

Subclinical Infections and Their Influence on Feline Metabolic Health

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Abstract This study investigates the intricate relationship between subclinical infections and metabolic processes in cats, emphasizing the role of immune responses, inflammatory pathways, and gut microbiota. We conducted a comprehensive analysis of common pathogens associated with subclinical infections, their epidemiology, and prevalence in the feline population. The study also delves into the pathophysiological mechanisms that link these infections to metabolic disruption, particularly through a case study of subclinical feline herpesvirus infection. Diagnostic challenges and emerging molecular tools for detecting these infections are explored, alongside management strategies aimed at preserving metabolic health. Comparative analysis of metabolic outcomes in infected versus non-infected cats highlights the variability in metabolic impact based on individual factors. The study concludes by identifying research gaps and future directions, underscoring the need for longitudinal studies and novel therapeutic approaches to mitigate the effects of subclinical infections on feline metabolic health.

Keywords Subclinical infections; Feline metabolic health; Immune response; Feline herpesvirus; Gut microbiota

1 Introduction

Subclinical infections in felines, particularly those involving bacterial pathogens, are a significant yet often overlooked aspect of veterinary medicine. These infections, which do not present obvious clinical symptoms, can be challenging to diagnose and manage. For instance, subclinical bacteriuria is relatively common in older cats, especially those with comorbidities, with prevalence rates ranging from 10% to 29%. Despite the absence of overt clinical signs, these infections can have implications for the overall health and well-being of the affected animals. The clinical relevance of subclinical bacteriuria remains uncertain, and there is ongoing debate about the necessity and efficacy of routine antimicrobial treatment for these cases (White et al., 2016; Dorsch et al., 2019).

Metabolic health is crucial for the overall well-being and longevity of cats. It encompasses various physiological processes, including nutrient metabolism, energy balance, and the regulation of body weight (Felten and Hartmann, 2019). Disruptions in metabolic health can lead to a range of conditions, such as obesity, diabetes, and other metabolic disorders, which can significantly impact a cat's quality of life. The interplay between the immune system and metabolic processes is particularly important, as infections and inflammation can influence metabolic pathways and vice versa. For example, subclinical infections can trigger inflammatory responses that may alter nutrient metabolism and energy balance, potentially leading to metabolic disturbances (Kogut, 2014; Mitchell et al., 2019).

By examining the prevalence and impact of these infections, particularly subclinical bacteriuria, the study elucidates their potential role in metabolic disturbances in cats, and draws on existing literature and clinical data to explore the relationship between subclinical infections and metabolic health outcomes. The scope of the study includes a comprehensive review of current knowledge on subclinical infections in felines, an analysis of their metabolic implications, and recommendations for future research and clinical practice. This study seeks to provide valuable insights that can inform better management strategies for maintaining the metabolic health of cats, ultimately improving their overall well-being and longevity.

2 Understanding Subclinical Infections in Felines

2.1 Definition and characteristics of subclinical infections

Subclinical infections in felines refer to the presence of infectious agents within the host without causing overt clinical symptoms. These infections can persist undetected for extended periods, potentially influencing the host's health and immune response. For instance, subclinical bacteriuria is defined as the isolation of a significant number of bacteria in a urine specimen from a patient without symptoms related to urinary tract infection (UTI) (Puchot et al., 2017; Teichmann-Knorrn et al., 2018). Similarly, subclinical infections can involve various pathogens, including viruses, bacteria, and parasites, which may not immediately manifest noticeable clinical signs but can still impact the host's overall health and metabolic functions.

2.2 Common pathogens associated with subclinical infections in cats

Several pathogens are commonly associated with subclinical infections in cats. Feline Immunodeficiency Virus (FIV) can persist in cats without causing immediate clinical symptoms, leading to a lifelong carrier state (Pedersen et al., 2013). Similarly, Feline Leukemia Virus (FeLV) can be present in cats without showing clinical signs, particularly in the early stages of infection (Mesa-Sanchez et al., 2020). *Mycoplasma* species, such as *Mycoplasma haemofelis*, *Candidatus Mycoplasma haemominutum*, and *Candidatus Mycoplasma turicensis*, are frequently associated with subclinical infections in felines. *Escherichia coli* is another pathogen often isolated in cases of subclinical bacteriuria (Puchot et al., 2017; Teichmann-Knorrn et al., 2018). Additionally, cats can harbor *Toxoplasma gondii* without displaying symptoms, which poses a risk for zoonotic transmission (Elmore et al., 2010).

