Original Article

doi: 10.31674/mjn.2024.v16isupp1.011

MJN

The Relationship between Body Mass Index (BMI), Sleep Quality, and Fertility Quality of Life among Infertile Couples

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ABSTRACT

Background: Infertility can profoundly impact various aspects of a couple's life, including their body mass index (BMI), sleep quality, and overall quality of life. This cross-sectional study aimed to explore the relationship between BMI, sleep quality, and quality of life among infertile couples. **Methods:** Conducted at a tertiary hospital in Selangor, the study involved 126 participants (63 couples). BMI, sleep quality (measured using the Pittsburgh Sleep Quality Index, PSQI), and quality of life (measured using the Fertility Quality of Life, FertiQoL) were assessed. Data were analysed using IBM SPSS version 29. **Results:** Poor sleep quality (PSQI score >5) was observed in 10.3% of participants, while 89.7% had good sleep quality (PSQI score <5). The mean BMI was 27.52 ± 6.48. This study revealed no significant relationship between all three variables (body mass index, sleep quality, and quality of life) among the infertile couple as the *p*-value was more than 0.05. **Conclusion:** These findings suggest that while BMI does not significantly impact the quality of life among infertile couples, sleep quality may have a minor influence; by addressing sleep quality issues and understanding their relationship with BMI and overall health, nurses can contribute to improving the quality of life for patients, particularly those struggling with infertility and related concerns.

Keywords: BMI; Infertility; FertiQoL; Nursing Practice; PSQI; Quality of Life; Sleep Quality

INTRODUCTION

Infertility is a significant issue affecting couples globally, impacting both physical health and mental well-being. The WHO (2020) defines infertility as the inability to conceive after 12 months or more of regular, unprotected intercourse, affecting 17.5% of adults worldwide. This condition is influenced by various factors such as Body Mass Index (BMI), sleep quality, and fertility-related quality of life (FertiQoL), making it a complex issue overall quality of life. The increasing prevalence of obesity and lifestyle changes worldwide has made it crucial to understand how BMI and sleep quality interact with fertility outcomes, as well as how they impact the emotional and social dimensions of affected individuals. This study explores these relationships to inform better healthcare practices and improve treatment outcomes for infertile couples (Ombelet, 2020; WHO, 2023).

Research shows that both low and high BMI can negatively affect fertility in both men and women. Women with high BMI are at risk of anovulation, polycystic ovary syndrome (PCOS), and other hormonal imbalances that disrupt menstrual cycles, while low BMI is linked to inadequate ovarian reserves (Legro *et al*., 2013; Rittenberg *et al*., 2011). In men, obesity can decrease sperm quality, leading to infertility. Poor sleep quality further exacerbates these issues by affecting hormonal balance, emotional well-being, and overall

Received: October 23, 2024 Received in revised form: November 8, 2024 Accepted: November 21, 2024

health. Lack of sleep can adversely affect both primary and secondary infertility through hormonal disruption, increased stress, impaired sexual function, overall health issues, and reduced quality of life (Philipsen *et al*., 2022).

Despite a growing body of evidence, there is limited research on how these factors interact to impact the fertility-related quality of life, leaving a gap in comprehensive infertility care strategies. This study addresses this gap by examining the relationship between BMI, sleep quality, and FertiQoL in infertile couples. This study holds significant value as it addresses a critical global health issue that affects millions of couples. By investigating the interplay between BMI, sleep quality, and FertiQoL, the research offers new insights that can lead to more effective and holistic interventions in fertility care. The findings will benefit healthcare providers, especially in enhancing the quality of life and reproductive outcomes for infertile couples. Nurses, as frontline healthcare professionals, will be empowered to offer better support, tailored counselling, and educational programs that emphasise the importance of maintaining a healthy BMI and improving sleep quality as part of infertility treatment (Wang *et al*., 2023). Moreover, this research can guide policymakers in developing public health campaigns and policies that promote healthy lifestyle changes, thus reducing infertility rates and improving overall well-being (WHO, 2020).

