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EFFECT OF OMEGA-3 FATTY ACID SUPPLEMENTATION ON INFLAMMATORY MARKERS IN DOGS WITH ATOPIC DERMATITIS

BY

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Abstract

The present study investigates the effects of omega-3 fatty acid supplementation on inflammatory markers in dogs diagnosed with atopic dermatitis (AD). A total of 30 dogs with clinical signs compatible with AD were identified for the study and randomised to either a control group (n = 15) or a treatment group (n = 15) that received omega-3 fatty acids (EPA and DHA) for 8 weeks. Inflammatory markers included interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and C-reactive protein (CRP), measuring before and after supplementation with omega-3 fatty acids. The data suggested a significant reduction in the inflammatory markers in the treatment group compared to the control group. Based on these results, omega-3 fatty acids may play a role in the modulation of EM in dogs diagnosed with AD.

Keywords: Atopic dermatitis, IL-6, TNF-α, CRP, Canine

1. Introduction

Atopic dermatitis (AD) is a chronic, inflammatory skin disease previously described in dogs as characterized by pruritus, erythema and secondary infections where the environmental allergens play a significant role [1]. While there is likely both a genetic and environmental polygenic component in ad atopic disease a long a common genetic background, and AD is the product of immune dysregulation and inability to limit the release of pro-inflammatory cytokines including IL-6, TNF-α, as well as CRP which will activate its inflammatory cascade via the release of other pro-inflammatory cytokines, chemokines and cytokines. Furthermore recently it has been demonstrated that omega-3 fatty acids especially eicopsapentaenoic acid (EPA) and docosahexaenoic acid (DHA) networks have significant anti-inflammatory ability and could play a significant role in treatment of chronic inflammatory diseased states. [2].

As to the immune-mediated nature of AD, it appears that using a therapy that targets the inflammatory cascade would clearly have significant advantages over utilizing a single inflammatory marker addressed with an anti-inflammatory agent. However send fundamentals include the understanding that omega-3 fatty acids including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are unsaturated fatty acids with a long history documented anti-inflammatory actions. An omega-3 fatty acid regulates immune systems function by inhibition occurs as a result of regulating eicosanoid release from membrane phospholipids and inhibition of pro-inflammatory cytokines, chemokines factor or chemotactic molecules. [4].

There are numerous studies documenting that omega-3 fatty acid benefits in inflammation which apply to humans as well as veterinary medicine [5]. Several previous ex veterinary studies documented evidence that omega-3s can be helpful in the treatment of inflammation skin diseases, especially drug or owner related allergies and suggested that omega-3s may improve systemic inflammation and consequently severity relating to pruritus, erythema and the severity of lesions/clinical outcomes. [6,7].

Although the literature supports the premise of omega-3 fatty acids as a potential anti-inflammatory source in AD, very few studies specifically investigating or measuring the impacts of omega-3 supplementation in inflammatory related markers in AD patients. This study aims to address some of the gaps in the literature by determining if omega-3 supplementation has any impact on inflammatory markers IL-6, TNF-α and CRP levels in dogs diagnosed with AD, and if so - does a reduction in inflammatory markers correspond with clinical improvement in dogs diseases state and/or clinical signs of pruritus, erythema and otitis and overall skin quality.

2. Materials and Methods

Study Design

A private veterinary clinic in Baghdad was the site of a randomised controlled study. The study included thirty

client-owned dogs having a history of pruritus and clinical symptoms of atopic dermatitis. The dogs were divided into two groups at random: one that received omega-3 fatty acid supplements as a therapy, and the other that received a placebo.

Inclusion Criteria

- Dogs aged 1–7 years.
- Clinical diagnosis of AD.
- No systemic or dermatologic diseases other than AD.
- Not on corticosteroids or immunosuppressive medications for at least 4 weeks before the study.

Intervention

- **Treatment Group**: 15 dogs received 1000 mg of omega-3 fatty acids (EPA 600 mg, DHA 400 mg) per 10 kg body weight daily for 8 weeks.
- **Control Group**: 15 dogs received a placebo (maltodextrin) in the same dose form and frequency.
- Permissions were obtained from all clients.

Outcome Measures

- **Primary Outcome**: Blood samples were collected without anesthesia from all animals using tubes without anticoagulants for serum isolation. Serum levels of IL-6, TNF-α, and CRP were measured at baseline (week 0) and after 8 weeks of supplementation. IL-6 and TNF- α were measured using kits purchased from Mybiosource, and measuring methods were done according to company instructions.
- **Secondary Outcome**: Clinical improvement was assessed using the Canine Atopic Dermatitis Extent and Severity Index (CADESI).The **Canine Atopic Dermatitis Extent and Severity Index (CADESI)** is a widely used scoring system to evaluate dogs' clinical signs of atopic dermatitis (AD). This system comprehensively assesseslesions' extent and symptoms' severity, including pruritus, erythema, and other inflammatory features. Each region is scored on a scale of 0 to 4 based on the percentage of involvement:

0 = No involvement
1 = Less than 10% of the region affected
2 = 10% to 30% of the region affected
3 = 31% to 50% of the region affected
4 = More than 50% of the region affected

3. Results

Demographics

- Both groups were comparable in age, breed, and severity of clinical signs of AD at baseline.
- No significant differences were found between the groups' baseline serum levels of IL-6, TNF-α, or CRP.

Inflammatory Marker Reduction

Table 1 summarizes the changes in inflammatory markers from baseline to week 8.

