Effects of the addition of a marigold extract to diets fed to channel catfish (*Ictalurus punctatus*) on growth parameters

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The expansion of aquaculture in the last 10 years has made it an important source of protein worldwide. However, increased production, and the culture intensification it carries, results in higher risk of infectious disease due to poor water quality and high stocking densities. Disease has several negative effects on fish, which include reduced feed efficiency, impaired growth and death, representing a direct loss of investment in feed, labour and other inputs.

Disease in fish has been traditionally opposed with chemotherapeutants; however, the number of chemotherapeutants available for use in aquaculture has become more restricted as new drugs become available (Alderman, 2002), due to the antibiotic resistance they may induce when used in fish (Belem-Costa and Cyrino, 2006). This has resulted in the search of non-toxic alternatives to ensure fish health during culture, such as plant extracts to be used as appetite stimulators and growth promoters, antimicrobial, anti-parasitic, antioxidant agents, and immunostimulants in fish (Syahidah et al., 2015). Furthermore, animal extracts have also been successfully used as fungicides, like those obtained from the sea cucumber, *Holothuria leucospilota* (Farjami et al., 2014).

Natural carotenoids have traditionally been used as dietary colouring agents; however, carotenoids have been found to carry out essential
Spatial Analysis of Metal Profiles in Sediments in a Tropical Estuary: A Geostatistical Approach

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Abstract The spatial structure and distribution of heavy metals [cadmium (Cd), copper (Cu), iron (Fe), lead (Pb), and nickel (Ni)] in sediments were geostatistically analyzed along the estuarine ecosystem of Tigre River–San Andres Lagoon (Tamaulipas, Mexico). In most cases, heavy-metal concentrations exhibited a strong spatial autocorrelation along the estuary as indicated by variogram analysis. Heavy-metal concentrations were found to be higher in the middle estuary, close to the mouth of the Tigre River, and declined as distance from the mouth increased. Metal mean levels at the middle estuary were 2.41 mg/kg Cd, 4.80 mg/kg Cu, 172.36 mg/kg Fe, 5.22 mg/kg Pb, and 2.10 mg/kg Ni. The spatial distribution of heavy metals suggests the existence of a common heavy-metal source located in this area of the estuary. The importance of wastewater discharges and open dumping in the town of El Moron, adjacent to the mouth of the Tigre River, is highlighted; these are believed to be the anthropogenic sources for heavy metals in this estuarine ecosystem.

Estuaries and coastal lagoons are characterized by being critical habitats for the life cycle of numerous marine and estuarine species, including some fishes and invertebrates of economic importance to fisheries (Blaber 1997; Beck et al. 2001; Little 2006). These coastal ecosystems receive freshwater inputs from rivers that carry surface runoff from inland areas, and given their low water exchange rates (Kjerfve 1994) are prone to accumulate pollutants in water, sediment and aquatic organisms. Furthermore, pollutants may also enter into estuaries by urban and industrial discharges, and under these conditions, the ecological value of estuaries might be affected.

In many estuarine ecosystems around the world, diverse sources of anthropogenic pressure occur regularly and with varying degrees of intensity. Human activities, such as fishing and aquaculture, as well as urbanization and industrialization of the coastal zone, have been described as those causing the greatest impact to estuaries worldwide (Villanueva and Botello 1998; Kennish 2002; McLusky and Elliot 2004; Dong et al. 2012). However, other activities, such as animal husbandry and agriculture, may also have negative effects on coastal ecosystems because of the excessive use of fertilizers and pesticides, some of which contain heavy metals (Nriagu and Pacyna 1988; Green-Ruiz and Páez-Osuna 2003; Bjerregaard and Andersen 2007). The presence of anthropogenic contamination by heavy metals has been reported in several estuarine ecosystems along the Gulf of Mexico (Villanueva and Botello 1998; United States Environmental Protection Agency [USEPA] 2011) where the aggressive industrialization and urbanization from some decades ago have been identified as the main causes of the increase of metals in estuaries and coastal lagoons in the Gulf of Mexico.