METHODOLOGY

This cross-sectional study was conducted at a tertiary hospital in Malaysia from September 2023 to February 2024. The sample consisted of 126 infertile couples, both primary and secondary infertility cases, selected using the Raosoft sample size calculator to ensure a 95% confidence level and a 5% margin of error. The participants in the study were all under the age of 43 and provided informed consent. This age range was chosen because female fertility generally begins to decline in the early 30s, with a more notable decrease after age 35. By focusing on women under 43, the study targets a group still within their reproductive years, where interventions are more likely to have a significant impact on fertility outcomes.

Data collection was carried out using a structured questionnaire that included demographic information, the PSQI, and the FertiQoL instrument. BMI was calculated from measured anthropometric data, while sleep quality was assessed based on respondents' self-reported sleep habits from the past month by using the Self-Reported Sleep Quality Using the Malay Version of the Pittsburgh Sleep Quality Index (PSQI-M) adapted from a previous study (Farah *et al*., 2019). It has 9 questions and is classified into seven domains. The domains are sleep quality, sleep latency, sleep duration, sleep efficiency in patients, sleep disturbances, sleep medication, and daytime dysfunction. The questions on the PSQI form yield a total score by adding up their scores, which range from 0 to 3. An overall score of 0 to 5 indicates good sleep quality, while a score higher than 5 indicates poor sleep quality.

The FertiQoL (Malay) questionnaire has core and treatment components (Ariffin, Daud & Ismail, 2017). The core component consists of 24 items and is categorised into four domains, which are emotional, social, cognitive/physical (mind-body), and relationship domains. The questionnaire asked respondents to assess items from these areas on a scale of 0 to 4. Higher scores denoted a greater quality of life. The subscale and overall FertiQoL scores were calculated and converted to provide a range of 0 to 100.

The instruments of this study were validated to accurately measure the BMI, sleep quality, and quality of life among infertile couples. A pilot study retested reliability in the specific population and setting, further ensuring robust and dependable findings. The reliability of the data was measured by the Cronbach's alpha value; the PSQI was 0.886, while the FertiQol was 0.909, indicating that the consistency of the data was good and excellent.

Data collection sessions were held weekly, primarily on Wednesdays, at infertility clinics to optimise resources. Couples were approached for consent after a detailed explanation of the study. Data collection occurred in a private setting, ensuring confidentiality. Flexibility allowed additional sessions on other dates if necessary.

After data collection, analysis was conducted using SPSS version 29.0. Descriptive statistics summarised categorical variables as frequencies and percentages and continuous variables as means and standard

deviations. Statistical tests included the correlation coefficient, with significance at $p < 0.05$.

The data was collected and analysed using IBM Statistical Packages for Social Science (SPSS) for Windows 29. The data was cleaned, and a reliability test was conducted to determine the consistency of a research study for all variables used. The reliability of the data was measured by the Cronbach's alpha value; the PSQI was 0.886, while the FertiQol was 0.909, indicating that the consistency of the data was good and excellent.

Ethical Consideration

The study received ethical approval by the Research Ethics Committee of Universiti Teknologi MARA, Malaysia with reference number. 600-TNCPI (5/1/6) REC/02/2023 (ST/MR/48) on 22nd September 2023.

RESULTS

Demographics

Table 1 shows the demographic profile of respondents in the study. The sample had a mean age of 32.98 years (SD 3.90), with most participants identifying as Malay (90.5%). The average duration of marriage was 5.09 years, and 76.2% of participants were employed full-time. 43.7% had unexplained infertility, and 46.8% had undergone prior fertility treatments (Table 1).

Table 1: The Characteristics of Respondents (n=126)

	Variable	Frequency	Percentage
Age			
	Mean: 32.98 SD 3.90		
	Minimum: 25 years old		
	Maximum: 43 years old		
	≥ 18 years old	41	32.54
	31-45	85	67.46
Gender			
	Male	63	50.0
	Female	63	50.0
Race			
	Malay	114	90.5
	Chinese	1	0.8
	Indian	10	7.9
	Others	1	0.8
Educational Level			
	Primary	1	0.8
	Secondary	29	23.0
	Diploma	47	37.3
	Degree	40	31.7
	Master	9	7.1
Employment			
	Employed full-time	96	76.2
	Employed part-time	3	2.4