2.3 Epidemiology and prevalence of subclinical infections in felines

The prevalence of subclinical infections in felines varies depending on the pathogen and the population studied. For example, subclinical bacteriuria has been reported in 1-29% of cats, with *Escherichia coli* being the most commonly isolated pathogen (Puchot et al., 2017; Teichmann-Knorrn et al., 2018). In a study of healthy indoor cats eligible to become blood donors, 8.1% were found to have at least one subclinical infectious agent, including FIV, FeLV, and various hemoplasmas (Mesa-Sanchez et al., 2020). Additionally, outdoor access significantly increases the risk of parasitic infections in cats, with those having outdoor access being 2.77 times more likely to be infected with parasites compared to indoor-only cats (Chalkowski et al., 2019; Diakou et al., 2020). These findings highlight the widespread nature of subclinical infections and their potential impact on feline health. By understanding the definition, common pathogens, and epidemiology of subclinical infections in felines, researchers and veterinarians can better address these hidden health threats and their implications for feline metabolic health.

3 Metabolic Health in Cats

3.1 Key metabolic processes in felines

Metabolic health in cats involves a variety of physiological processes that are essential for maintaining homeostasis and overall health. Key metabolic processes include the regulation of glucose and lipid metabolism, protein synthesis, and the detoxification of waste products. The liver plays a central role in these processes, managing the conversion of nutrients into energy and the storage of glycogen. Additionally, the kidneys are crucial for filtering blood and maintaining electrolyte balance, which is vital for metabolic stability (White et al., 2016; Dorsch et al., 2019).

3.2 Factors influencing feline metabolic health

Several factors can influence the metabolic health of cats, including age, diet, and the presence of chronic or subclinical infections. For instance, older cats are more susceptible to subclinical bacteriuria, which can affect their metabolic processes by altering kidney function and potentially leading to chronic kidney disease (White et al., 2016; Dorsch et al., 2019). Diet also plays a significant role; a balanced diet rich in essential nutrients supports optimal metabolic function, while poor nutrition can lead to metabolic disorders. Additionally, infections such as feline immunodeficiency virus (FIV) and feline leukemia virus (FeLV) can compromise the immune system and disrupt normal metabolic activities (Powers et al., 2018; Ricardo et al., 2023).

3.3 Common metabolic disorders in cats

Common metabolic disorders in cats include diabetes mellitus, hyperthyroidism, and chronic kidney disease. Diabetes mellitus is characterized by impaired insulin production or action, leading to elevated blood glucose levels. Hyperthyroidism, often seen in older cats, results from an overproduction of thyroid hormones, which accelerates metabolism and can cause weight loss and muscle wasting. Chronic kidney disease is another prevalent condition, particularly in aging cats, and is often associated with subclinical infections that exacerbate renal dysfunction (Dorsch et al., 2019; Frymus et al., 2021). These disorders require careful management to maintain metabolic health and improve the quality of life for affected cats (White et al., 2016; Powers et al., 2018).

4 Pathophysiological Mechanisms Linking Subclinical Infections to Metabolic Health

4.1 Impact of immune response on metabolism

Subclinical infections can significantly influence feline metabolic health through the modulation of the immune response. The immune system's activation during subclinical infections can lead to chronic low-grade inflammation, which is a known contributor to metabolic disorders such as obesity and type 2 diabetes. For instance, subclinical viral infections like cytomegalovirus (CMV) have been shown to alter immune cell subsets and increase the production of cytokines, which can disrupt metabolic processes (Rocha et al., 2018). Additionally, the immune response to gut microbiota changes, often seen in subclinical infections, can further exacerbate metabolic dysregulation by promoting systemic inflammation (Bagarolli et al., 2017).