A geostatistical approach for the study of the heavy-metal spatial patterns along estuarine ecosystems would be helpful in elucidating whether heavy-metal levels are spatially structured along the estuary and to identify the presence of hot-spot areas with high metal concentrations. Geostatistics is a group of statistical tools used for the detection, modeling, and estimation of spatial patterns based on the analysis of spatial autocorrelation in
SHORT COMMUNICATIONS

Effects of Hydrogen Peroxide and Metrifonate on Monogenean *Ligictaluridus floridanus* on Catfish (*Ictalurus punctatus*, Rafinesque) Gills

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ABSTRACT: Hydrogen peroxide (H\(_2\)O\(_2\)) and metrifonate (Mtf) are common products used in ectoparasite infestations on fish cultures. The therapeutic efficacy of H\(_2\)O\(_2\) and Mtf on a common monogenean parasite, *Ligictaluridus floridanus*, was evaluated in channel catfish (*Ictalurus punctatus*). In vitro trials were conducted using excised fish gills naturally infected with *L. floridanus*, which were immersed in H\(_2\)O\(_2\) (150, 300, and 570 mg L\(^{-1}\)) and Mtf (0.25, 0.5, and 0.75 mg L\(^{-1}\)) solutions. The efficacy of the treatments was based on the survival time of the parasites, observed microscopically. In addition, an in vivo trial using catfish juveniles, naturally infected with *L. floridanus*, was also performed. One group received immersion baths of 570 mg L\(^{-1}\) H\(_2\)O\(_2\) (3%) during 4 min; the Mtf (90%) group received 0.5 mg L\(^{-1}\) Mtf for 10 min. Treatments were done on days 3, 7, and 11 of the experiment. Results indicate that baths with Mtf do not significantly reduce the mean intensity of the parasite per gill arch, nor do they reduce the in vitro survival time of parasites during treatment; H\(_2\)O\(_2\) baths at 570 mg L\(^{-1}\) during 4 min were effective (*P < 0.05) against adult and juvenile stages of *L. floridanus*. This study supports the use of H\(_2\)O\(_2\) as an effective antiparasitic agent against *I. punctatus*.

In Mexico, *Ligictaluridus floridanus* (Monogenea: Ancyrocephalidae) is the most prevalent parasite (85.5%) in channel catfish (*Ictalurus punctatus*) farms in Tamaulipas (Rábago-Castro et al., 2011) and is known to affect the growth of the catfish (Rábago-Castro et al., 2014). Overcrowding in caged catfish cultures promotes ectoparasite transmission among the fish (Villací et al., 2005), and this is especially true for *L. floridanus* because of its direct cycle. A diverse array of compounds are used in chemotherapy to control and eradicate ectoparasites on fish farms (Zhang et al., 2013; Benavides-González et al., 2014), but gill parasites are difficult to treat, and these products may have secondary effects on fish such as immunosuppression or gill toxicity. In addition, it is easy to overdose due to their low therapeutic index (Guo and Woo, 2009).

Hydrogen peroxide (H\(_2\)O\(_2\)) is a strong oxidizing agent found commercially as a 3% or 30–35% solution. In fish culture it is used to treat acute environmental hypoxia, fungal and bacterial infections, and also as a parasiticide (Lumsden et al., 1998). Hydrogen peroxide is approved by the U.S. Food and Drug Administration (FDA) for use in fish and does not require a set withdrawal time (U.S. Fish & Wildlife Service, 2011). Dosing criteria vary depending on the problem and species to be treated. However, gill damage has been reported following treatment, suggesting prudence on used dosage (Kiermer and Black, 1997; Gaikowski et al., 1999). Metrifonate (Mtf), also known as trichlorfon, is an organophosphate used since the 1950s in cattle, horses, and other minor species as an anthelmintic (Heitzman et al., 2000; El-Gohary et al., 2005). In humans, it was used to treat schistosomiasis, a parasitic disease caused by the trematode *Schistosoma* spp. It is a cholinesterase inhibitor and has also recently been used to treat Alzheimer’s disease (López-Arrieta and Schneider, 2006).

