sample size; therefore, the results of this study must be validated on a larger sample size in future. The study is also constrained by other limitations, notably the absence of patient randomisation and the lack of blinding procedures, which could potentially introduce biases.

Conclusion

The findings of the current study can assist in understanding various lifestyle factors associated with infertility, i.e. diet, physical activity, stress, and sleep. According to the study, F&V intake, moderate PA, and adequate sleep had a positive effect on fertility in women, but obesity and high mental stress level had a negative effect. Although junk food intake was high in the infertile group, this effect was not statistically significant.

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Author Contribution:

TS: Concept, methodology, investigation, data curation, writing, visualization, resources.
ZA: Supervision, validation, formal analysis, resources, project administration.
SL: Data curation, writing, review and editing, formal analysis, data analysis.