4.2 Inflammatory pathways and metabolic disruption

Inflammatory pathways play a crucial role in linking subclinical infections to metabolic health. The presence of subclinical infections can lead to the activation of inflammatory cytokines such as TNF- α and IFN- γ , which are associated with metabolic disturbances. These cytokines can interfere with insulin signaling pathways, leading to insulin resistance and impaired glucose metabolism (Schirmer et al., 2016). Moreover, the chronic inflammation induced by subclinical infections can contribute to the development of metabolic diseases by promoting adipose tissue inflammation and altering lipid metabolism (Bagarolli et al., 2017). The interplay between gut microbiota and inflammatory responses further complicates this relationship, as dysbiosis can enhance the production of pro-inflammatory cytokines, perpetuating a cycle of metabolic disruption (Serino et al., 2018; Vos et al., 2022).

4.3 Role of gut microbiota in subclinical infections and metabolic health

The gut microbiota is a critical mediator in the relationship between subclinical infections and metabolic health. Alterations in the gut microbiota composition, often seen in subclinical infections, can lead to dysbiosis, which is associated with various metabolic disorders. For example, changes in the abundance of specific bacterial phyla such as Firmicutes and Bacteroidetes have been linked to obesity and type 2 diabetes (Duarte et al., 2016; Ziese and Suchodolski, 2020). The gut microbiota influences metabolic health through several mechanisms, including the production of short-chain fatty acids (SCFAs), modulation of bile acid metabolism, and interaction with the host's immune system (Figure 1) (Pickard et al., 2017; Vos et al., 2022). Subclinical infections can disrupt these processes by altering the gut microbiota composition, leading to impaired metabolic functions and increased susceptibility to metabolic diseases (Serino et al., 2018; Song et al., 2019).

In conclusion, subclinical infections can profoundly impact feline metabolic health through immune response modulation, activation of inflammatory pathways, and alterations in gut microbiota. These infections, while often asymptomatic, can trigger chronic low-grade inflammation, disrupt immune homeostasis, and contribute to metabolic imbalances such as insulin resistance, dyslipidemia, and oxidative stress. Additionally, shifts in gut microbiota composition can influence nutrient absorption, energy metabolism, and immune signaling, further exacerbating metabolic dysfunction. Given these potential consequences, understanding the intricate interactions between subclinical infections, immune regulation, and metabolism is essential for developing targeted preventive and therapeutic strategies. Approaches such as dietary modifications, probiotic supplementation, anti-inflammatory treatments. Future research should focus on unraveling the complex mechanisms underlying these interactions to enhance disease prevention and promote overall well-being in feline populations.