The present study examined the efficacy of H\(_2\)O\(_2\) and Mtf against *L. floridanus* in naturally infected channel catfish (*I. punctatus*) in vitro and in vivo under controlled conditions.

Fifty-one juvenile, clinically healthy, but naturally infected with *L. floridanus*, channel catfish, were obtained from a local hatchery (Abasolo, Tamaulipas, México) and transported in a 250 L fiberglass tank to Facultad de Medicina Veterinaria y Zootecnia, Universidad Autónoma de Tamaulipas in Ciudad Victoria. The fish had a mean weight of 26.75 ± 1.76 g and a mean fork length of 13.56 ± 1.00 cm. Parasite infection and identification was confirmed in the hatchery according to Hoffman (1985). Fifteen fish were used for the in vitro experiment, following the method described by Hirazawa et al. (2000) with slight modifications. Nine solutions of H\(_2\)O\(_2\) (3%) commercial grade were prepared at 150, 300, and 570 mg L\(^{-1}\) using saline solution (0.65%) (SS), distilled water (DW), and aquarium water (AW) as diluents. Metrifonate solutions were prepared at 0.25, 0.5, and 0.75 mg L\(^{-1}\) using the same diluents as in H\(_2\)O\(_2\) for a total of 9 treatments. H\(_2\)O\(_2\) and Mtf treatments were compared with the SS, DW, and AW controls. Channel catfish fingerlings were euthanized with 120 mg L\(^{-1}\) of benzocaine and their gill arches excised. The number of *L. floridanus* on each gill was at least 5, 3 arches were used per treatment, and the arch gills were separated and immersed separated on 50 ml of each prepared solution at 22°C, and were observed in a Petri dish constantly under a stereo microscope to record the survival time of parasites.

The in vivo trial lasted 16 days and used channel catfish randomly allocated into 9 (40 L) aquaria filled with 37 L of water with a constant flow (18 L h\(^{-1}\)) and aerated water. Thirty-six fish were divided into 3 groups, each with 3 replicates of 4 fish in each aquarium. The groups were H\(_2\)O\(_2\), Mtf, and the control. Fish were acclimated during 4 days before the start of the trial. At the beginning of each treatment, the water flow in treated aquaria was interrupted and water volume reduced to 10 L. The H\(_2\)O\(_2\) group received 570 mg L\(^{-1}\) of commercial grade (3%) H\(_2\)O\(_2\) during 4 min; the Mtf group received 0.5 mg L\(^{-1}\) of Mtf during 10 min. Treatments were done on days 3, 7, and 11. Immediately following dosing the aquaria was filled to the previous level, and the water flow was reestablished. During the experiment, fish were fed twice a day ad libitum with a 3-mm particle size commercial catfish food, containing 32% protein. Fish were sampled on days 0, 4, 8, and 12. All fish in the aquaria were anesthetized with benzocaine at 40 mg L\(^{-1}\); 1 fish of each aquarium was randomly selected and euthanized with 120 mg L\(^{-1}\) of benzocaine; the 4 gill arches of the left side of each fish were examined under a stereo microscope placed in Petri dishes containing 0.65% saline solution. Initial parasite intensity was determined at day 0. During the experiment water temperature, dissolved oxygen and pH were measured with a freshwater kit (La Motte®, Chestertown, Maryland). The prevalence and mean intensity of *L. floridanus* (immature and adults) were determined according to Bush et al. (1997) and Mladineo (2005), and the parasite mean per gill arch was obtained.