	Self-employed	16	12.7
	Unemployed	10	7.9
	Retired	1	0.8
Income			
	Minimum: 4,849		
	Maximum: >RM10,960		
	RM 0 – RM 4,849	77	61.1
	RM 4,850 – RM 10,959	41	32.5
	> RM 10,960	8	6.3
Duration of Marriage Life			
	Mean: 5.10 SD 2.48		
	Minimum: 2 years old		
	Maximum: 12 years old		
Family History			
	Yes	12	9.5
	No	51	40.5
Pattern of Menstrual Cycle			
	Regular	53	42.1
	Irregular	10	7.9
Contraceptive			
	Yes	0	0
	No	63	50
Type of Infertility			
	Type 1	55	43.7
	Type 2	8	6.3
Duration of Infertility			
	Mean: 4.98 SD 2.34		
	Minimum: 2 years old		
	Maximum: 12 years old		
Treatment History			
	Yes	4	3.2
	No	59	46.8

The Weight Status (Body Mass Index)

Table 2 portrayed the weight status of 126 infertile couples, revealing a mean BMI of 27.52 (SD 6.48), with a range from 18.69 to 70.80. Notably, 37.3% are normal weight, 38.9% are overweight, and 23.8% are obese, highlighting a concerning prevalence of overweight and obesity among the sample.

This finding highlights the gender differences in BMI among individuals struggling with infertility. The average BMI for males in the study is 26.79, which is classified as overweight according to standard BMI categories (25–29.9). In comparison, females in the study have a higher average BMI of 28.25, which also falls

into the overweight range but is closer to the threshold for obesity (30 and above).

The larger standard deviation (SD) in females (7.97) compared to males (4.47) suggests that there is more variation in BMI among females, meaning that some women in the study may have significantly higher BMIs than the average, contributing to greater overall variability. This distribution indicates significant gender differences, emphasising the need for addressing weight-related factors in fertility assessments and interventions.

Table 2: The Weight Status among Infertile Couple

Variables		Frequency			Percentage	*p*-value
BMI		**Male**	**Female**	**Total**		0.02*
Mean		26.79 ± 4.47	28.25 ±7.97	27.52 ±6.48		
	Minimum: 18.69					
	Maximum: 70.80					
	Underweight (BMI: <18.5)	0	0	0	0	
	Normal (BMI: 18.5 – 24.9)	20	27	47	37.3	
	Overweight (BMI: 25 – 29.9)	32	17	49	38.9	
	Obese (BMI: > 30)	11	19	30	23.8	

**P= chi-square*

Sleep Quality

Table 3 presents the sleep quality among infertile couples. This study revealed that the bedtime average was at 8:20 pm, with a mean sleep duration of 6.53 hours. Most respondents (89.7%) report good sleep quality, but subjective assessments indicate a notable perception of sleep failure. Sleep latency averages 1.07 minutes, while sleep efficiency shows significant difficulty, affecting 96.8% of participants. Minimal sleep disturbance is reported, with 21.4% using sleep medication frequently. Daytime dysfunction is low, with a mean score of 0.98.

Table 3: The Sleep Quality among Infertile Couple (n=126)

Variables		Time/Duration	%
Bedtime		20:20 pm	5.04
	Minimal	10:30 pm	
	Maximum	0.:00am	
Duration of Sleep		20 minutes	18.65
	Minimal	1 minute	
	Maximum	120 minutes	
Wake up Time		04:00 am	
	Minimal	04:00 am	
	Maximum	12.00 noon	
Sleep Duration (Hours)		6.53 hours	1.11
	Minimal	3.00 hours	
	Maximum	9.67 hours	
Time Spent in Bed		6.88 minutes	1.09
	Minimal	3.50 minutes	
	Maximum	10.00 minutes	
Sleeping Behaviour			
	Poor Sleep Quality (PSQI score >5)	13	10.3
	Good Sleep Quality (PSQI score <5)	113	89.7
Component 1: Subjective Sleep Quality (Q9) [Mean: 1.34; SD **1.19]**			
	Very Good (0)	42	33.3
	Fairly Good (1)	31	24.6
	Fairly Bad (2)	21	16.7
	Very Bad (3)	32	25.4
Component 2: Sleep Latency (Q2a and 5a) [Mean: 1.07; SD **0.81]**			
	0 (0)	29	23.0
	1-2 (1)	67	53.2
	3-4 (2)	22	17.5
	5-6 (3)	8	6.3