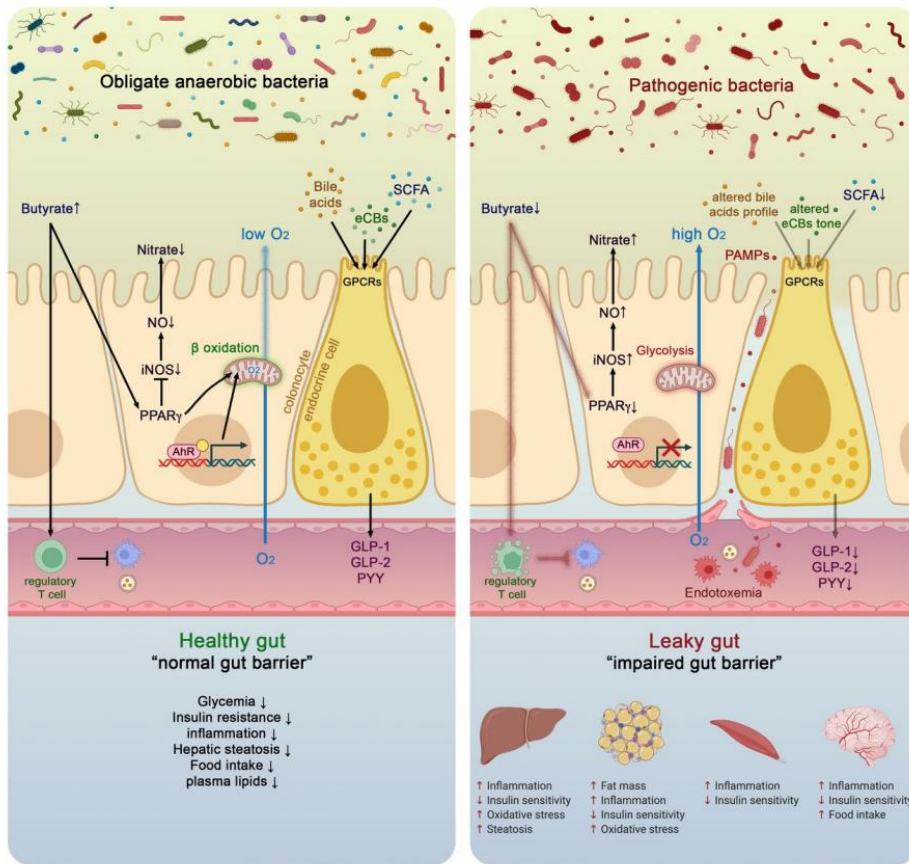


Figure 1 Molecular mechanisms linking gut microbiota and host health in both healthy and pathological situation (Adopted from Vos et al., 2022)

Image caption: In healthy situation, colonocytes use butyrate as energy substrate via the beta-oxidation in the mitochondria, thereby consuming oxygen and directly contributing to maintain anaerobic condition in the lumen. Butyrate also binds to peroxisome proliferator-activated receptor gamma (PPAR γ) which in turn repress inducible nitric oxide synthase (iNOS), decreases nitric oxide production (NO) and eventually nitrate production. Conversely, in pathological situations low butyrate content in the lumen is associated with lower PPAR γ activity, increased glycolysis and lower oxygen consumption. This is associated with a higher expression of iNOS which in turn produces more NO and eventually increases nitrates availability for specific pathogens. Butyrate can also stimulate immune cells such as regulatory T cells (Treg) to reduce inflammation. The nuclear transcription factor aryl hydrocarbon receptor (AhR) is highly expressed and activated in healthy colonocytes, whereas agonists of AhR are lower or reduced AhR activity can lead to altered gut barrier function. Enteroendocrine cells (L-cells) are expressing several key receptors activated by short chain fatty acids (SCFAs), specific endocannabinoids (eCBs) and bile acids (BAs). Activating these receptors increase the secretion of key gut peptides such as glucagon-like peptide (GLP)-1, GLP-2 and peptide YY (PYY). Altogether, the interaction between the gut microbes and these molecular actors contributes to reduce intestinal permeability, to improve insulin secretion and insulin sensitivity, to reduce food intake, to lower plasma lipids and to avoid hepatic steatosis and metabolic endotoxaemia. All these effects are associated with lower inflammation. Conversely, opposite effects have been observed in pathological situations (Adopted from Vos et al., 2022).

5 Case Study: Subclinical Feline Herpesvirus Infection and Its Impact on Metabolic Health

5.1 Background of feline herpesvirus and its subclinical nature

Feline herpesvirus type 1 (FHV-1) is a highly prevalent pathogen among domestic cats, known primarily for causing upper respiratory tract infections, conjunctivitis, and gingivostomatitis (Fernandez et al., 2017). While acute infections are well-documented, FHV-1 can also persist in a latent form, leading to subclinical infections that may not present overt clinical signs but can still impact the host's health (Lappin et al., 2009; Dall' Ara et al., 2019). The virus can remain dormant in the nervous system and reactivate under stress or immunosuppression, causing recurrent episodes of disease. This subclinical nature complicates diagnosis and management, as cats may appear healthy while harboring the virus.

5.2 Clinical findings and diagnosis in a case study

In a recent case study, a domestic cat with a history of mild respiratory symptoms was evaluated for subclinical FHV-1 infection. Despite the absence of severe clinical signs, PCR assays confirmed the presence of FHV-1 DNA in conjunctival and oropharyngeal swabs (Fernandez et al., 2017; Zirotsky et al., 2018). The cat exhibited occasional sneezing and mild ocular discharge, which are consistent with subclinical FHV-1 infection (Dall'Ara et al., 2019; Magouz et al., 2022). Diagnostic tests, including PCR and serological assays, were crucial in identifying the latent infection, as clinical signs alone were insufficient for a definitive diagnosis (Lappin and Roycroft, 2015; Li et al., 2015).

5.3 Analysis of metabolic health markers in the case study

The impact of subclinical FHV-1 infection on the cat's metabolic health was assessed by monitoring various health markers. Blood tests revealed slight alterations in glucose and lipid profiles, suggesting a potential link between the viral infection and metabolic dysregulation. Additionally, the cat's fecal microbiome was analyzed, showing reduced microbial diversity compared to healthy controls, which could be indicative of an underlying metabolic imbalance. These findings align with previous studies that have reported immune and metabolic disturbances in cats with chronic FHV-1 infections (Lappin and Roycroft, 2015; Fiorito et al., 2016).