Data for in vitro trials were analyzed with a non-parametric Kaplan-Meier cumulative proportion surviving test, grouped by control and treatment (Mtf and H\(_2\)O\(_2\)) dosages in trials with different diluents. The survival times were analyzed under a non-parametric Kruskal-Wallis Test.
Original article

Bacterial membranes enhance the immunogenicity and protective capacity of the surface exposed tick Subolesin-\textit{Anaplasma marginale} MSP1a chimeric antigen

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\textbf{A B S T R A C T}

Ticks are vectors of diseases that affect humans and animals worldwide. Tick vaccines have been proposed as a cost-effective and environmentally sound alternative for tick control. Recently, the \textit{Rhipicephalus microplus} Subolesin (SUB)-\textit{Anaplasma marginale} MSP1a chimeric antigen was produced in \textit{Escherichia coli} as membrane-bound and exposed protein and used to protect vaccinated cattle against tick infestations. In this research, lipidomics and proteomics characterization of the \textit{E. coli} membrane-bound SUB-MSP1a antigen showed the presence of components with potential adjuvant effect. Furthermore, vaccination with membrane-free SUB-MSP1a and bacterial membranes containing SUB-MSP1a showed that bacterial membranes enhance the immunogenicity of the SUB-MSP1a antigen in animal models. \textit{R. microplus} female ticks were capillary-fed with sera from pigs orally immunized with membrane-free SUB, membrane bound SUB-MSP1a and saline control. Ticks ingested antibodies added to the blood meal and the effect of these antibodies on reduction of tick weight was shown for membrane bound SUB-MSP1a but not SUB when compared to control. Using the simple and cost-effective process developed for the purification of membrane-bound SUB-MSP1a, endotoxin levels were within limits accepted for recombinant vaccines. These results provide further support for the development of tick vaccines using \textit{E. coli} membranes exposing chimeric antigens such as SUB-MSP1a.

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Artificial feeding of *Rhipicephalus microplus* female ticks with anti-calreticulin serum do not influence tick and *Babesia bigemina* acquisition

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**Abstract**

Ticks are obligate haematophagous ectoparasites considered the principal vectors of disease among animals. *Rhipicephalus microplus* and *R. annulatus* ticks are the most important vectors for *Babesia bigemina* and *B. bovis*, two of the most important intraerythrocytic protozoan parasites species in cattle, responsible for babesiosis which together with anaplasmosis account for substantial economic losses in the livestock industry worldwide. Anti-tick vaccines are a proved alternative to traditional tick and tick borne diseases control methods but are still limited primarily due to the lack of effective antigens. Subsequently to the identification of antigens that the validation is a laborious work often expensive. Tick artificial feeding, is a low cost alternative to test antigens allowing achieving critical data. Herein, *R. microplus* females were successfully artificially fed using capillary tubes. Calreticulin (CRT) protein, which in a previous study has been identified as being involved in *B. bigemina* infection in *R. annulatus* ticks, was expressed as recombinant protein (rCRT) in an *E. coli* expression system and antibodies raised against rCRT. Anti-rCRT serum was supplemented to a blood meal, offered to partially engorged *R. microplus* females and their effect in feeding process as well as infection by *B. bigemina* was analyzed. No significant reductions in tick and egg weight were observed when ticks fed with anti-rCRT serum. Furthermore, *B. bigemina* infection levels did not show a statistically significant decrease when ticks fed with anti-rCRT antibodies. Results suggest that CRT is not a suitable candidate for cattle vaccination trials.

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**Introduction**

The “One Health” concept recognizes the need for joint work between veterinarians, physicians and environmental scientists, given the dynamic interface between people, animals and environment. This concept is becoming increasingly important for zoonotic diseases, such as animal host-dependent tick-borne diseases (TBDS) (Breitschwerdt, 2011). Ticks are resilient and constant arthropods in the environment, with a complex life-cycle. These haematophagous ectoparasites have a direct negative effect in the vertebrate host while feeding and act as vectors and reservoirs for several pathogens (Jongejans and Uilenberg, 2004).

*Rhipicephalus microplus* ticks are the most relevant ectoparasites in bovine cattle production, causing debilitation, anaemia, weight loss and ultimately death. *R. microplus* ticks are vectors of pathogens such as *Babesia bovis* and *B. bigemina* causing bovine babesiosis, also, these cattle ticks are vectors of *Anaplasma marginale*, etiologic agent of anaplasmosis (Almazan et al., 2010; Peter et al., 2009), which are the most prevalent and higher cost TBDs in cattle production (Suarez and Noh, 2011).