Component 3: Sleep Duration (Q4) [Mean: 1.02; SD **0.95]**			
	> 7 hours (0)	45	35.7
	6-7 hours (1)	43	34.1
	5-6 hours (2)	28	22.2
	< 5 hours (3)	10	7.9
Component 4: Sleep Efficiency (Q1,3 and 4) [Mean: 2.94; SD **0.37]**			
	> 85% (0)	1	0.8
	75-84% (1)	2	1.6
	65-74% (2)	1	0.8
	< 65% (3)	122	96.8
Component 5: Sleep Disturbance (Q5b-5j) [Mean: 1.41; SD **0.65]**			
	0 (0)	8	6.3
	1-9 (1)	62	49.2
	10-18 (2)	53	42.1
	19-27 (3)	3	2.4
Component 6: Use of Sleep Medication (Q6) [Mean: 1.48; SD **1.07]**			
	Not during the past month (0)	29	23.0
	Less than once a week (1)	34	27.0
	Once or twice a week (2)	36	28.6
	Three or more times a week (3)	27	21.4
Component 7: Daytime Dysfunction (Q7 and 8) [Mean: 0.98; SD **0.58]**			
	0 (0)	21	16.7
	1-2 (1)	87	69.0
	3-4 (2)	17	13.5
	5-6 (3)	1	0.8

Quality of Life

Table 4 outlines the quality of life among infertile couples experiencing fertility issues, focusing on general aspects of quality of life and exploring the impact of fertility treatments. The results of the study offer a clear overview of the quality of life among infertile couples in the university hospital, as measured by FertiQoL scores. The overall quality of life is reasonably good, with a mean score of 79.37 and a standard deviation of 13.07 for the Core FertiQoL.

Emotionally, couples have a moderate level of well-being, reflected by a mean score of 74.90 and a standard deviation of 17.49, followed by the social satisfaction, with a mean score of 76.26 and a standard deviation of 16.24. Their physical and cognitive perceptions, which were under the mind-body domain, are similarly positive, with a mean score of 79.07 and a standard deviation of 15.68. While the interpersonal relationships are particularly strong, with the highest mean score of 87.27 and a standard deviation of 11.44.

However, there are some areas that could use improvement. The Treatment FertiQoL domain has a mean score of 70.67 and a standard deviation of 10.92, indicating some dissatisfaction with treatment aspects. Environment Tolerability also shows a fair level of comfort with a mean score of 73.08 and a standard deviation of 9.90. Tolerability has the lowest score at 68.25, with a standard deviation of 16.80, indicating variability in how couples tolerate their circumstances. Overall, the Total FertiQoL score is 75.02 with a standard deviation of 10.31, suggesting a moderate to high quality of life among the couples studied.

The study results suggest that infertile couples at the university hospital generally experience a moderate to high quality of life, with particularly strong interpersonal relationships. While emotional, physical, and cognitive aspects are relatively positive, there are areas where improvements could be beneficial, particularly in treatment satisfaction and tolerability of their circumstances. These findings highlight the complexity of quality of life and suggest a need for targeted support in specific domains to enhance overall well-being for infertile couples.

Table 4 : The Quality of Life among Infertile Couple

Variables	Mean	SD
Core FertiQoL	79.37	13.07
Emotional	74.90	17.49
Mind-body	79.07	15.68
Relational	87.27	11.44
Social	76.26	16.24
Treatment FertiQoL	70.67	10.92
Environment Tolerability	73.08	9.90
Tolerability	68.25	16.80
TOTAL FertiQoL SCORE	75.02	10.31

Correlations

Table 5 summarises the relationship between body mass index (BMI), sleep quality, and quality of life among infertile couples. The findings of this study indicate that there are no significant relationships among Body Mass Index (BMI), Sleep Quality (measured by the PSQI), and Quality of Life (measured by FertiQoL) among infertile couples at the university hospital.

For BMI and Sleep Quality, the Pearson correlation coefficient is 0.168 with a significance value of 0.060. Although this suggests a positive correlation, it is not statistically significant, indicating no strong evidence of a relationship between BMI and sleep quality.

Regarding BMI and quality of life, the Pearson correlation coefficient is 0.003 with a significance value of 0.974. This very small correlation and high *p*-value suggest there is no meaningful relationship between BMI and quality of life.