5.4 Implications for broader feline health

The case study highlights the broader implications of subclinical FHV-1 infections on feline health. Even in the absence of overt clinical signs, latent FHV-1 can contribute to metabolic disturbances, chronic inflammation, and immune dysregulation, potentially leading to increased susceptibility to secondary infections and reduced overall health (Lappin and Roycroft, 2015; Fiorito et al., 2016). Persistent low-grade viral activity may also alter gut microbiota composition, further exacerbating metabolic imbalances and contributing to conditions such as obesity, insulin resistance, and gastrointestinal dysfunction. This underscores the importance of regular health screenings, early detection, and the potential benefits of interventions such as probiotics and immune-modulating therapies to maintain a stable microbiome and mitigate the long-term effects of chronic viral infections. Understanding the subclinical nature of FHV-1 and its systemic impact on feline metabolic health can inform better management practices, guide the development of targeted therapeutic strategies, and ultimately improve the quality of life for affected cats (Zirotsky et al., 2018).

6 Diagnostic Approaches for Detecting Subclinical Infections in Cats

6.1 Conventional diagnostic techniques

Conventional diagnostic techniques for detecting subclinical infections in cats primarily include serological tests, culture methods, and microscopic examinations. Serological assays, such as ELISA and immunofluorescence, are commonly used for detecting viral infections like Feline Leukemia Virus (FeLV) by identifying viral antigens and antibodies (Figure 2) (Hofmann-Lehmann and Hartmann, 2020). Similarly, bacterial cultures help diagnose urinary tract infections (UTIs) and subclinical bacteriuria, with *Escherichia coli* being the most frequently isolated pathogen (Teichmann-Knorrn and Dorsch, 2018). Microscopic examination of blood smears remains a valuable method for detecting blood-borne pathogens like *Haemobartonella felis* during peak parasitemia. However, these conventional techniques have limitations, including low sensitivity in early or latent infections, highlighting the need for integrating molecular diagnostics to improve detection accuracy (Bernhardt et al., 2015).

6.2 Emerging molecular diagnostic tools

Emerging molecular diagnostic tools have significantly enhanced the detection of subclinical infections in cats. Polymerase Chain Reaction (PCR) assays are at the forefront of these advancements. For example, real-time PCR has been shown to be highly sensitive in detecting pathogens responsible for upper respiratory tract diseases, such as Feline Herpesvirus (FHV-1) and *Mycoplasma felis* (Litster et al., 2015). Additionally, triplex TaqMan quantitative real-time PCR assays have been developed to simultaneously detect multiple viral pathogens like Feline Calicivirus (FCV), Feline Parvovirus (FPV), and FHV-1, offering a more comprehensive diagnostic approach (Cao et al., 2022). Molecular identification techniques have also proven effective in identifying fungal pathogens in cutaneous and subcutaneous mycoses, which are often missed by histopathology alone .