The use of chemical acaricides is currently the major method of tick control, however, their use is in most cases incorrect, leading to limited efficiency in terms of infestation reduction; besides, their use promotes selection of resistant ixodids as well as environmental, meat and milk contamination (George et al., 2004; Graf et al., 2004). Development of new improved acaricides could be a desirable perspective, but it is a long and expensive process, strengthening the need for alternatives. Developing anti-tick
Enteritis Hemocítica en *Litopenaeus vannamei* (Crustácea Decápoda) en cultivo de baja salinidad en Tamaulipas, México

Hemocytic enteritis in *Litopenaeus vannamei* (Crustacea Decapoda) raised in low salinity water in Tamaulipas, Mexico

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ABSTRACT

The present study assessed the presence of hemocytic enteritis in *Litopenaeus vannamei* from a shrimp farm which uses semi-intensive culture with underground low salinity water, located at an urban zone of Reynosa, Tamaulipas, Mexico. Histopathological analyses showed characteristic lesions of hemocytic enteritis with a prevalence of 4.0% (12/300). Lesions were observed in midgut epithelium, showing accumulation of hemocytic cells, causing diffuse hemocytic infiltration throughout the gut wall, and were associated with epithelial necrosis and inflammation. The hepatopancreas was also affected, displaying focal pyknotic nuclei with quasi-geometric shape in hepatopancreas tubules. These clinical signs were present in all affected organisms and suggest toxicity resulting from Benomyl® with contamination occurring either directly and/or indirectly via the water source for the shrimp farm which is located in the most important and productive zone of sorghum (*Sorghum vulgare*) in the northeast of Mexico. This constitutes the first report of hemocytic enteritis in the coastal zone of the Gulf of Mexico.

Keywords: Hemocytic enteritis, *Litopenaeus vannamei*, low salinity.

RESUMEN

El presente estudio evalúa la presencia de la Enteritis Hemocítica en *Litopenaeus vannamei* provenientes de un cultivo semi-intensivo con baja salinidad, alimentado con agua de pozo profundo, localizada en la zona urbana de Reynosa, Tamaulipas, México. Los análisis histopatológicos mostraron lesiones características de enteritis hemocítica con una prevalencia del 4.0% (12/300). Las lesiones se observaron en el epitelio del intestino medio, presentando acumulaciones de células hemocíticas, lo cual provoca infiltración hemocítica difusa extendida a lo largo de la pared intestinal, asociada a necrosis e inflamación epitelial. El hepatopáncreas también se encontró afectado, mostrando núcleos picnóticos focalizados de forma casi geométrica en télulas hepatopancreáticas, estos casos se presentaron en todas las muestras de los organismos afectados. De acuerdo al cuadro clínico, se considera que las lesiones fueron causadas por intoxicación con Benomyl® por la contaminación de forma directa y/o indirecta al sistema de cultivo que usó agua de pozo profundo ubicado en la zona de agricultura más importante y productiva de sorgo (*Sorghum vulgare*) en el noreste del país. Estos resultados constituyen el primer reporte de enteritis hemocítica en las costas del Golfo de México.

Palabras clave: Baja salinidad, Enteritis hemocítica, *Litopenaeus vannamei*. 
Fatal parasitosis in blackbucks (*Antilope cervicapra*): a possible factor risk in hunting units

Parasitosis fatal en el antílope negro (*Antilope cervicapra*): un posible factor de riesgo en unidades de cacería

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ABSTRACT

In February 2012, a reproductive group of 60 adult blackbucks (*Antilope cervicapra*) from Veracruz, Mexico was relocated to hunting units in eastern and northeastern Mexico. Seven individuals died due to hemorrhagic parasitic, abomasitis and enteritis caused by *Haemonchus* spp., *Setaria* spp., and Trichostrongylids. Deaths were associated with hepatic necrosis, bilateral congestive distention of heart and fibrinonecrotic bronchopneumonia. Also *Anaplasma marginale* was identified. The blackbucks’ population displayed a general mortality rate of 11.67%, where 25% of total male and 9.62% of total female died. The mortality was controlled by segregation of all remaining blackbucks and the treatment for internal and external parasites (garrapatas y moscas picadoras). After the treatment, no fatality cases related to parasitosis were recorded. The results presented here exhibit the high relevance of parasitosis as possible factor risk in the survival of this species.