Inflammatory Marker	Baseline (Mean ± SD)	Week 8 (Mean ± SD)	p-Value (Treatment)	p-Value (Control)
IL-6 (pg/mL)	45.6 ± 5.2	18.7 ± 4.3	< 0.01	0.12
TNF-α (pg/mL)	38.3 ± 3.4	21.2 ± 3.9	< 0.01	0.23
CRP (mg/L)	16.5 ± 2.3	7.4 ± 1.5	< 0.01	0.19

Interpretation:

- In the treatment group, there was a significant reduction in IL-6 ($p < 0.01$), TNF-α ($p < 0.01$), and CRP ($p < 0.01$) levels after 8 weeks of omega-3 supplementation.
- The control group showed no significant changes in any inflammatory markers ($p > 0.05$ for all).

Clinical Improvement

Table 2 presents the clinical improvement based on the CADESI score.

Group	Baseline (Mean ± SD)	Week 8 (Mean ± SD)	p-Value
Treatment	30.2 ± 5.1	15.6 ± 4.2	< 0.01
Control	29.8 ± 4.9	27.4 ± 5.1	0.08

Interpretation:

- The treatment group showed a significant reduction in CADESI scores ($p < 0.01$), indicating a noticeable improvement in clinical symptoms, including reduced pruritus and erythema.

No significant improvement was observed in the control group ($p = 0.08$).

4. Discussion

The current study demonstrates that omega-3 fatty acid supplementation results in a significant reduction in inflammatory markers, TNF-α, IL-6, as well as CRP, in dogs with atopic dermatitis. The results tell us that omega-3 fatty acids can modulate the immune response in AD by decreasing the mediators of inflammation (pro-inflammatory cytokines and acute-phase reactants). The clinical improvement in the treatment group, as measured by the CADESI score, supports the anti-inflammatory effects observed in this study. Decreases in clinical signs, such as pruritus, erythema, etc., corroborate the decrease in systemic inflammatory markers. Our results are backed by previous studies indicating omega-3 are an important component in control of animal allergic disease [9].

The lack of statistical significance in inflammatory markers or clinical signs in the control group indicates that omega-3 supplementation offers significant benefits compared to placebo treatment for chronic inflammatory diseases like AD.

Overall, the findings from this present study provide convincing evidence that omega-3 fatty acids are beneficial for the management of atopic dermatitis in dogs [10]. Omega-3 fatty acid supplementation resulted in a significant reduction in inflammatory markers (IL-6, TNF-α, CRP) which are considered important mediators of the inflammatory process in AD [11]. The decrease in systemic inflammation was reflected by the notable decreases we observed in clinical signs of the disease (as measured using the CADESI).The findings indicate that omega-3 fatty acids can impact the immune response and the clinical aspects of AD in dogs [12].

Regulation of the production of eicosanoids is the most likely mechanism for omega-3 fatty acids' anti-inflammatory actions. Prostaglandins E3 (PGE3) and resolvins, anti-inflammatory eicosanoids that inhibit program-induced pro-inflammatory eicosanoids produced by omega-6 fatty acids, are derived from omega-3 fatty acids, including EPA and DHA [13]. Hence, by integrating omega-3 fatty acids into the cell membrane phospholipids, omega-3s modulate the eicosanoid balance, ultimately leading to less inflammation. The changes in the resolution of the inflammatory cascade seen in the decline in IL-6, TNF-α, and CRP levels demonstrates their vital role in AD pathophysiology [14,15].

The important clinical impacts noted in the study highlight the potential for omega-3 supplementation to have therapeutic value [16]. The reductions in pruritus, erythema, and overall lesion severity is in agreement with other studies that demonstrated clinical benefits from omega-3 supplementation in the management of allergic skin diseases in dogs [17]. As previously described, the CADESI score and outcome measures include pruritus and lesion severity, which had a significant decline for the treatment group. This indicates that omega-3 fatty acids have a positive impact on the management of the disease [18].

While the results of the study are promising, there are limitations to reflect upon. The duration of the supplementation (8 weeks) was relatively short, and thus, future studies should study the long-term effects and evaluate the sustainability of the changes noted in the study. Although we did not explore the potential adjuvant effects of omega-3 supplementation with other treatment modalities that are employed for AD, such as corticosteroids or antihistamines, this very important component of future study will provide a more comprehensive therapeutic approach.

The study also did not investigate the effect of an omega-3 supplementation at difference dosages or the effects of omega-3 supplementation on particular breeds or subtypes of atopic dermatitis. Future studies should focus on the consequence of these variables to enhance treatment regimens and see if certain breeds will have a greater response to omega-3 supplementation.

6. Conclusion

The findings from this study support the use of omega-3 fatty acid supplements for use as an adjunctive therapy for canine allergenic dermatitis. Omega-3 fatty acids could represent a fairly effective supplemental therapy option to address an immune-mediated chronic skin condition. Omega-3 fatty acids have been shown to reduce the clinical signs of atopic dermatitis in dogs, and reduce inflammatory marker levels. Given the increased interest in alternative and adjunctive therapies for atopic dermatitis, veterinarians who treat animals with inflammatory skin diseases may recognize omega-3 fatty acids as a potential therapy option. To maximize the benefits of omega-3 fatty acids in dogs with allergic dermatitis, further studies need to be done to establish the optimal dose, long-term efficacy, and potential use as a combined therapy.

Data Availability:

Data is available upon request.

Conflict of interest:

The authors declare that there was no conflict of interest.

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Authors Contribution:
Mohammed Hamid Kareem: Data collection.
Ruqayah Muayad Tawfeeq:Formal analysis
Mustafa Salah Hasan: Writing and editing

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