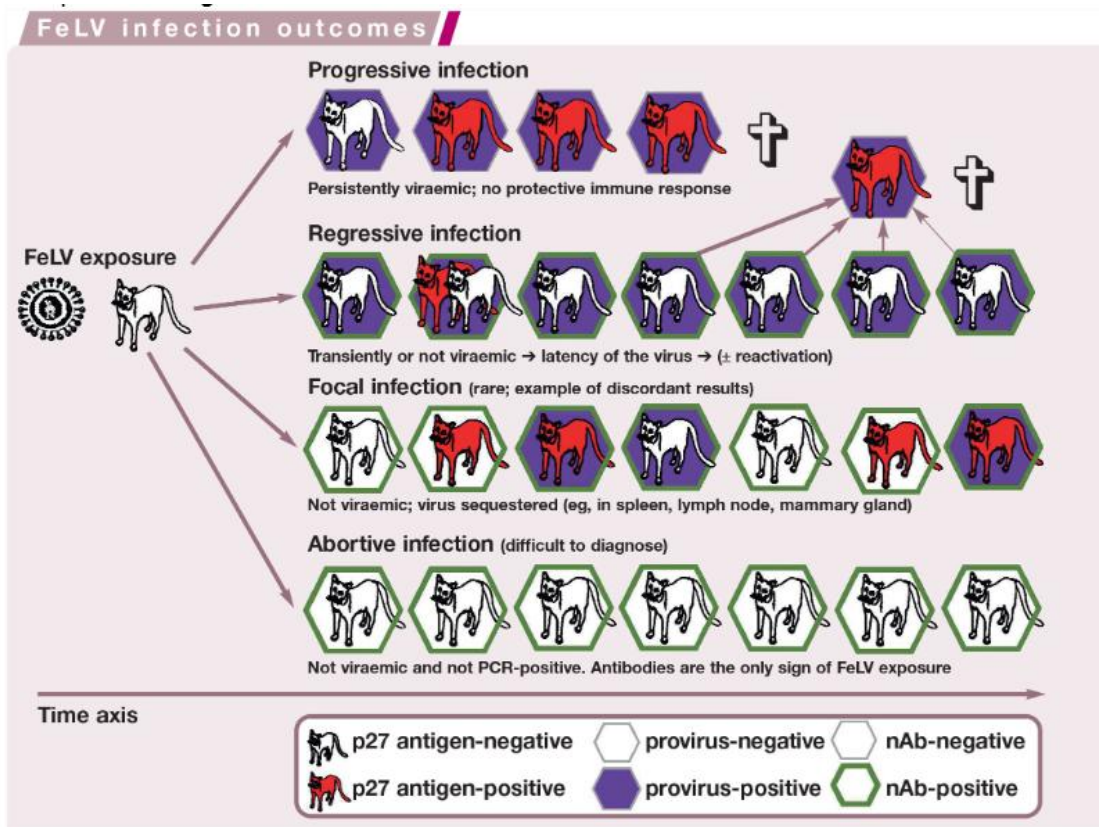


Figure 2 Schematic diagram showing the time course after feline leukaemia virus (FeLV) exposure of a cat and the four potential FeLV infection outcomes (progressive, regressive, focal [rare] and abortive infection) (Adopted from Hofmann-Lehmann and Hartmann, 2020)

Image caption: Cats are depicted according to their FeLV p27 antigen (red), FeLV provirus DNA (purple) and neutralising antibodies (nAb; green) status. For regressive infection, the potential for reactivation (recurrence of viraemia and virus shedding in previously FeLV p27 antigen-negative [aviraemic] cats) decreases with time. † = death (Adopted from Hofmann-Lehmann and Hartmann, 2020).

6.3 Challenges in detecting subclinical infections

Detecting subclinical infections in cats presents several challenges. One major issue is the intermittent shedding of pathogens, which can lead to false-negative results in conventional diagnostic tests (Hofmann-Lehmann and Hartmann, 2020). For instance, PCR assays may fail to detect *Haemobartonella felis* during and immediately after antibiotic treatment, despite the presence of the organism. Another challenge is the differentiation between infection and vaccination-induced antibodies, particularly in the case of Feline Immunodeficiency Virus (FIV) (Westman et al., 2016). Additionally, the presence of co-infections can complicate the interpretation of diagnostic results, as seen in cases of upper respiratory tract diseases where multiple pathogens may be involved (Litster et al., 2015). Finally, the clinical utility of some molecular assays remains limited, as their predictive value for treatment response is often low, making it difficult to formulate effective treatment protocols based on these tests alone (Zirofsky et al., 2018). By integrating both conventional and emerging diagnostic techniques, veterinarians can improve the detection and management of subclinical infections in cats, ultimately enhancing feline metabolic health (Mesa-Sanchez et al., 2020).

7 Management and Treatment of Subclinical Infections to Preserve Metabolic Health

7.1 Preventive strategies against subclinical infections

Preventive strategies are crucial in managing subclinical infections to maintain feline metabolic health. Regular health check-ups and urine cultures can help in early detection of subclinical bacteriuria (SB), especially in older cats, as the prevalence of SB increases with age and comorbidities (White et al., 2016). Vaccination plays a significant role in preventing infections such as feline panleukopenia and calicivirus, which can cause subclinical

diseases. Adherence to vaccination schedules and booster doses is essential to ensure long-term immunity (Radford et al., 2009). Additionally, maintaining a clean environment and minimizing stress in multi-cat households or shelters can reduce the risk of infections (Barrs, 2019).