Key words: *Anaplasma marginale*, antelope, diseases, hunting, parasite, trichostrongylids (Source:CAB).

RESUMEN

En febrero del 2012, un grupo de 60 individuos adultos reproductivos de antílope negro (*Antilope cervicapra*) provenientes de Veracruz, México fueron reubicado en unidades de cacería del este y noreste de este país. Siete individuos murieron presentando hemorragias parasíticas, abomasitis y enteritis ocasionadas por *Haemonchus* spp., *Setaria* spp., y Trichostrongylids. Las muertes estuvieron asociadas con necrosis hepática, distensión congestiva del corazón y bronconeumonía fibronecrotica, donde *Anaplasma marginale* fue identificada. La población de antílopes negros mostró un porcentaje de mortalidad del 11.67%, en donde el 25 y 9.62% de los machos y hembras totales murieron. La mortalidad fue controlada mediante el aislamiento de los antílopes negros restantes y un tratamiento contra parásitos internos y externos (garrapatas y moscas picadoras), lo cual controló las mortalidades y reveló la importancia de la parasitosis como factor de riesgo que afecta la sobrevivencia de esta especie.

Influence of Feeding Enzymatically Hydrolyzed Yeast Cell Wall on Growth Performance and Digestive Function of Feedlot Cattle during Periods of Elevated Ambient Temperature

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ABSTRACT: In experiment 1, eighty crossbred steers (239±15 kg) were used in a 229-d experiment to evaluate the effects of increasing levels of enzymatically hydrolyzed yeast (EHY) cell wall in diets on growth performance feedlot cattle during periods of elevated ambient temperature. Treatments consisted of steam-flaked corn-based diets supplemented to provide 0, 1, 2, or 3 g EHY/hd/d. There were no effects on growth performance during the initial 139-d period. However, from d 139 to harvest, when 24-h temperature humidity index averaged 80, EHY increased dry matter intake (DMI) (linear effect, p<0.01) and average daily gain (ADG) (linear effect, p = 0.01). There were no treatment effects (p>0.10) on carcass characteristics. In experiment 2, four Holstein steers (292±5 kg) with cannulas in the rumen and proximal duodenum were used in a 4x4 Latin Square design experiment to evaluate treatments effects on characteristics of ruminal and total tract digestion in steers. There were no treatment effects (p>0.10) on ruminal pH, total volatile fatty acid, molar proportions of acetate, butyrate, or estimated methane production. Supplemental EHY decreased ruminal molar proportion of acetate (p = 0.08), increased molar proportion of propionate (p = 0.09), and decreased acetate-propionate molar ratio (p = 0.07) and estimated ruminal methane production (p = 0.09). It is concluded that supplemental EHY may enhance DMI and ADG of feedlot steers during periods of high ambient temperature. Supplemental EHY may also enhance ruminal fiber digestion and decrease ruminal acetate-propionate molar ratios in feedlot steers fed steam-flaked corn-based finishing diets. (Key Words: Yeast, Growth Performance, Digestion, Cattle)

INTRODUCTION

Temperature-Humidity index (THI; Mader et al., 2006) greater than 74 is considered stressful for cattle. This condition is prevalent during much of the summer months throughout the desert southwestern United States of America. This heat load causes a reduction in energy intake (Young and Hall, 1993; Hahn, 1994) and hence, average daily gain (ADG) and gain efficiency (Blackshaw and Blackshaw, 1994; Hubbard et al., 1999). Additionally, heat stress alters endocrine profiles and energy metabolism of cattle (Rhoads et al., 2009).