For sleep quality and quality of life, the Pearson correlation coefficient is -0.145 with a significance value of 0.106. The negative correlation implies a slight inverse relationship, meaning that as sleep quality worsens, quality of life might slightly decrease. However, this relationship is not statistically significant.

Overall, these results indicate that within this study, BMI, sleep quality, and quality of life do not have significant correlations among the infertile couples. This suggests that other factors may play a more crucial role in affecting these variables, or that the sample size or study design may limit the detection of any potential relationships.

Table 5: The Relationship between Body Mass Index (BMI), Sleep Quality, and Quality of Life among Infertile Couple

Variables	Statistical Analysis	Body Mass Index (BMI)	Sleep Quality (PSQI)	Quality of Life (FertiQoL)
Body Mass Index (BMI)	Pearson Correlation	1	0.168	0.003
	Sig. (2-tailed)		0.060	0.974
Sleep Quality (PSQI)	Pearson Correlation	0.168	1	-0.145
	Sig. (2-tailed)	0.060		0.106
Quality of Life (FertiQoL)	Pearson Correlation	0.003	-0.145	1
	Sig. (2-tailed)	0.974	0.106	

DISCUSSION

The present study provides valuable insights into the relationships between body mass index (BMI), sleep quality, and fertility-related quality of life (FertiQoL) among infertile couples. The findings reveal associations between these factors to offer new perspectives on the multifaceted nature of infertility and its impact on individuals and couples.

The study confirms a high prevalence of overweight and obesity among infertile couples, which is consistent with prior research. For instance, Khmil *et al*. (2020) reported that 58% of their infertile female

participants were either overweight or obese, a finding that mirrors the results of the study where 62.7% of them are either overweight or obese, with women having higher BMI than men. This gender difference is critical because it underscores how BMI affects fertility across both sexes, rather than just in women, as emphasised by Wang *et al*. (2023), who reported normal BMI among male partners of infertile couples. The increased BMI observed in the study may reflect broader societal trends related to obesity and its associated health risks. According to the WHO (2024), obesity rates in Malaysia are rising, which has led to significant health issues, including infertility.

The link between high BMI and infertility is well-documented. Overweight and obese women are more likely to experience conditions like anovulation and polycystic ovary syndrome (PCOS), both of which directly impact reproductive health. Similarly, being underweight can also disrupt hormonal balance and ovarian function, leading to conditions such as PCOS or primary ovarian insufficiency, both of which can further hinder fertility (Legro *et al*., 2013; Urata *et al*., 2024). In men, obesity is associated with reduced sperm quality and hormonal imbalances, further compounding fertility challenges (Craig *et al*., 2019). Though this study shows no significant association between BMI and either FertiQol or sleep quality, previous studies suggest that by targeting weight management through lifestyle interventions, such as diet and physical activity, clinics may improve fertility outcomes for overweight and obese patients (Campbell *et al*., 2020).

Variations of sleep quality among the participants were reported, with the majority of them reported to have good sleep quality, which was similar to findings by Reisi *et al*. (2023). Contradicting the findings of Philipsen *et al*. (2022), where 91.1% of couples undergoing IVF or ICSI reported poor sleep quality. The discrepancy could be attributed to differences in stress levels, cultural factors, and the type of fertility treatments participants were undergoing. Notably, the Danish study by Philipsen *et al*. (2022) focused on couples undergoing intense fertility treatments, which might have increased their stress levels and negatively impacted their sleep.

The mean PSQI scores obtained in the study suggest that the infertile couples were experiencing relatively good sleep, possibly due to effective coping strategies or a strong support system. However, the link between BMI and sleep quality shows no significant association in the study. Contradictory to previous studies that mentioned the correlation between higher BMI and poorer sleep quality, it suggests a bidirectional relationship where obesity can impair sleep, and poor sleep, in turn, can exacerbate weight gain (Kristicevic *et al*., 2018). These factors could affect fertility outcomes, highlighting the need for interventions aimed at improving both sleep and BMI among infertile couples (Fry & Rehman, 2022).

The quality of life among infertile couples is a key focus of this study, and the results indicate that most participants reported relatively high FertiQoL scores, with the emotional subscale scoring the lowest. This is consistent with previous research that found that emotional distress is a major concern among infertile couples (Yang *et al.*, 2023). The emotional toll of infertility is often linked to anxiety, stress, and feelings of inadequacy, which can severely impact an individual's mental health (Pedro *et al*., 2021).