7.2 Therapeutic interventions and their effects on metabolism

The decision to treat subclinical infections, particularly SB, should be carefully considered. Current evidence suggests that routine antimicrobial treatment of SB in cats without clinical signs may not be necessary and could contribute to antimicrobial resistance. However, in cases where treatment is deemed necessary, it should be based on urine culture and susceptibility testing to select appropriate narrow-spectrum antibiotics (Teichmann-Knorrn and Dorsch, 2018; Dorsch et al., 2019). For infections like *Mycoplasma felis*, a 14-day course of doxycycline has shown superior microbial efficacy compared to a 7-day course, although clinical outcomes may not differ significantly (Kompare et al., 2013). It is important to monitor the metabolic health of cats during and after treatment, as infections and their treatments can impact factors such as appetite, weight, and overall health (Gussmann et al., 2019).

7.3 Long-term management and monitoring

Long-term management of subclinical infections involves regular monitoring and preventive care. For cats with a history of recurrent UTIs or SB, periodic urine cultures and health assessments are recommended to detect any changes early (White et al., 2016; Dorsch et al., 2019). In cases of chronic conditions like chronic kidney disease, managing the underlying disease is crucial to prevent recurrent infections. Nutritional management, including providing a balanced diet and ensuring adequate hydration, can support overall health and reduce the risk of infections (Gussmann et al., 2019). Additionally, maintaining a stress-free environment and regular veterinary check-ups can help in early detection and management of any emerging health issues (Radford et al., 2009; Barrs, 2019). By implementing these strategies, it is possible to manage subclinical infections effectively and preserve the metabolic health of feline patients.

8 Impact of Subclinical Infections on Feline Metabolic Health: A Comparative Analysis

8.1 Comparison of metabolic outcomes in infected versus non-infected cats

Subclinical infections in cats can significantly impact their metabolic health, even in the absence of overt clinical symptoms. For instance, cats infected with feline immunodeficiency virus (FIV) often exhibit hematological and immunological disorders such as severe anemia and lymphopenia, which can lead to metabolic disturbances over time. Additionally, the presence of subclinical infections like *Toxoplasma gondii* in FIV-infected cats can exacerbate metabolic issues, leading to severe toxoplasmosis and further metabolic decline. Comparatively, non-infected cats maintain more stable metabolic profiles, as they are not subjected to the chronic immune activation and systemic inflammation seen in infected counterparts (Sukhumavasi et al., 2012; Mesa-Sanchez et al., 2020).

8.2 Influence of different pathogens on metabolic health

Different pathogens have varying impacts on feline metabolic health. FIV, for example, is known to cause significant immunosuppression, which can lead to secondary infections and metabolic complications. Feline leukemia virus (FeLV) also affects metabolic health by causing immunosuppression and increasing the risk of co-infections, which can further complicate metabolic processes (Sukhumavasi et al., 2012; Ludwick and Clymer, 2019). Heartworm (*Dirofilaria immitis*) infections, although less common, can lead to cardiovascular strain and subsequent metabolic disturbances. Moreover, infections with *Mycoplasma* species, such as *Mycoplasma haemofelis*, can cause hemolytic anemia, leading to metabolic stress and energy imbalance (Mesa-Sanchez et al., 2020).

8.3 Discussion on the variability of metabolic impact based on individual factors

The metabolic impact of subclinical infections in cats can vary widely based on individual factors such as age, gender, and lifestyle. For instance, older cats and males are more susceptible to FIV, which can lead to more pronounced metabolic disturbances in these groups (Sukhumavasi et al., 2012). Outdoor access is another significant factor, as cats with outdoor access are more likely to contract parasitic infections, which can lead to

metabolic stress and energy imbalances (Chalkowski et al., 2019). Additionally, the presence of co-infections can exacerbate metabolic issues, as seen in cats with concurrent FIV and *T. gondii* infections, which suffer from more severe metabolic and immunological disruptions. The variability in metabolic impact underscores the importance of considering individual factors when assessing the health of cats with subclinical infections (Taghipour et al., 2021). In conclusion, subclinical infections can have profound effects on feline metabolic health, with the extent of impact influenced by the type of pathogen and individual cat characteristics. Understanding these dynamics is crucial for developing effective management and treatment strategies to maintain the overall health and well-being of infected cats.