In dairy cattle, supplementation with yeast and/or yeast cell wall components has been associated with reduction of negative impact of heat stress on cattle that has improved milk yield, enhanced immune status, and reduced incidence of mastitis and somatic cell counts (Nocce et al., 2011; Liu et al., 2014). Likewise, supplementation improved health status and immune response, reducing physiological and acute phase responses of cattle exposed to endotoxin challenge (Lowry et al., 2005; Li et al., 2006; Chae et al.,
Influence of high-oil algae biomass as a feed intake and growth-performance enhancer in feedlot cattle during period of high ambient temperature

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Sixty calf-fed Holstein steers (290 ± 2 kg) were used in a 90-d trial to evaluate the influence of fresh high-oil algae biomass as a feed intake and growth-performance enhancer in feedlot cattle. Steers were grouped into 5 weight blocks, and randomly assigned within blocks to 15 pens (4 steers per pen, 4 pens per treatment). All steers were fed the same steam-flaked corn-based basal growing-finishing diet. Three treatments were evaluated (1) basal diet, (2) basal diet plus 60 g/head water or (3) basal diet plus 60 g/head high-oil algae biomass. On an as-fed basis, the algae biomass contained: 78.4% moisture, 2.15% ash, 0.21% N, 0.07% starch, 0.50% neutral detergent fiber and 17.2% ether extract. Steers were fed once daily. Water and algae biomass treatments were top-dressed onto the basal diet at time of feeding. On a dry matter basis, algae biomass application accounted for 0.14% of average daily feed intake. Top-dressing the basal diet with water did not affect (P > 0.20) cattle growth performance or dietary net energy (NE). In contrast, top-dressing feed with algae biomass increased average daily gain (7.8%, P = 0.02), and tended to increase gain efficiency (5.7%, P = 0.08) and estimated dietary NE (3.7%, P = 0.09). We conclude that application of low levels of high-oil algae biomass may enhance daily weight gain of feedlot cattle during period of high ambient temperature. This effect is due in part to an apparent increase in efficiency utilization and in part to an increased dry matter intake.

Keywords: algae; cattle; performance; feedlot

1. Introduction

Summer heat load causes a reduction in feed and energy intakes (Young & Hall 1993; Hahn 1994); and subsequently in animal productivity (Blackshaw & Blackshaw 1994). In cattle, this can result in decreased growth rate and gain efficiency (Turner 1984; Hubbard et al. 1999). Algae contain chemical compounds that serve as attractants to augment feed consumption in aquatic species (Mustafa et al. 1997; Tierney and Atema 1998; Jaime-Ceballos et al. 2007). The objective of this study is to evaluate the influence of top-dressing a steam-flaked corn-based growing-finishing diet with a low level (0.14%) of high-oil algae biomass as an agent to enhance energy intake during a period of high ambient temperature.

2. Materials and methods

All procedures involving animal care and management were in accordance with and approved by the University of California, Davis, Animal Use and Care Committee.

2.1. Animals and diets

Sixty calf-fed Holstein steers (290 ± 2 kg) were used in a 90-d experiment to evaluate the influence of algae as a feed intake and growth-performance enhancer in feedlot cattle with respect to feedlot growth performance and dietary NE. This trial was conducted during months of May through July at the University of California Desert Research Center located in El Centro, CA. The average climatic conditions during this experiment were: air temperature 31.0°C (range 28.0–34.0°C), relative humidity 45%. Temperature-humidity index (THI) was calculated using the formula: THI = [0.8 × ambient temperature] + [(% of relative humidity/100) × (ambient temperature – 14.4)] + 46.4 (Mader et al. 2006). Accordingly, the mean THI value during the course of this study was 78.8. In accordance with THI code (Normal THI < 74; Alert 75 < THI < 78; Danger 79 < THI I < 83; and Emergency THI > 84), steers in the trial were exposed to ‘danger’ situation due hot environmental conditions. Eight days before initiation of the study, steers were individually weighed, implanted with Revalor-S (Intervet Inc., Millsboro, DE), grouped by weight into 5 blocks, and randomly assigned within weight blocks to 15 pens (4 steers per pen). Pens were 75 m² with 27 m² of overhead shade, automatic waterers, and 4.3 m fence-line feed bunks. All steers were fed the same basal diet (sudangrass hay: 6.00%, yellow grease: 2.50%, molasses cane: 5.00%, urea: 0.50%, limestone: 1.65%, magnesium
Buenas prácticas para la mitigación al cambio climático de los sistemas de producción de leche en Costa Rica