The findings also align with Dourou *et al*. (2023), who reported low emotional subscale scores among infertile couples, indicating that emotional well-being remains a critical aspect of quality of life in this population. However, unlike some studies, such as Ogboghodo *et al*. (2020), this study did not find significant gender differences in quality of life. This could be due to differences in the sample population, cultural contexts, or the availability of support systems, which may have contributed to more equitable experiences of infertility among men and women in this study. The current study found that participants reported similarly positive physical and cognitive perceptions, both of which are part of the mind-body domain. According to Szigeti *et al*. (2024), these findings are consistent with previous research that emphasises the importance of addressing both mental and physical health in order to improve outcomes for individuals facing infertility.

The relationship between BMI, sleep quality, and quality of life is complex, and previous studies stated that higher BMI and poor sleep quality can contribute to emotional distress, reducing overall quality of life (Nariya & Khatri, 2021). Muniandy and Yi Ying (2021) further mentioned the need to address both physical

and emotional health, as it is crucial in ensuring comprehensive infertility care. Previous findings underscore the importance of a holistic approach to infertility treatment where effective interventions targeting areas such as psychological counselling, lifestyle modifications, and stress management techniques are essential to improve the well-being of infertile couples (Ariffin, Daud & Ismail, 2017; Armah *et al*., 2022). Healthcare providers, especially nurses, should integrate lifestyle interventions, psychological support, and personalised care into their treatment protocols to ensure that both the physical and emotional needs of infertile couples are met (Gameiro *et al*., 2017).

Recommendation

This study emphasises the need to integrate BMI, sleep quality, and quality of life assessments into nursing care for infertile couples. Nurses should collaborate with other healthcare professionals to provide comprehensive, personalised care. Psychologists can examine the psychological impact of infertility and how mental health support can enhance fertility outcomes. Nutritionists can explore how diet and nutritional interventions influence BMI and reproductive health. Physicians, particularly those specialising in reproductive health, should investigate how medical treatments interact with lifestyle factors such as sleep and stress. Further research from these professionals will improve the understanding of how these factors work together and inform more effective, multi-disciplinary care strategies for infertile couples. Tailored interventions, such as weight management programs, sleep hygiene education, and emotional support, should be developed based on individual needs. Patient education, along with behavioural techniques like motivational interviewing, can help couples make informed lifestyle choices. Routine screenings for BMI, sleep quality, and quality of life should be implemented in infertility clinics, with ongoing support to address challenges over time and improve overall well-being.

Limitation

The study includes a small and homogeneous sample size, which limits the generalisability of the findings. Additionally, reliance on self-reported data for BMI and sleep quality introduces potential biases, and the cross-sectional design limits the ability to draw causal inferences. The measurement tools may lack sensitivity, and confounding factors such as diet, exercise, and smoking complicate the attribution of the results to BMI and sleep quality. Moreover, cultural and socioeconomic factors were not fully accounted for. Variability in fertility treatments and gender-specific responses adds complexity, making it harder to interpret the results. Future studies should involve more diverse populations and focus on long-term effects and educational interventions.

CONCLUSION

This study explores the complex interplay between BMI, sleep quality, and fertility-related quality of life (FertiQoL) among infertile couples. While high BMI is linked to fertility challenges, no significant associations were found between BMI, sleep quality, and FertiQoL in this sample. Sleep quality was generally good, but no clear connection to BMI emerged, contrary to previous studies. Emotional well-being remains a major concern, underscoring the need for targeted interventions addressing both physical and emotional health. A comprehensive approach, including lifestyle modifications and psychological support, is crucial for improving fertility outcomes and overall well-being in infertile couples. Future studies should examine long-term trends, the effectiveness of interventions, diverse populations, underlying mechanisms, technological advancements, and policy impacts to better understand and support these couples.

Conflict of Interest

The authors declare that they have no competing interest.

ACKNOWLEDGEMENT

This study was funded by Universiti Teknologi MARA, Malaysia internal grant, 600-RMC/KEPU 5/3 (006/2023). The authors extend their gratitude to all participants who agreed to take part in this study and also thank the authorities of the youth centres for permitting to collect data on their premises.

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