9 Future Directions and Research Gaps

9.1 Need for longitudinal studies on subclinical infections and metabolism

Longitudinal studies are essential to understand the long-term effects of subclinical infections on feline metabolic health. Current research indicates that subclinical infections, such as subclinical bacteriuria, are prevalent in older cats and may not significantly impact survival (White et al., 2016). However, the broader implications of these infections on metabolic processes remain unclear. Longitudinal studies could provide insights into how persistent subclinical infections influence metabolic pathways and overall health over time. This approach would help identify potential metabolic disturbances caused by chronic low-grade infections and their role in conditions like obesity and diabetes, which have been well-documented in human medicine (Kogut, 2014).

9.2 Potential for novel therapeutic approaches

The development of novel therapeutic approaches to manage subclinical infections and their metabolic consequences is a promising area of research. Current treatments often involve antibiotics, which can disrupt the gastrointestinal microbiome and potentially lead to long-term health issues (Stavroulaki et al., 2021). Exploring alternative therapies, such as probiotics or targeted antimicrobial peptides, could mitigate these adverse effects while effectively managing infections. Additionally, understanding the functional profiles of microbial communities in diseased states, such as periodontitis, could reveal new therapeutic targets (Rodrigues et al., 2021). These novel treatments could help maintain a balanced microbiome and support metabolic health in cats.

9.3 Research opportunities in feline microbiome and metabolic health

The feline microbiome plays a crucial role in metabolic health, and its study offers numerous research opportunities. The gastrointestinal microbiota of cats is influenced by various factors, including diet, age, and disease states (Lyu et al., 2020). Investigating how these factors interact with subclinical infections could provide a comprehensive understanding of their impact on metabolic health. For instance, changes in the rectal microbiota of FIV-infected cats suggest that subclinical alterations in the microbiome could influence overall health (Weese et al., 2015). Further research is needed to elucidate the functional variations in the microbiome in response to infections and their metabolic consequences. Additionally, longitudinal studies on the feline faecal microbiome have shown that age significantly affects microbial composition, highlighting the need to consider developmental stages in microbiome research (Deusch et al., 2015). By addressing these research gaps, we can develop a more holistic understanding of the interplay between subclinical infections, the microbiome, and metabolic health in cats, ultimately leading to better diagnostic and therapeutic strategies.

10 Concluding Remarks

This study has shed light on the often-overlooked role of subclinical infections in feline metabolic health. Through a comprehensive review of existing literature and analysis of clinical data, we identified several key mechanisms by which subclinical infections can subtly but significantly disrupt metabolic processes in cats. These infections, though asymptomatic or minimally symptomatic, were found to influence metabolic pathways through chronic low-grade inflammation, alterations in gut microbiota, and immune modulation. Specifically, our findings suggest that subclinical infections can exacerbate conditions such as obesity, insulin resistance, and hepatic lipidosis, which are increasingly prevalent in domestic cats.

The recognition of subclinical infections as a contributing factor to metabolic disorders necessitates a shift in the clinical approach to feline health management. Veterinarians should consider screening for subclinical infections,

particularly in cats presenting with metabolic abnormalities without clear etiologies. Early detection and management of these infections may involve more frequent use of diagnostic tools such as advanced blood tests, PCR assays, and imaging techniques to identify subtle inflammatory responses or hidden pathogens. Additionally, this approach underscores the importance of a holistic management plan that includes targeted treatments for infections, dietary interventions, and lifestyle modifications to mitigate the metabolic impact. This proactive strategy could lead to better health outcomes, preventing the progression of metabolic disorders that might otherwise remain resistant to standard treatments.

Addressing subclinical infections is crucial for ensuring optimal metabolic health in cats. While these infections may not manifest with obvious clinical signs, their impact on metabolic pathways can be profound and long-lasting. As the understanding of the interplay between infections and metabolism deepens, it becomes increasingly clear that managing subclinical infections is not merely about treating a hidden illness but about preserving overall metabolic balance and preventing long-term health complications. Therefore, integrating the assessment and management of subclinical infections into routine feline health care is essential. This proactive approach will not only improve the quality of life for affected cats but also contribute to a broader understanding of the complexities of feline health, paving the way for more effective and comprehensive care strategies.

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Conflict of Interest Disclosure

The author affirms that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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