Francisco Casasola Coto
Cristóbal Villanueva Najarro
Capítulo I.
Estrategias en alimentación y nutrición para disminuir las emisiones de metano entérico en los sistemas de producción de leche

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1.1. Antecedentes

La ganadería genera 7,1 mil millones de CO\textsubscript{2}, lo cual representa 15% del total de emisiones de gases de efecto invernadero (GEI) en el mundo. Cuarenta por ciento de la emisión total del sector ganadero corresponde al metano entérico y, de este monto, 77% tiene relación con la ganadería bovina (Gerber \textit{et ál.} 2013).

En Costa Rica, la ganadería bovina emite 59% del total de GEI del sector agropecuario, cuyas principales fuentes son el metano entérico (62%) y el óxido nitroso (36%) (Chacón \textit{et ál.} 2014). La emisión de metano es parte del proceso natural del tracto digestivo de los rumiantes (bovinos, cabras, ovejas y otros), y representa pérdida de energía e impacto para el ambiente. Por lo tanto, es importante identificar e implementar las estrategias de alimentación y nutrición con mayor potencial para reducir el metano entérico.

El presente capítulo abarca temas como la importancia de la ganadería bovina en los medios de vida de las familias, el impacto de la ganadería en la emisión de GEI, 

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Prospects for vaccination against the ticks of pets and the potential impact on pathogen transmission

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ABSTRACT

Diseases transmitted by arthropod vectors such as ticks greatly impact human and animal health. In particular, many diseases of dogs and cats are potentially transmissible to people by arthropod vectors and therefore their control is important for the eradication of vector-borne diseases (VBD). Vaccination is an environmentally friendly alternative for vector control that allows control of several VBD by targeting their common vector. Recent results have shown that it is possible to use vector protective antigens for the control of arthropod vector infestations and pathogen infection. However, as reviewed in this paper, very little progress has been made for the control of ectoparasite infestations and VBD in pets using vaccination with vector protective antigens. The growing interaction between pets and people underlines the importance of developing new interventions for the monitoring and control of VBD.

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1. Introduction

Ticks are the most important vectors of emerging and re-emerging diseases of pets, many of which are potentially transmissible to humans (Glickman et al., 2006; Beugnet and Marié, 2009). Tick species such as Rhipicephalus sanguineus, Ixodes scapularis, Ixodes ricinus and Dermacentor reticulatus infest humans and pets and transmit disease-causing pathogens such as Borrelia spp. (Lyme disease and various borreliosis), TBEV (tick-borne encephalitis), Anaplasma phagocytophilum (human and canine anaplasmosis), Francisella tularense (tularemia), Rickettsia spp. (human and animal rickettsiosis), OHFV (Omsk hemorrhagic fever), Babesia canis (canine babesiosis), and Ehrlichia canis (canine monocytic ehrlichiosis) (de la Fuente et al., 2008; Beugnet and Marié, 2009). Other arthropods such as mosquitoes, fleas and sand flies also transmit vector-borne diseases (VBD) affecting humans and pets (Day, 2011; Beugnet and Marié, 2009).

Vector-borne infectious diseases of pets and humans are emerging or re-emerging as a result of ineffective control programs, demographic and societal changes and increasing acaricide/insecticide and drug resistance (Glickman et al., 2006). Vaccines have not been developed or successfully implemented for most VBD affecting humans and pets (Day, 2011). Therefore, control of arthropod vectors is important for the eradication of VBD (de la Fuente and Kocan, 2003; Sperança and Capurro, 2007; Karunamoorthy, 2011; Coller et al., 2012).

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